



CalTrak[®] 500

CalTrak[®] 500 High Accuracy Modular Primary Standard Gas Volume Flow Calibrator

Cal Labs & Industry Applications

Instruction Manual

Models: SL-500



Part Number: IM-Cal-500 Rev. F 3/14



SIERRA[®]

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Warnings and Cautions

Note and Safety Information

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



Warning!

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



Caution!

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



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 components

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 4 of this manual.

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)

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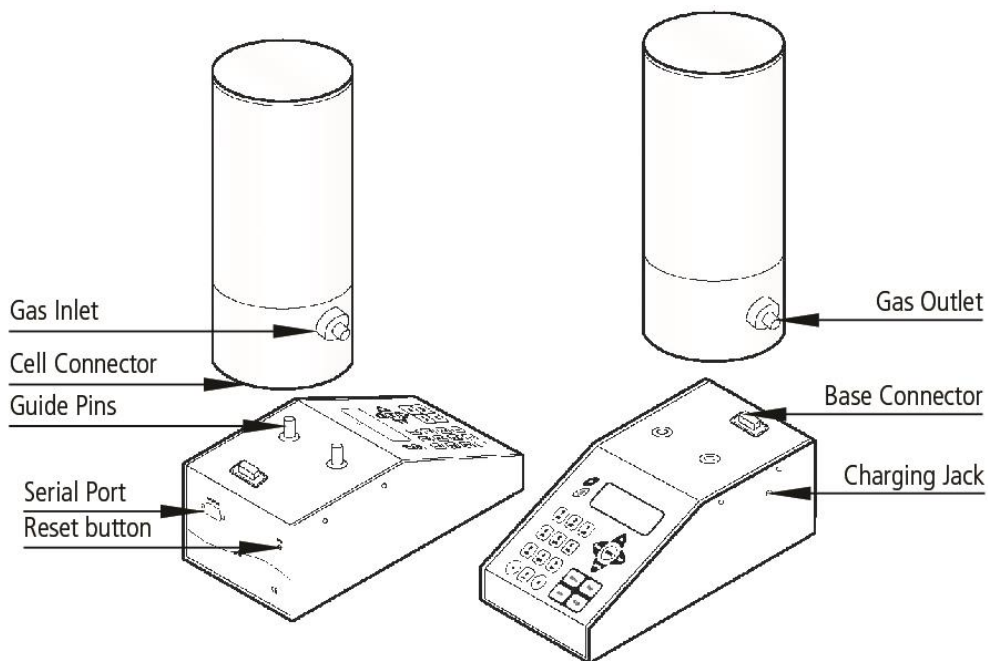
Chapter 1: Introduction

Bring world class accuracy to your flow lab. Sierra's CalTrak[®] 500 is a modular piston prover that offers portability and low maintenance for customers who have many flow instruments needing to be validated or calibrated frequently. The CalTrak 500 system comes with a base unit and choice of flow cells fitted with low massborosilicate glass pistons with a low friction coating that oscillate between two detectors to quickly and accurately measure gas flow rates. The design of the CalTrak 500 allows for increased flexibility and speed of reading.

The CalTrak 500 consists of a base with interchangeable flow cells. Each cell has a specific range. Cells can be easily changed (no tools needed) within seconds and can be purchased separately. Cells for the 500 can be used only with the 500 base.

Flow measurements can be taken manually (one reading at a time), or automatically in continuous mode. CalTrak calibrators offer digital communications via RS-232 and USB and come with our CalSoft[™] complete data collection software suite.

This manual will provide the information needed to operate your CalTrak 500. If at any time you have questions regarding its operation, please contact Sierra through our web site (www.sierrainstruments.com) or call us at 800.866.0200 to speak with a member of our professional customer service staff.



In Your CalTrak 500 Shipment

Your CalTrak 500 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 SL500 Base with the following:

- SL500 Electronic Base
- Battery Charger
- Leak Test Cable
- RS-232 Cable
- Instruction Manual
- Certificate of Calibration

Your SL500 Flow Cell Includes

- SL500 Flow Cell
- Leak Test Plug
- Certificate of Calibration

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



Warnings!

- The CalTrak 500 is not rated intrinsically safe and is not for use with explosive gasses or for use in explosive environments.
- The CalTrak 500 is not designed for pressurization above 2 psig or for gas flows above the rated specifications of the flow cell in use. Please consult the product specification on the inside front cover of the manual for more in-formation regarding acceptable gas flow ranges or visit our website at www.sierrainstruments.com or the most current product specifications.
- For use with clean laboratory air or other inert, non-corrosive gasses only.

Chapter 2: Operation

Getting Started

Although the SL500's battery comes charged from the factory, we recommend fully charging your new battery by connecting the AC power adapter/charger to the SL500's charging jack and then plugging it into a standard wall outlet. Initial charging should take approximately eight hours.

After initial charging, you may continue to charge your SL500 indefinitely by leaving it connected to the power supply. Otherwise, make sure to fully charge your SL500 at least once every three months to help maintain battery life.

On bases manufactured after January 2008 a small cooling fan was added for improved performance. The fan operates when the base is connected to the charger.

Turning the CalTrak 500 On and Off

Press On to start the CalTrak 500. An opening screen will appear indicating the instrument's revision level followed by the "Main Menu".

The SL500 has a battery saving automatic shut off system. After 65 minutes of inactivity, the SL500 will shut off. Alternatively, the unit can be shut off manually by pressing the Reset button followed by the number 0 from the "Main Menu".

