CalTrak® 800
High Accuracy Modular Primary Standard Gas Volume Flow Calibrator

Cal Labs & Industry Applications

Instruction Manual

Models: SL800

Part Number: IM-Cal-SL800 Rev. F 4/16

SIERRA®

GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

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Warnings and Cautions

Note and Safety Information

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

Warning!

This statement appears with information that is important to protect people and equipment from damage. Pay very close attention to all warnings that apply to your application.

Caution!

This statement appears with information that is important for protecting your equipment and performance. Read and follow all cautions that apply to your application.

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

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

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

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

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

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

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

Caution! When using toxic or corrosive gases, purge the line with inert gas for a minimum of four hours at full gas flow before installing the meter.

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

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

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

Receipt of System Components

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

Technical Assistance

If you encounter a problem with your flow meter, review the configuration information for each step of the installation, operation, and setup procedures. Verify that your settings and adjustments are consistent with factory recommendations. Installation information can be found in Chapter 2 of this manual, and troubleshooting information can be found in Chapter 10.

If the problem persists after following the troubleshooting procedures outlined in this manual, contact Sierra Instruments by fax or by E-mail (see inside front cover). For urgent phone support you may call (800) 866-0200 or (831) 373-0200 between 8:00 a.m. and 5:00 p.m. PST. In Europe, contact Sierra Instruments Europe at +31 (0)72-5071400. In the Asia-Pacific region, contact Sierra Instruments Asia at +86-21-58798521. When contacting Technical Support, make sure to include this information:

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

Table of Contents

Chapter 1: Introduction

Congratulations! You've chosen the CalTrak SL 800, featuring proven CalTrak® technology from Sierra. The CalTrak SL 800 has five interchangeable cells that offer ±0.25% to ± 0.15% of reading standardized accuracy within a portable primary standard that's ideal for both volumetric and standardized flow applications where a high degree of measurement accuracy is required. Before you get started, we recommend taking a few moments to review this manual and familiarize yourself with the CalTrak SL 800. If at any time you have questions regarding its operation, please contact Sierra through our web site (www.sierrainstruments.com), or call us at SL 800-866-0200 to speak with one of our knowledgeable customer support representatives.

Operation

The CalTrak SL 800 is a positive displacement primary piston prover for gas flow measurements in either pressure or vacuum applications. Using Proven CalTrak Technology, it combines the accuracy of a primary standard with unequaled speed and convenience. Volumetric or standardized flow readings are obtained with the push of a button. The CalTrak SL 800 can be set to take flow readings manually, one reading at a time, or automatically in the continuous auto-read mode. The CalTrak SL 800 can be programmed for up to 100 readings in an averaging sequence.

The versatile CalTrak SL 800 can be used to measure the gas flow rates at atmospheric pressure ± 7mmHg. Its Proven CalTrak Technology features a near-frictionless piston and flow cell design that provides highly-accurate, liquid-free flow measurements of unequaled speed and convenience. The CalTrak SL 800 consists of two primary components: The base and the flow cell. There are five interchangeable flow cell models, each with a designated flow range. The flow cell plugs into the base unit in order to create a complete, functional CalTrak SL 800 system. The base component houses the main computer and timing circuitry. The flow cell is easily fitted into the base unit's interface connector and two guide pins.

The flow cell performs the actual flow measurements. For this purpose, it houses a "piston and glass assembly" comprised of a borosilicate glass tube housing a precision-machined graphite piston. The flow cell also contains an integrated temperature sensor and barometric pressure transducer in the gas flow stream for instant conversion of the volumetric readings into standardized flow.

CalTrak Pro software captures flow data from your CalTrak instrument to a PC.

The CalTrak Pro software allows you to:

- View and plot the flow data in real-time.
- Export your data to a Windows environment.
- Enter flow data from a flow meter and compare the flow measurements from your CalTrak® precision calibrator.
- Upload the latest version of the firmware to your CalTrak®.

Unpacking Checklist

Your CalTrak 800 has been packaged with care and includes all components necessary for complete operation. Please take a moment to check that you have received the following items. If you believe you have not received a full shipment or if you have any questions, please contact Sierra immediately.