LCD Backlight

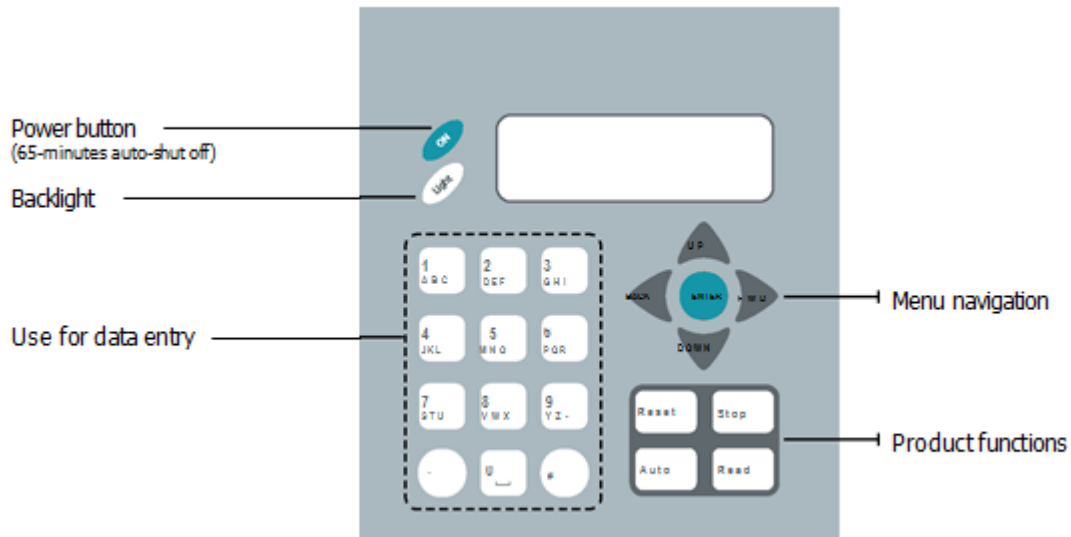
The CalTrak 500's LCD display includes a backlight function to illuminate the display. The default setting for the backlight is always on. If you wish to conserve battery power you may wish to turn the backlight off or enable the backlight only when inputting information on the keypad.

To turn the backlight off, from the "Main Menu" press the Light button one time. To enable the backlight only when inputting information on the keypad press the Light button a second time. To return to the default setting (always on), press the Light button a third time.

Low Battery Indicator

A low battery condition is indicated by a "B" appearing in the upper right-hand corner of the LCD. The low battery indicator allows the user to connect to an external power source prior to the unit powering down. Time between low battery indication and loss of power varies depending on the current application.

Chapter 3: Using the CalTrak 500 Keypad



CalTrak 500 Keypad

General Menu Navigation

Use the Up/Down arrows to navigate between different lines within a menu. Use the Enter button to select a field to be modified and to lock-in any changes. Use the keypad for data entry, such as entering standard temperature conditions; use the Up/Down arrows to toggle between fields, such as Temperature or Pressure units. Use the Fwd and Back keys to advance to the following menu or return to the previous menu

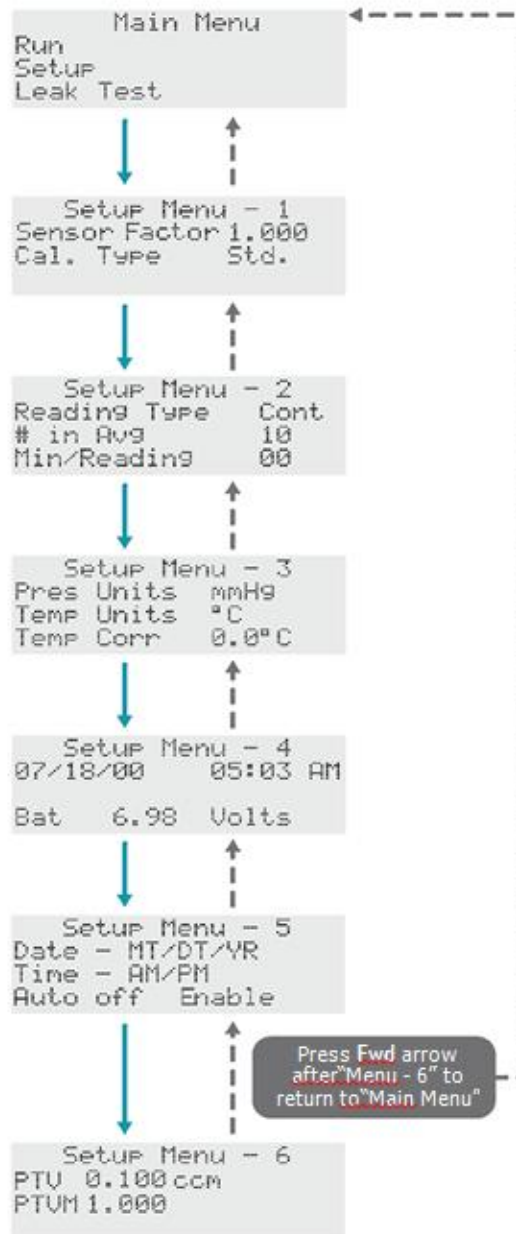
Keypad Function

The keypad is used for both numeric character entry. When pressed, each alphanumeric button will display its corresponding number. To go back, use the back arrow. The SL500 will overwrite previous entries. Use the Enter key to lock-in any selections.

- **Reset Button:** Clears both the current reading and the group average and opens the valve, allowing the piston to return to its resting state.
- **Stop Button:** Stops current reading and opens the valve, allowing the piston to return to its resting state.
- **Auto Button:** Initiates automatic readings (must be accessed from the “Run Menu”). If the Reading type has been set to “Cont” in “Setup Menu - 2”, the unit will run until the preset average is reached and then restart the cycle. If the Reading type has been set to “Burst” in “Setup Menu - 2”, the unit will run until the preset average is reached and then stop.
- **Read Button:** Initiates a single reading (must be accessed from the “Run Menu”).

CalTrak 500 Menu Tree

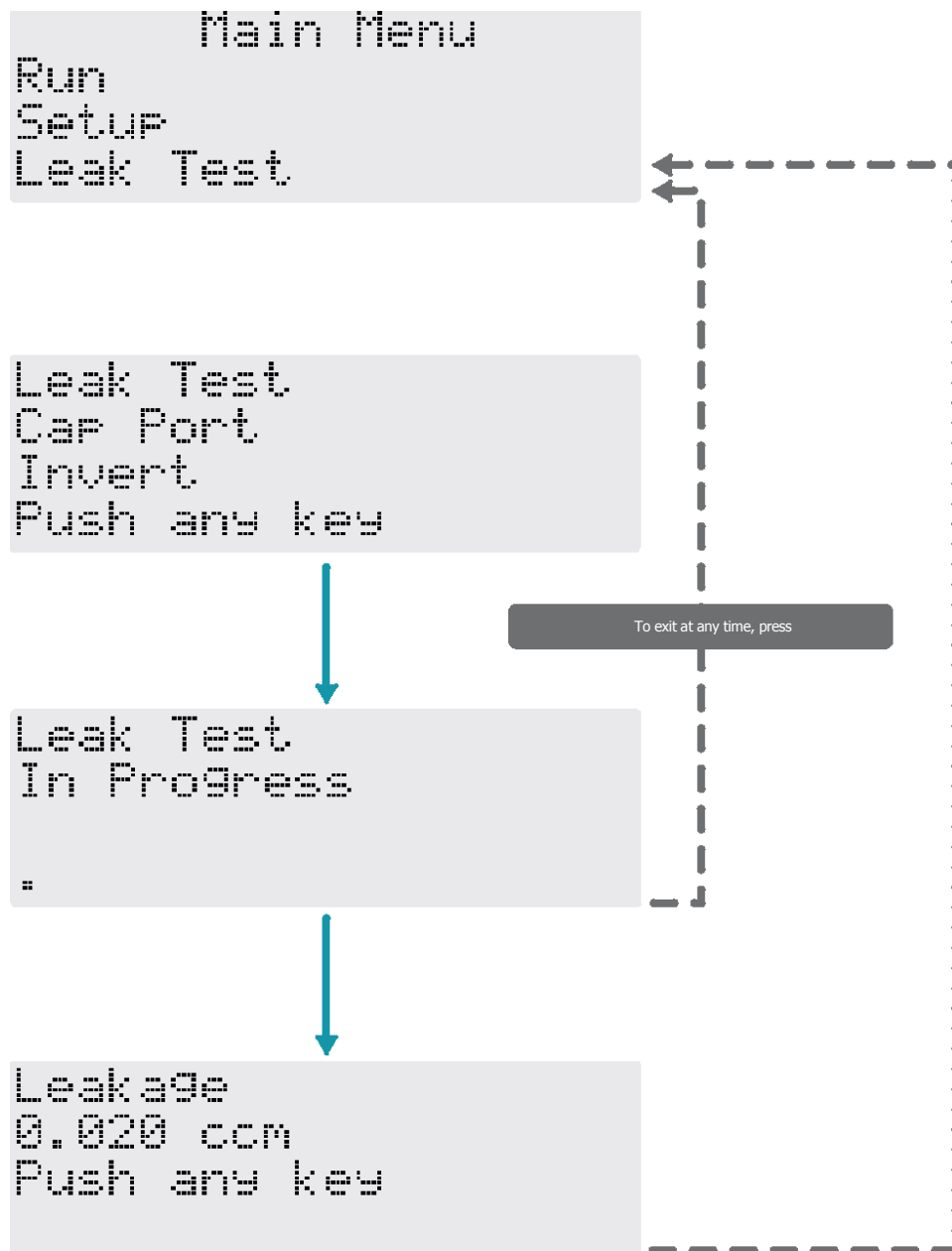
→ = Forward navigation
← = Backward navigation



- Use the Up/Down arrows to navigate between different lines.
- Use the Enter button to select a field to be modified depending on the function and to lock in any changes.
- Use either the keypad or the Up/Down arrows to modify the desired field.
- Use the Fwd and Back keys to advance to the following menu or return to the previous menu.

CalTrak 500 Menu Tree

→ = Forward navigation
- - - → = Backward navigation



- Use the Up/Down arrows to navigate between different lines.
- Use the Enter button to select a field to be modified depending on the function and to lock in any changes.
- Use either the keypad or the Up/Down arrows to modify the desired field.
- Use the Fwd and Back keys to advance to the following menu or return to the previous menu.

Error Messages

No Cell

Cell is not present or unit does not see cell. Cell is not present or unit does not “see” cell.

To exit, press Back, or wait to return to Main Menu

To exit, press Back, or wait to return to “Main Menu”.

Piston Error

Piston did not return to bottom of cell properly. Piston did not return o bottom of cell properly.

To exit, press any key.

Chapter 4: Installing and Removing Flow Cells

The SL500 accepts interchangeable SL500 (only) flow cells for different flow ranges. If the user attempts to enter the “Run Menu” prior to installing a flow cell, the unit indicates “No Cell” and returns to the “Main Menu” after a 5 second delay.

Installing Flow Cells

1. Position the selected flow cell into the base opening, its top label facing you.
2. Turn the cell back and forth to locate the guide pins; when the guide pins are engaged, press down.
3. When powered on, the SL500 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 SL500 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
Date Format	MM/DT/YR	DT/MM/YR
Time Format	AM/PM	24 Hr

Chapter 6: Connecting the CalTrak 500 to Gas Flow Source

The accuracy of the SL500 is dependent upon its source being stable. An unstable flow source may produce inconsistent readings. Flow direction is indicated by the arrow on the top of the flow 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 SL500 is designed to be used at ambient pressures. Do not subject the SL500 to a pressure 2 psig higher or lower than atmospheric pressure. This is easily accomplished by leaving the outlet of the flow cell open to atmosphere for pressure applications or the inlet outlet 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 SL500 calibrator does not exceed 2 psig.