Your CalTrak comes with the following:

Your SL800 Base with the following:

- CalTrak SL 800 Electronic Base
- Power Supply Adapter
- RS-232 Serial Cable
- USB Cable
- Certificate of Calibration

Your SL800 Flow Cell Includes

- CalTrak SL 800 Flow Cell
- Dust Caps
- Certificate of Calibration
- External Inlet Filter (SL 800-3 only)

Carrying cases and accessories are available for purchase from Sierra or your local Sierra Partner.

	**Warnings!** • The CalTrak SL 800 is not rated intrinsically safe and is not for use with explosive gasses or for use in explosive environments. • The CalTrak SL 800 is not designed for gas flows above the rated specifications of the flow cell in use. Please consult the product specification on page 23 of the manual for more information regarding acceptable gas flow ranges • For use with clean laboratory air or other inert gasses only.

Chapter 2: Using Your CalTrak 800

Getting Started

Ensure that the included 12V 3A AC power supply is connected to the base. Install the desired cell onto the base. All cells, except the -75 cell, should be installed with the blue adapter ring in place. If using the -75 cell, remove the adapter ring by rotating counter clockwise and lift off.

Turning the CalTrak 800 On and Off

Flip the power switch in the rear of the CalTrak SL 800 base to start the unit. An opening screen will appear followed by the splash screen.

The CalTrak SL 800 is designed to operate using only AC power, this unit does not have a battery. Ensure that your unit is plugged in prior to turning on.

Communications Ports

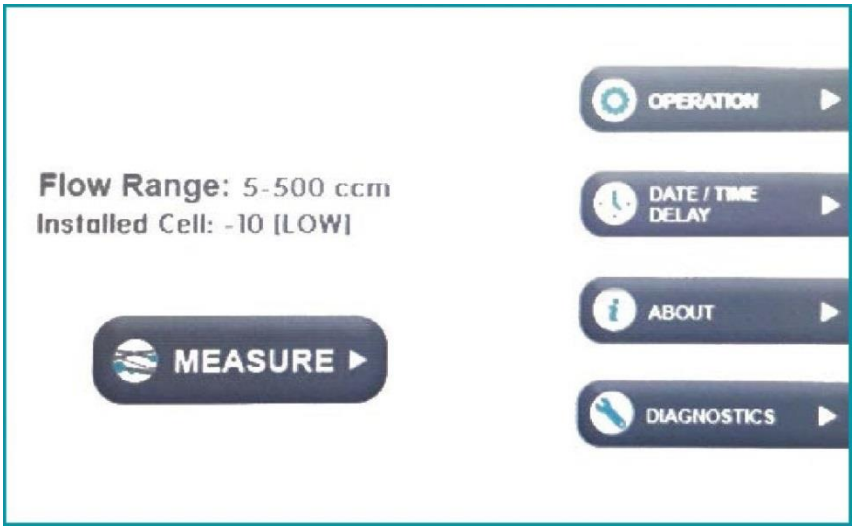
The CalTrak SL 800 includes a USB-B port and RS-232 serial port for bidirectional communication, including data download and operation using the CalTrak Pro software. The USB port includes a driver and does not require any additional driver download.

New firmware, as it becomes available, can be easily uploaded through the USB or RS-232 serial ports.

The side of the base contains a gold port that is used for pressure calibration at our facility. Nothing should be inserted into this port by the user.

On the back on the base is the clock signal port. This is used for verifying clock timing.

Chapter 3: Using the CalTrak 800 Touchscreen



CalTrak 800 Touchscreen

The CalTrak SL 800 uses a resistive touchscreen display for easy navigation through menu options and data entry. Numeric values can be changed using the blue arrows on the right of the screen. At any time, the user may return to the home screen by pushing the home icon in the lower left of the screen.

Home Screen

The Home screen allows access to the Measure screen and all submenus. You can return to this screen at any time during operation by pressing the Home button in the lower left corner of the screen.

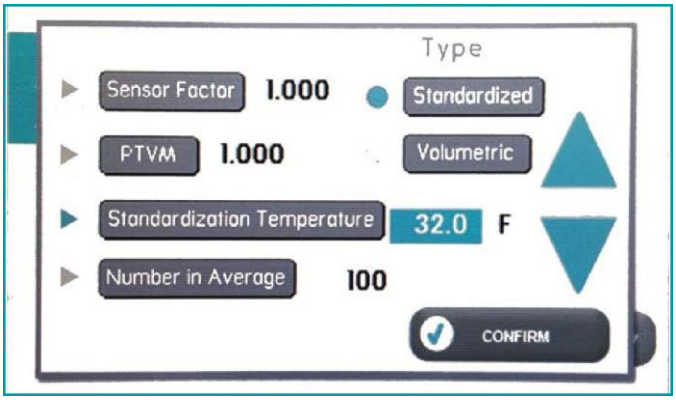
Measure Screen

The Measure screen allows you to capture and observe instantaneous flow data. During operation, the measured flow rate, reading number, standardization information, and average readings are displayed at the top. Gas pressure and temperature inside the tube are displayed on a constant basis regardless of whether the unit is operating.

By pressing on the blue and grey portions of the screen allow you to access additional user-defined parameters. By pressing the blue flow

measurement section, you can change the sensor factor, PTVM, flow standardization, standardization temperature, and reading average number. Pressing the grey gas temperature/pressure section allows you to change the pressure and temperature units. This option is only available through this menu.

Operations Screen

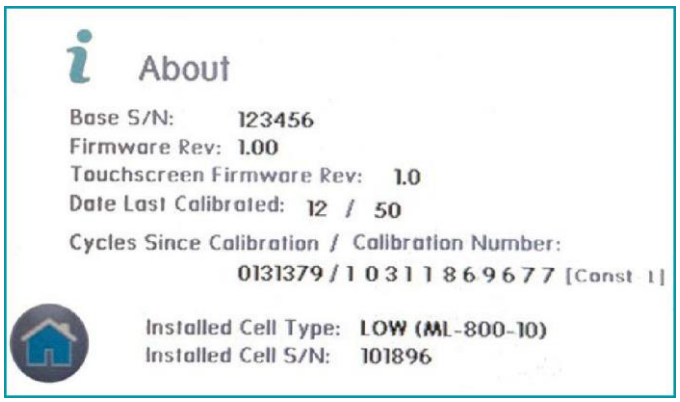


The Operation screen allows you to change measurement parameters including sensor factor, PTVM, standardized or volumetric flow, standardization temperature, and reading average number. When you are done changing these values, pressing CONFIRM will take you to the Measure screen. These input parameters can also be accessed by pressing the 'plus' symbol in the blue portion of the Measure screen.

Date/Time Delay Screen

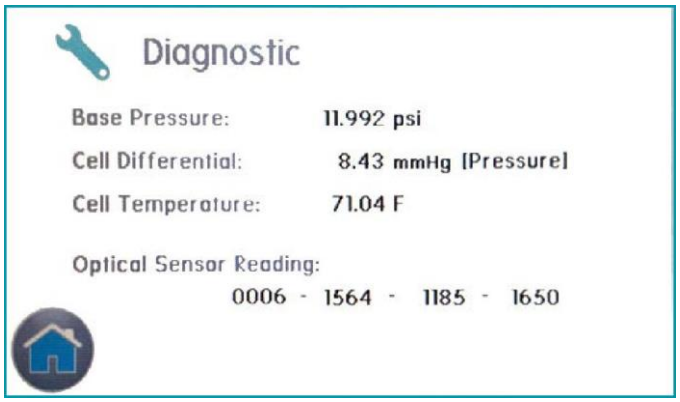
The Date/Time/Delay screen allows you to change the date, time, and delay between individual measurements. To edit these fields, press on the gray box of the field you would like to change. The value highlighted will change by using the arrows on the right.

About Screen



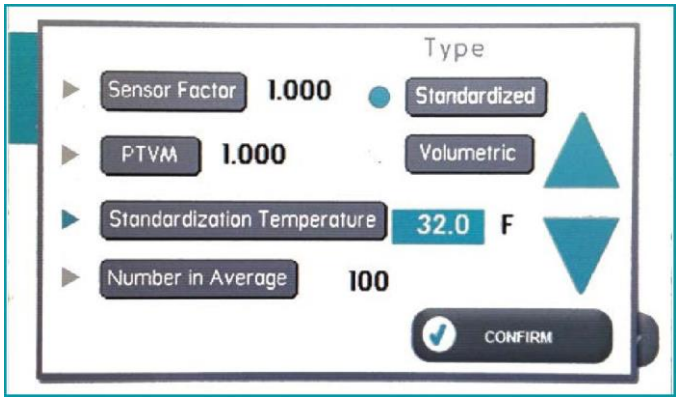
The About screen displays the base serial number, firmware revision, date of last cell calibration, cycles run since last calibration, calibration number, model of installed cell and cell serial number. Provide these numbers when contacting customer service or technical support.