Chapter 7: Taking Readings

The SL500 default is preset for ten (10) readings in an averaging sequence. This parameter is user-definable (see Setup Menu 2, Reading Type, # in Average & Min./Reading).

```
      Main Menu
Run
Setup
Leak Test
```

1. Press Enter, Read, or Auto to enter the “Run Menu”.

```
Flow          ecm
Avg          #
 26.1      °C  ST  0.0
746.8 mmHg  SF  1.000
```

- Press the Read button to initiate a single reading.
- Press the Auto button to initiate continuous hands-free readings.
- Press the Stop button to stop current flow reading and open valve.
 - Press the Reset button to clear the display of current data

Chapter 8: Setting User Preferences

The SL500 offers enhanced electronics options to allow the user to define parameters specific to an application. There are six Setup Menus.

General Menu Navigation

Use the Up/Down arrows to navigate between different lines within a menu. Use the Enter button to select a field to be modified and to lock-in any changes. Use the keypad for data entry, such as the number of readings in an averaging sequence; use the Up/Down arrows to toggle between fields, such as Temperature or Pressure units. Use the Fwd and Back keys to advance to the following menu or return to the previous menu.

Keypad Function

The keypad is used for numeric character entry. When pressed, each alphanumeric button will display its corresponding number. To go back, use the back arrow. The SL500 will overwrite previous entries. Use the Enter key to lock-in any selections.

```
      Main Menu
Run
Setup
Leak Test
```

To enter “Setup Menu - 1” from the “Main Menu”, select Setup and press Enter.

Setup Menu 1, Sensor Factor, Calibration Type

```
      Setup Menu - 1
Sensor Factor 1.000
Cal. Type      Std.
```

Option 1, “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).

Option 2, “Cal. Type”

This option changes the sample type being displayed. Toggles between “std.” (standardized readings) and “vol.” (volumetric readings).

Setup Menu 2, Reading Type, # in Average & Minutes/Reading

```
      Setup Menu - 2
Reading Type   Cont
# in Avg      10
Min/Reading    00
```

Option 1, “Reading Type”

Toggles between “Cont.” (continuous auto-read) and “Burst” (performs continuous auto-read, then stops after the quantity in averaging sequence is reached [as programmed in Setup Menu 2, Option 2, # in Average]).

Option 2, “# in Average”

Changes the quantity in an averaging sequence (consecutive readings) from 1-100.

Option 3, “Min./Reading”

Specifies the time interval (in minutes) between flow readings.

Setup Menu 3, Pres. Units, Temp. Units, Temp Corr.

```
Setup Menu - 3
Pres Units  mmHg
Temp Units  °C
Temp Corr   0.0°C
```

Option 1, "Pres. Units"

This option allows you to toggle between mmHg, mBar, kPa and PSI.

Option 2, "Temp. Units"

This option allows you to set the temperature units for ° F or ° C.

Option 3, "Temp. Corr."

This option is used to set the standardization temperature.

Setup Menu 4, Date, Time & Battery Voltage

```
Setup Menu - 4
07/18/00    05:03 AM
Bat  6.98 Volts
```

This menu has an alternate navigation method.

Within this menu, use the Fwd and Back arrows to select each option, such as Month or Day. To change a selected option, use the Up/Down arrows. Date and time formats are specified using Setup Menu 5, Date and Time Formats.

Option 1, Date

This option allows you to set the date.

Option 2, Time

This option allows you to set the time.

Setup Menu 5, Date & Time Formats

```
Setup Menu - 5
Date - MT/DT/YR
Time - AM/PM
Auto off  Enable
```

Option 1, "Date"

Toggles between "MT/DT/YR" or "DT/MT/YR" date format.

Option 2, "Time"

Toggles between "AM/PM" or "24 Hr" time format.

Option 3, "Auto Off"

Toggles between "Enable" or "Disable" 65-minute auto-shut off.

Setup Menu 6, Piston Tare Value (PTV) and Piston Tare Value Multiplier (PTVM)

PTV stands for Piston Tare Value; this is the amount of gas that passes around the piston during measurement. All Sierra calibration equipment has a factory set Piston Tare Value that is stored in the memory of the Sierra DryCal cell. The value is typically very small 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 the Piston Tare Value (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 Piston Tare Value. For highest accuracy, the instrument's Piston Tare Value (PTV) can be adjusted. Adjusting the Piston Tare Value is accomplished by entering a new Piston Tare Value Multiplier (PTVM). The Piston Tare Value Multiplier is multiplied to the Piston Tare Value and used to adjust the measurement; the default value for air and nitrogen is 1.000. The Piston Tare Value Multiplier (PTVM) can be set to any value from 3.000 to 0.2000.

For flows above 20 ccm, a new a Piston Tare Value Multiplier (PTVM) value 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 Piston Tare Value Multiplier (PTVM) for this cell.

```
Setup Menu - 6
PTV 0.100 ccm
PTVM 1.000
```

Option 1, "PTV" Piston Tare Value

This is the unique piston tare value of a particular flow cell. It is factored into each flow reading for leakage-independent measurements. The piston tare value is factory-set and non-adjustable.

Option 2, "PTVM" Piston Tare Value Multiplier

This is the adjustable piston tare value multiplier used to adjust the piston tare value to enhance accuracy at lower flows when using gasses other than nitrogen or air. The piston tare value multiplier's factory setting is 1.000, although it may be changed to any value between 0.200 and 3.00 if gasses other than air or nitrogen are used.

Chapter 9: Using Sensor Factors

When calibrating an MFC or MFM using a surrogate or proxy gas (meaning the MFC or MFM was originally calibrated by the manufacturer for a gas other than what you are currently using), the reading of the SL500 can be scaled by the sensor factor to allow for this.

To enable your SL500 to scale its actual flow measurements to match the adjusted flow from the MFC or MFM, input the sensor factor into the SL500 before calibrating the MFC or MFM (see SETUP – Readings).

The Sensor Factor is displayed on the run screen of the SL500 as SF X.XXX. The default setting is 1.000. Because a sensor factor other than your SL500's default value of 1.000 modifies the actual flow to a "reported" flow make sure to change this setting back to 1.000 when a calibration involving the use of a sensor factor is completed.

Chapter 10: Leak Testing

To ensure proper function of the SL500 annual factory calibration is recommended. However, a quality assurance self-test feature is provided to verify proper integrity of the flow cell. It is recommended that the self-check leakage test be conducted periodically as part of an ongoing quality assurance program. Passing the leak test does not ensure proper function of the ML-500, although it does ensure that total leakage is within the product's allowable limits. The leak test may take as long as 6 hours or more to complete per fitting. Since the leak test may take several hours, it is recommended to plug the charger into the base during the leak test to prevent unit from turning off.

When performing the leak test procedure note the inlet and outlet leakage. If the inlet and outlet leakage do not agree within 50% of each other, assure that the inlet and outlet Fittings are tight, then repeat the leak test procedure. If the problem persists, please contact Sierra .

The maximum leakage limits are .200 ccm for the ML-500-10; 1.000 ccm for the ML-500-24; and 3.000 ccm for the ML-500-44. If the leakage exceeds the maximum limits, repeat the leak test procedure. If the problem persists, please contact Sierra for assistance.

To Initiate the Leak Test

1. Place the SL500 on a flat, vibration-free surface.
2. While in the "Main Menu" install the leak test cable (included with the SL500 base unit) between the 9-pin SL500 Base Connector and the 9-pin Cell Connector.

```
Main Menu
Run
Setup
Leak Test
```

3. From the "Main Menu" remove the cell and select "Leak Test".
4. After a leak test is initiated, the display will read:

```
Leak Test
Cap Port
Invert
Push any key
```

5. Place the leak test plug over either the inlet or the outlet port fitting on the SL500 flow cell.
6. Invert the SL500 flow cell.
7. Push any key to commence the leak test. At this point the SL500 will time the descent of the piston. The leak test may take up to 6 hours to complete. The display will read:

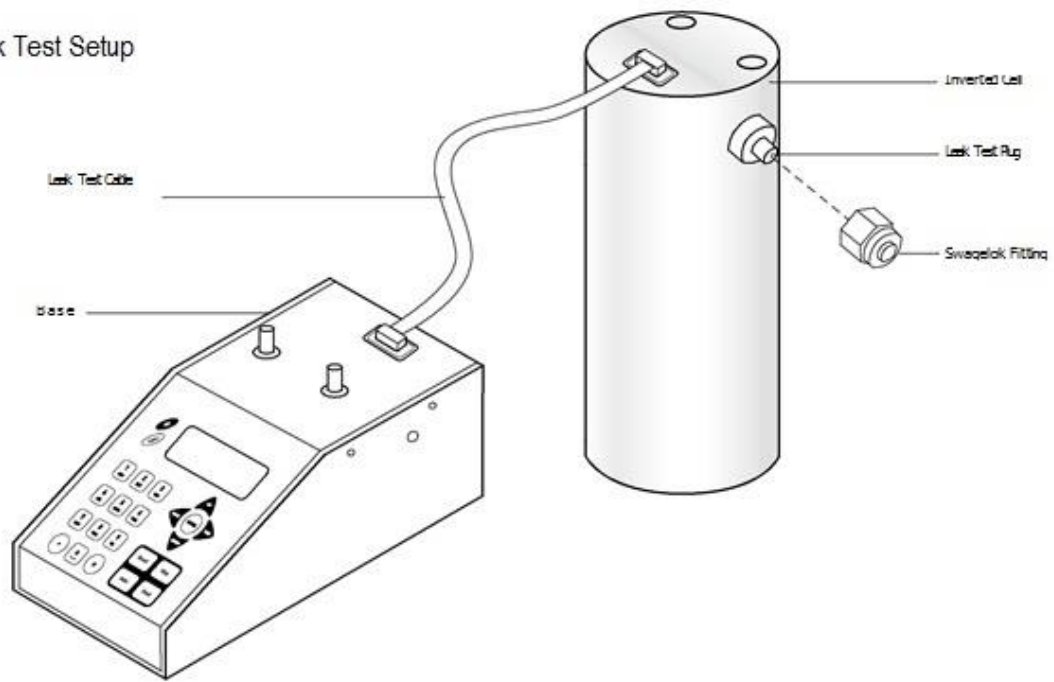
```
Leak Test
In Progress
"
```

8. If the test is completed successfully a leakage rate will be displayed. The display will appear similar to the following:

```
Leakage
0.020 ccm
Push any key
```

9. Repeat the procedure with the leak test port cap over the opposite port fitting.

Leak Test Setup



Chapter 11: Annual Maintenance and Calibration

Your SL500 is engineered to provide years of reliable service, with appropriate care and maintenance. Sierra recommends an annual calibration by our ISO 17025–accredited laboratory, to help ensure the best possible flow measurements and to provide a bullet-proof audit trail for those applications subject to regulatory requirements. If you should encounter any problems with your CalTrak 500, immediately contact Customer Service and provide a detailed description of your situation, including SL500 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 SL500 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 SL500’s measurement accuracy or general performance.