Diagnostics Screen



The Diagnostics screen shows important information regarding the base and cell pressure, cell temperature, and optical sensor reading. These are continuously monitored when the base is operating.

Setting User Preferences

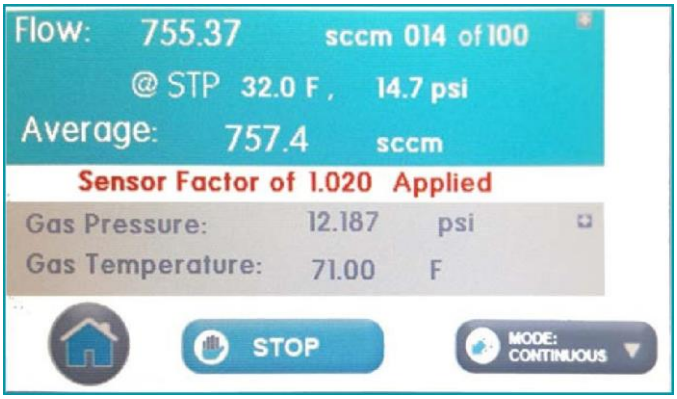


The CalTrak SL 800 offers enhanced electronics options to allow the user to define parameters specific to an application.

These parameters may be entered from the Operation screen or by pressing the blue section of the Measure screen.

"Sensor Factor"

As applicable, change the sensor factor from its default value of 1.000 to the value provided by the MFC or MFM manufacturer. See Using Sensor Factors.



"PTVM"

PTV stands for Piston Tare Value, which is the amount of gas that passes around the piston during measurement. All CalTrak calibration equipment has a factory set PTV that is stored in the memory of the CalTrak cell. The value is typically very small: 0.008 for the ultra-low flow cells, 0.1 ccm for low flow cells, 0.2 ccm for medium flow cells, and 1.4 ccm for the high flow cells. We adjust for this leakage by adding PTV to the measurements.

On our highest accuracy instruments, we allow for the adjustment of the Piston Tare Value with the Piston Tare Value Multiplier (PTVM). When using the instrument with gas species other than air or nitrogen, the molecular behaviors of these gases may degrade the PTV. For highest accuracy, the instrument's PTV can be adjusted. Adjusting the PTV is accomplished by entering a new PTVM. The PTV is multiplied by the PTVM to adjust the measurement. The default value for air and nitrogen is 1.000. The PTVM can be set to any value from 3.000 to 0.200.

For flows above 20 ccm, a new PTVM can be calculated by using the viscosity of the gas being measured and accurate results will be obtained. Calculate the PTVM by taking the ratio of the viscosity of nitrogen to the viscosity of the gas under test. For example, to calibrate hydrogen, consider the following: at 0°C, the viscosity of nitrogen is 165.31 microPoise, and the viscosity of hydrogen is 83.21 microPoise. Express these as 165.31/83.21, or 1.987, and enter 1.987 as the PTVM for this cell.

When measuring alternate gases at flows below 20 ccm, or for absolute best accuracy, it may be necessary to perform a dynamic leak test using the gas under test. Contact Sierra for information on this test.

"Standardized or Volumetric"

Choose whether you would like to conduct standardized or volumetric flow readings. The user can select the standardization temperature. The standardization pressure is set at 760mmHg (14.7 psi = 1 atm = 1013.25 mbar). Change the standardization temperature by selecting this option and changing the value using the arrows.

"Number in Average"

Changes the quantity in an average sequence (consecutive readings) from 1-100. Default value is set at 10.

Chapter 4: Installing and Removing Flow Cells

The CalTrak accepts interchangeable CalTrak SL 800 specific flow cells for different flow ranges. When a cell is installed, the home screen displays the model number and flow range of the installed cell. If no cell is installed, this information will be blank. The base includes a blue friction fit adapter ring that should be removed when using the -75 cell due to its larger diameter. Replace this adapter ring when using the other cells.

Installing Flow Cells

1. Ensure blue adapter ring is installed for using all cells except the -75. Remove the ring if installing the -75 cell.
2. Position the selected flow cell into the base opening, its top label facing you.
3. Carefully align the cell with the guide pins; when the guide pins are engaged, press down.
4. When powered on, the CalTrak SL 800 senses which cell is installed and displays the appropriate units for that cell.