For these reasons, Sierra highly recommends having your SL500 annually verified by our ISO 17025–accredited laboratory in order to ensure its measurement integrity. For those applications subject to regulatory or ISO requirements, verification by our accredited laboratory provides you with a defensible audit trail of the highest quality.

As the ultimate quality assurance measure, as well as to keep your SL500 in top condition and updated with the latest hardware and firmware upgrades (as available), Sierra offers our elective Recertification program. Recertification is an intensive service and calibration package that provides pre- and post-dynamic flow comparisons against our proven Sierra CalSoft Technology lab standard; complete product refurbishment - including cleaning of the piston and glass assembly, installation of any available upgrades and other routine and preventative maintenance items; and full dimensional calibration, comprised of 20 or more tests using precision instruments and gauges, such as depth and laser micrometers and a temperature bath. When completed, you receive NIST-traceable, ISO 17025-, ANSI Z-540- and NIST Handbook 150-backed calibration certificates.

Recertification includes a 90-day service warranty should any related labor or parts replacements prove faulty. Due to the intensive nature of our SL500 Recertification, the time spent within our service facility during this process is generally fourteen days, beginning from the day we receive your product.

To obtain current Recertification pricing, please contact Sierra at **800.866.0200**, or visit our web site at www.sierrainstruments.com. Please contact us to see if expedited service is available for an additional charge.

Returning Equipment to 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 12: Storage

Protecting Your CalTrak When Not In Use

If you need to store your CalTrak for an extended period, please follow these guidelines:

- Always store it in a clean, dry place.
- If possible, leave it attached to its AC power adapter/charger while in storage.
- If your CalTrak cannot be attached to its AC power adapter/charger while in storage, please do the following:
 - Fully charge it before extended storage. If the battery is not fully charged prior to storage, it might be permanently damaged.
 - Fully charge it at least once every three months.
- When removing your CalTrak from storage, recharge the battery for at least 12 hours prior to reusing your CalTrak after storage.

Chapter 13: Product Specifications

WHY PRIMARY STANDARD?

CalTrak 500 and 800 are a true primary standard in every sense of the word, because their accuracy is based upon primary SI units: The interior diameter of the glass measuring cylinder; the length of piston travel within the cylinder; and the time it takes the piston to travel this distance, implying a known volume. Our patented technology, therefore, offers accuracies at the level of national laboratories in one portable device.

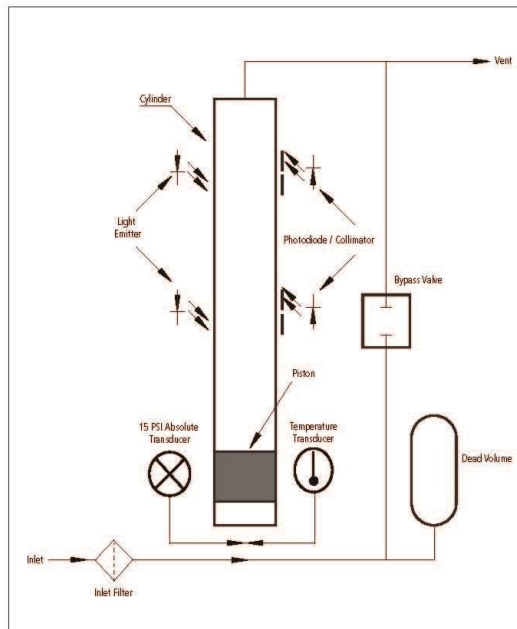
OPERATING PRINCIPLE

Sierra's CalTrak models contain a nearly frictionless graphite piston that moves freely inside a borosilicate glass tube. When the parallel bypass valve is closed, the gas flow is directed into the tube to push the piston up (see Figure 1).

Two photo-optic sensors detect the piston as it travels past. The distance the piston travels between the two sensors is precisely defined and represents a known volume. Accurate crystal-based timers drive a microprocessor which calculates the rate of rise. This defines the volumetric flow rate.

At the same time, extremely accurate temperature and absolute pressure sensors collect data used to calculate the mass flow rate.

Figure 1: CalTrak 500 & 800 - standard



PERFORMANCE SPECIFICATIONS

Flow Ranges and Single-Reading Accuracy ⁽¹⁾					
Model 500	Range ⁽²⁾	Accuracy ⁽¹⁾ (% Reading)		Time Per Measurement (time in seconds)	Compression Fittings
		Mass ⁽³⁾	Volumetric ⁽²⁾		
SL-500-10	5 - 500 sccm (0.5 slpm)	+/- 0.40	+/- 0.25	1 to 80	¼-inch ID Swagelok®
SL-500-24	50 - 5000 sccm (5.0 slpm)	+/- 0.35	+/- 0.20	1 to 50	¼-inch ID Swagelok®
SL-500-44	SL-500-44 500 - 50,000 sccm (0.5 - 50 slpm)	+/- 0.45 ⁽⁴⁾	+/- 0.25 ⁽⁴⁾	1 to 20	½-inch Swagelok®

Model 800	Range ⁽²⁾	Accuracy ⁽¹⁾ (% Reading)		Time Per Measurement (time in seconds)	Compression Fittings
		Mass ⁽³⁾	Volumetric ⁽²⁾		
SL-800-3	0.5 sccm to 50 sccm	+/- 0.25	+/- 0.25 plus 0.002 sccm	1 to 60	¼-inch ID Swagelok®
SL-800-10	5 - 500 sccm (0.5 slpm)	+/- 0.15	+/- 0.15	3 to 135	¼-inch ID Swagelok®
SL-800-24	50 - 5000 sccm (5.0 slpm)	+/- 0.15	+/- 0.15	3 to 90	¼-inch ID Swagelok®
SL-800-44	500 - 50,000 sccm (50 slpm)	+/- 0.15	+/- 0.15	1 to 35	½-inch Swagelok®
SL-800-75	1000 sccm -100 slpm	+/- 0.15	+/- 0.15	1 to 50	½-inch Swagelok®

Table 1: Flow Cell Specifications

- Notes: (1) Using the averaging mode will increase accuracy
 (2) Temperature range 5°C to 40°C (41°F to 104°F)
 (3) Temperature range 15°C to 30°C (59°F to 86°F)
 (4) From 30-50 slpm: 0.45% standardized, 0.3% volumetric
 (5) At gas pressure of 760 mmHg (1 atm), and a gas temperature of 25°C (77°F) with standardization temperature set to 0°C (32°F)

OPERATION SPECIFICATIONS

Operating Temperature

Volume: 5°C to 40°C (41°F to 104°F)
 Mass: 15°C to 30°C (59°F to 81°F)

Operating Pressure

15 psia (1.03 barA)

Ambient Temperature

15°C to 30°C (59°F to 86°F)

Storage Temperature

0°C to 70°C (32°F to 158°F)

Gas Compatibility

Non-corrosive, humidity less than 70% non-condensing

Flow Modes

Suction and pressure

Pressure & Suction Fittings

See Table 1 Flow Cell Specifications on page 2

Warranty

1 year; battery 6 months

Approvals

CE; RoHS compliant
 Built and calibrated to ISO 17025 by NVLAP-certified laboratory. All calibrations traceable to NIST.

Digital Communication

RS-232

PHYSICAL SPECIFICATIONS

Configuration

SL500: base with modular, interchangeable flow cells (three)
 SL800: base with modular, interchangeable flow cells (five)

Display

Backlit LCD

Weight

500
 Base: 3.5 kg (17.8 lbs)
 Cells: 85.1 oz (2412.5 g) to 88.4 oz (2507 g) flow cell dependent

800

Base: 4.5 kg (10 lbs)
 Cells: 80 oz (2300 g) to 160 oz (4535 g) flow cell dependent

Dimensions

Model	Width mm (in.)	Depth mm (in.)	Height mm (in.)
500	135 (5.25)	280 (11)	340 (13.5)
800	152 (6)	280 (11)	436 (17)

POWER REQUIREMENTS

AC Power Adapter/Charger

100-240 VAC, 50-60 Hz
 12V DC, >500ma, 2.5 mm, center positive,
 North American standard, others available

Battery

Internal continuously chargeable sealed lead-acid battery
 6 volt lead acid battery; battery Operational Time
 (5 cycles/min)

USER INTERFACE & SOFTWARE

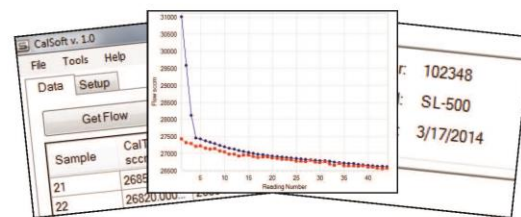
Local Interface

Backlit LCD graphical display; Four directional arrow buttons on the control panel allow you to navigate through the menu; user selectable flow units plus time intervals

CalSoft™ Software

Software System Requirements
 Windows® XP, Windows® 7
 Microsoft Excel® 2003 and up

- Captures flow data from your CalTrak instrument for easy export into common software packages, a PC, or Microsoft environment.
- Real-time data monitoring
- Upload the latest version of the firmware to your CalTrak
- Enter flow rates from pumps or other flow source or flow meters and calibrate the flow source.
- Compare the flow measurements from your CalTrak precision calibrator.



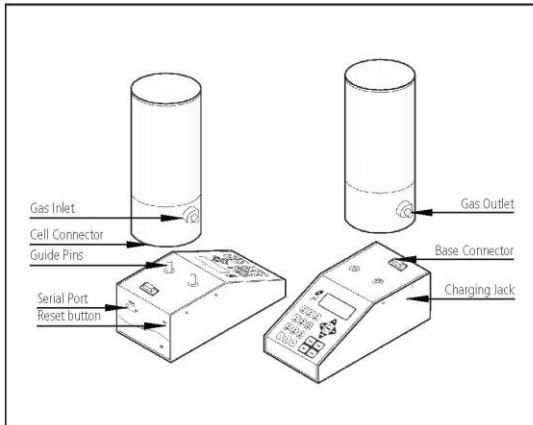
GAS FLOW SOURCE CONTROL

Mass Flow Controllers SmartTrak 100 Mass Flow Controller

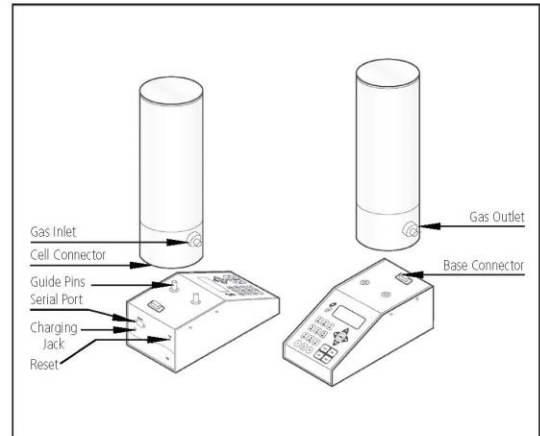
Sierra's popular SmartTrak® 100 Series Mass Flow Controllers are ideal for generating and maintaining a constant flow of gas so that any type of flow meter can easily be calibrated. Special versions of the SmartTrak are available to cover the range of each CalTrak flow cell. With the built-in display and controls, SmartTrak is a complete gas flow generation system.