Removing Flow Cells

Grasp the flow cell firmly, hold the base in place, and lift upwards.

Chapter 5: Factory Default Settings

The SL800 has a number of user-definable features and settings. To return to factory default settings at any time, press Reset followed by Save from the “Main Menu”.

Parameters	Factory Settings	Optional Settings
No. of Readings in an Averaging Sequence	10	1-100
Atmospheric Pressure	mm Hg	mBar, kPa, PSI
Temperature	°C	°F
Standardized Temperature Setting	0°C	0.0 – 50.0°C

Chapter 6: Connecting the CalTrak 800 to Gas Flow Source

The accuracy of the CalTrak SL 800 is dependent upon its source being stable. An unstable flow source may produce inconsistent readings. Flow direction is indicated on the cell. To use a pressure flow source, connect to the inlet fitting, or to use a vacuum flow source, connect to the outlet fitting.

The CalTrak SL 800 is designed to be used at ambient pressures only. This is easily accomplished by leaving the outlet of the flow cell open to atmosphere for pressure applications or the inlet open to atmosphere in vacuum scenarios. If tubing is needed to exhaust test gases to a fume hood insure that the exhaust tubing is of sufficient diameter such that the pressure to the CalTrak SL 800 calibrator does not exceed 5 inches of water column (WC) above ambient pressure.

Chapter 7: Taking Readings

The CalTrak SL 800 default is preset for ten (10) readings in an averaging sequence. This parameter is user-definable from the Operation menu.

1. Press Measure on home screen.

- Press the Mode button to cycle through options for single, burst, or continuous readings.
- Press Start button to begin measurements.
- Press the Stop button to stop current flow reading and open valve.

Setting User Preferences

The CalTrak SL 800 offers enhanced electronics options to allow the user to define parameters specific to an application.

These parameters may be entered from the Operation screen or by pressing the blue section of the Measure screen

Chapter 8: Using Sensor Factors for MFC and MFM Calibration

MFCs (mass flow controllers) and MFMs (mass flow meters) are originally calibrated by the manufacturer with a specific gas. When you use an MFC or MFM with a different gas than the one used in the last calibration, you must apply a flow correction factor to account for different gas properties that affect flow. The MFC or MFM manufacturer can provide the appropriate sensor factor value. The user can also apply this flow correction factor to the CalTrak SL 800 readings.

To enable your CalTrak SL 800 to scale its actual flow measurements to match the adjusted flow from the MFC or MFM, input the sensor factor into the CalTrak SL 800 before calibrating the MFC or MFM.

The Sensor Factor is displayed on the run screen of the CalTrak SL 800 as SF X.XXX. The default setting is 1.000. If you input a sensor factor other than 1, red text will display on the Measure screen showing the sensor factor applied.

Chapter 9: Error Messages

“No Cell” - This message means that the cell is not present. Hit the home button to reset and install the cell.

“Piston Error” - This message means that the piston did not return to the bottom of the cell properly during operation. Hit the home button to reset.

If you continue to receive error messages after following these steps. Please contact customer service for assistance.

Chapter 10: Annual Maintenance and Calibration

Your CalTrak SL 800 is engineered to provide years of reliable service, with appropriate care and maintenance. Sierra recommends an annual calibration, to help ensure the best possible flow measurements and to provide an audit trail for those applications subject to regulatory requirements. If you should encounter any problems with your CalTrak SL 800, immediately contact Customer Service and provide a detailed description of your situation, including CalTrak SL 800 model and serial number, information about the flow source and the current calibration setup, environmental conditions during the test, the flow point or points that you're checking and an explanation of the issue you're experiencing.

Recertification

Your CalTrak SL 800 primary piston prover is a precision measuring standard comprised of moving parts that are machined to extremely close tolerances. Additionally, various environmental factors, product wear, drift of the temperature sensors and pressure transducers, or inadvertent damage may adversely affect your measurement accuracy or general performance.

For these reasons, Sierra highly recommends having your CalTrak SL 800 annually verified in order to ensure its measurement integrity. For those applications subject to regulatory or ISO requirements, verification by oan accredited laboratory provides you with a defensible audit trail of the highest quality.

Returning Equipment to Factory

Please contact Sierra for a service quote before sending your CalTrak SL 800 to our factory.