CalTrak 500 Back and Front View



CalTrak 800 Back and Front View



EXAMPLE CONFIGURATIONS

CalTrak Base with Three Flow Cells

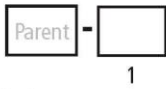


CalTrak 500 and 800 are modular units capable of expanded flow ranges from 5 sccm up to 100 slpm. Each system comes with a base and three modular flow cells that can be easily switched out depending on flow rate. Save money by buying only the cell you need, or buy all three for ultimate flexibility.

CalTrak MFM/MFC Calibration Setup



CalTrak 500 and 800 are for inert gases only and are ideally suited for MFM and MFC calibration for owners and users of many instruments that require calibration/verification one or more times a year. The picture above shows a typical MFM and/or MFC calibration setup.



Feature

Instructions: To order a CalTrak, please fill in each feature number block by selecting the codes from the corresponding features below.

Parent number: CalTrak SL Bases	
SL-500-B	CalTrak® +/-0.35% of reading accuracy (flow cell dependent) gas flow calibrator (base only). The CalTrak base unit requires SL500 cell(s) to create an operational unit. Standard configuration includes: Leak test cable, RS-232 cable, 100-240 AC battery charger and manual.
SL-800-B	CalTrak +/-0.15% reading accuracy (flow cell dependent) gas flow calibrator (base only). The CalTrak base unit requires SL800 cell(s) to create an operational unit. Standard configuration includes: Leak test cable, RS-232 cable, 100-240 AC battery charger and manual.

Feature 1: CalTrak SL Cells	
SL-500-10	Low flow cell for use with SL-500-B unit. Flow range 5 sccm to 500 sccm (0.5 slpm); Accuracy: Volumetric: +/-0.25% of reading/ Mass: +/-0.40% of reading
SL-500-24	Medium flow cell for use with SL-500-B unit. Flow range 50 sccm to 5000 sccm (5.0 slpm); Accuracy: Volumetric: +/-0.20% of reading/ Mass: +/-0.35% of reading
SL-500-44	High flow cell for use with SL-500-B unit. Flow range 500 sccm to 50,000 sccm (0.5 slpm to 50 slpm); Accuracy: Volumetric: 0.25% of reading/ Mass: +/-0.45% of reading
SL-800-3*	Ultra Low flow cell for use with SL-800-B unit. Flow range 0.5 sccm to 50 sccm; Accuracy: Volumetric: +/-0.25 plus 0.002 sccm / Mass: +/- 0.25% of reading
SL-800-10	Low flow cell for use with SL-800-B unit. Flow range 5 sccm - 500 sccm (0.5 slpm); Accuracy: Volumetric: +/-0.15% of reading/ Mass: +/-0.15% of reading
SL-800-24	Medium flow cell for use with SL-800-B unit. Flow range 50 sccm to 5000 sccm (5.0 slpm); Accuracy: Volumetric: +/-0.15% of reading/ Mass: +/-0.15% of reading
SL-800-44	High flow cell for use with SL-800-B unit. Flow range 500 sccm to 50,000 sccm (50 slpm); Accuracy: Volumetric: +/-0.15% of reading/ Mass: +/-0.15% of reading
SL-800-75**	High flow cell for use with SL-800-B unit. Flow range 1000 sccm - 100 slpm; Accuracy: Volumetric: +/-0.15% of reading/ Mass: +/-0.15% of reading

*Note: SL-800-3 is only compatible with SL-800 bases loaded with firmware release of 2.07 or higher.

**Note: SL-800-75 is only compatible with SL-800 bases loaded with firmware release of 2.07 or higher.

Cases

PEL-1550: Case with foam insert. Fits one SL-500 base, one cell and accessories.

PEL-1620: Case with foam insert. Fits one SL-500 base, up to 3 cells and accessories.

PEL-1600: Case with foam insert. Fits one SL-800 base, one cell and accessories.

PEL-1650: Case with foam insert. Fits one SL-800 base, up to 3 cells and accessories.

CalTrak Base with Three Flow Cells



Chapter 14: Limited Warranty

Outlining Our Responsibilities

The CalTrak 500 Series is warranted to the original end user to be free from defects in materials and workmanship under normal use and service for a period of one year from the date of purchase as shown on the purchaser's receipt. The CalTrak 500 Series' battery is warranted for six months from the original purchase date. If the unit was purchased from an authorized reseller, a copy of an invoice or packing slip showing the date of purchase may be required to obtain warranty service.

The obligation of Sierra Instruments, Inc. under this warranty shall be limited to repair or replacement (at our option), during the warranty period, of any part that proves defective in material or workmanship under normal use and service, provided the product is returned to Sierra Instruments, Inc., transportation charges prepaid.

Notwithstanding the foregoing, Sierra Instruments, Inc. shall have no liability to repair or replace any Sierra Instruments, Inc. product:

1. That has been damaged following sale, including but not limited to damage resulting from improper electrical voltages or currents, defacement, misuse, abuse, neglect, accident, fire, flood, terrorism, act of God or use in violation of the instructions furnished by Sierra Instruments, Inc.
2. When the serial number has been altered or removed.
3. That has been repaired, altered or maintained by any person or party other than Sierra's own service facility or a Sierra authorized service center, should one be established.

This warranty is in lieu of all other warranties and all other obligations or liabilities arising as a result of any defect or deficiency of the product, whether in contract or in tort or otherwise. All other warranties, expressed or implied, including any implied warranties of merchantability and fitness for a particular purpose, are specifically excluded.

In no event shall Sierra be liable for any special, incidental or consequential damages for breach of this or any other warranty, express or implied whatsoever.