If you are sending in your CalTrak for repair or evaluation (rather than elective re-certification), contact Sierra for technical support or troubleshooting assistance prior to shipping the unit. Provide us a detailed description of your issues. If we are unable to resolve the situation by phone or email, we will issue you an RMA (return merchandise authorization) number. Follow the instructions for returning your instrument for service as noted below.

RMA Note – Returning Unit for Service

Sierra will not evaluate or service your instrument without an RMA number. Go to http://www.sierrainstruments.com/rma to complete an RMA.

Shipping

When shipping your CalTrak, be sure to follow some simple guidelines to avoid costly damage to your property.

- Pack your instrument carefully. Use adequate packing material. Whenever possible, use the original packing and foam or bubble wrap that came with your CalTrak (packing peanuts NOT recommended). Or use a Sierra CalTrak Pelican carrying case, which provides a hard case shell for protection of your valuable equipment. If you do not already have a Pelican case, visit us at www.sierrainstruments.com for more information on obtaining one.
- Include a copy of the RMA form (complete with Sierra supplied RMA number) with the unit(s).
- Use a major freight carrier (e.g., FedEx, UPS) that supplies tracking numbers.
- Insure your CalTrak. Sierra is not responsible for damage occurred during transit.
- Understand our mutual shipping obligations. Sierra is responsible for shipping cost only if the issue is product related and the CalTrak is still under warranty.

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)

Chapter 11: Storage

Protecting Your CalTrak When Not In Use

If you need to store your CalTrak SL800 for an extended period, please follow these guidelines: Always store it in a clean, dry place.

Chapter 12: Product Specifications

Interchangeable Flow Cell Models:

Model Number	SL 800-3	SL 800-10	SL 800-24	SL 800-44	SL 800-75
Flow Range	0.5—50 mL/min	5—500 mL/min	50—5,000 mL/min	500—50,000 mL/min	1-100 L/min
Accuracy, Standardized	±0.25% 0.5-50 sccm ± 0.002 sccm	±0.15%	±0.15%	±0.15%	±0.15%
Time Per Reading	1—60 seconds	3—135 seconds	3—90 seconds	1—35 seconds	1-50 seconds
Weight	80 oz/2300 grams	85 oz / 2413 g	86 oz / 2439 g	88 oz / 2507 g	160 oz / 4535 g
Inlet Fitting	1/8 in	1/4 in	1/4 in	1/4 in	1/2 in
Outlet Fitting	1/8 in	1/4 in	1/4 in	1/2 in	1/2 in

Specifications based on averaged readings. Accuracy is stated as a percent of reading (including standardization, if applicable).

Basics:

Dimensions: Cell Model 3: 9.0 x 4.0 in / 229 x 102 mm
Dimensions: Cell Models 10, 24, 44: 13.3 x 4.0 in / 337 x 102 mm
Dimensions: Cell Model 75: 14.8 x 5 in / 375 x 102 mm
Dimensions: Base: (H x W x D) 3.9 x 8.5 x 12.6 in / 99 x 216 x 320 mm

Weight: Base 5 lbs / 2268 g
Gas Compatibility: Non-corrosive, non-condensing, non-combustible gasses. Less than 70% humidity.

Usage:

Flow Mode: Suction and Pressure
Configuration: Base with modular, interchangeable flow cells (five)
Temperature & Pressure Sensors: Yes, in the flow stream of each interchangeable flow cell
Reading Modes: Single, Auto or User-Specified Burst
AC Adapter/Plug: 12V DC, > 3.0A, 2.5 mm, center positive, North American standard, others available
Inlet and Outlet Fittings:
Swagelok™ Operating
Temperature: 15–30° C
Storage Temperature: 0–
70° C
Operating Humidity: 0–70%, non-condensing
Display: Resistive
touchscreen Operating
Pressure (Absolute): 15 PSI
Data Port: RS-232 Serial
and USB-B

Sierra highly recommends annual Recertification (product maintenance, pre and post dynamic flow comparisons and full dimensional calibration). This is elective and is not included as a warranty item.

All specifications are subject to change. Please contact Sierra

CalTrak Pro Software:

Visit Sierra's website to download your copy of CalTrak Pro software CalTrak Pro captures flow data from your CalTrak SL 800 directly to a pre-configured table. The data can be exported to selectable Windows office environment.

To run CalTrak Pro, you must have Windows® XP or 7, Microsoft Excel® 2003 and up, and either a USB port or a RS-232 serial port.

Appendix A: 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.