



CalTrak® 850

CalTrak® 850 Primary Standard Gas Mass Flow Calibrator

*High Accuracy, All-In-One System,
Inert & Corrosive Semicon Gases*

Instruction Manual

Models: 850



Part Number: IM-CalTrak -850 Rev. V2 4/15



SIERRA®
EXPERIENCE OUR PASSION FOR FLOW!

GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

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TRADEMARKS

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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! When measuring hazardous gases, the 850 should be placed in a vent hood as a safety precaution. The 850 can also be operated at sub atmospheric pressures as a safety precaution against accidental gas leakage.

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 2 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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Introduction

Sierra's CalTrak™ 850 is a high accuracy, all-in-one, portable gas mass flow calibrator for use in laboratory or industrial environments. Designed to calibrate or verify mass flow meters and mass flow controllers commonly used in the semiconductor industry, the CalTrak 850 can measure corrosive gases compatible with these wetted path materials: 304-316 stainless steel, borosilicate glass, Teflon®, and AFLAS® elastomeric.

Flow measurements can be taken manually (one reading at a time), or automatically in continuous mode, with up to 100 measurements in an average sequence. CalTrak 850 calibrators offer digital communications via RS-232 and USB plus a complete data collection software suite call CalSoft.

The design of the CalTrak 850 allows for increased flexibility and speed of reading. Three tubes sit horizontally in the instrument and are fitted with low mass-borosilicate glass pistons with a low friction coating that oscillate between two detectors to quickly and accurately measure gas flow rates.

This manual will provide the information needed to operate your CalTrak 850. 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.

Precautions

- The 850 internal components are designed to handle corrosive gases compatible with boro-silicate glass, 304 – 316 stainless steel and AFLAS® fluoroelastomer. When measuring corrosive gases the user must take appropriate laboratory safety procedures to contain and prevent inadvertent gas leakage from the 850 and connecting plumbing.
- The 850 is not designed to measure gas pressure above 16 psia (1103 mbar) or for gas flows above 50,000 ccm. If pressurization reaches 15.9psia (1096 mbar), the following warning will appear on the display on the main control panel: OVERPRESSURE! If this occurs, remove the overpressure situation, then touch “Stop” on the LCD display to clear this warning.
- The 850 does not contain user-serviceable parts and must be returned to Sierra's New Jersey, USA location for maintenance.

In Your CalTrak 850 Shipment

Your 850 is a high accuracy primary standard, and has been shipped in Sierra's rugged, reusable shipping container. The 850 weighs 62 lbs / 28 kilograms; **unpacking by two people is recommended**. The 850 can be lifted from the shipping container by grasping the back or bottom of the unit. Your 850 comes with the following:

Your CalTrak 850 comes with the following:

- AC Power Adapter/Charger
- PC Serial Cable (RS-232)
- CalSoft Software
- Calibration Certificate
- Manual
- Reusable shipping container

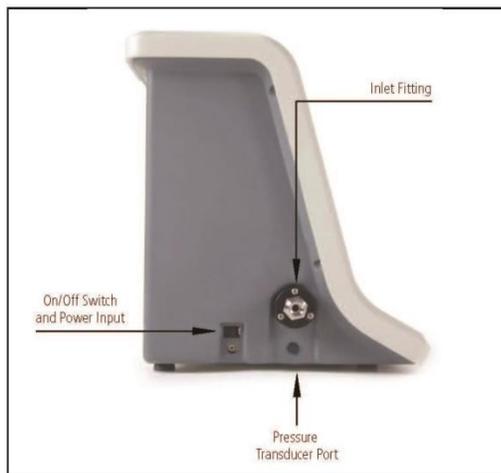
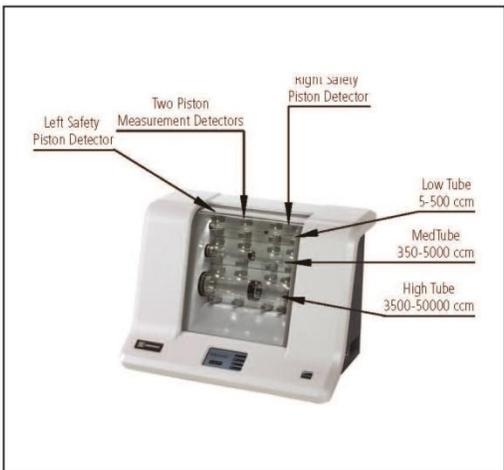
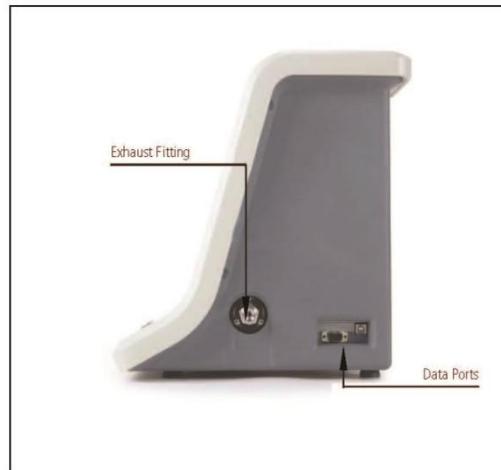
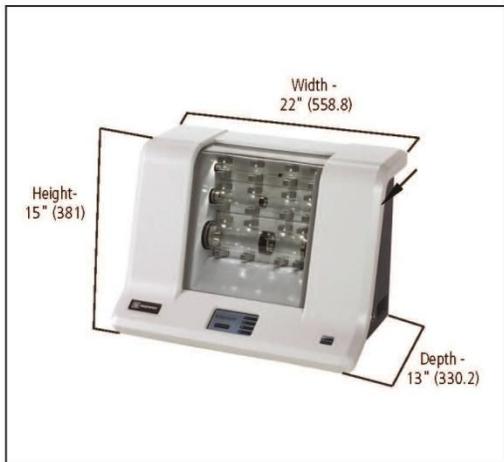
Note: You can also utilize Sierra's CalSoft software package available for download from www.sierrainstruments.com. CalSoft software captures flow data from your Sierra CalTrak instrument for easy export into common software packages. See page 9 for software requirements.

About CalTrak 850

The 850 contains three measurement tubes for measuring gas flow rates from 5 to 50,000 ccm across a pressure range of 14 to 15.9 psia. The “High Flow” tube, located at the bottom, measures flow rates of 3,500 to 50,000 ccm, the middle “Medium Flow” tube measures flow rates from 350 to 5,000 ccm and the “Low Flow” tube, located at the top, measures flow rates from 5 to 500 ccm. The 850 will select the correct measurement tube as flow readings are taken. Standardized flow rate corrections are made using the internal temperature and pressure transducers and the application of a compressibility factor correction.

Four piston detectors are used for each tube. The two inner piston detectors measure the time required to displace the piston a known volume/distance. From this time interval the volumetric flow rate is calculated. The two outer most piston detectors are used to initialize the piston position and as a safety in case of measurement piston detector failure. The piston detector assemblies also contain white LEDs that illuminate the active measurement tube. Small green LEDs located on the bottom arm of the piston detectors indicate internal valves activity.

When a gas flow measurement is initiated two normally closed valves for the selected tube open and four flow control valves operate directing the gas flow. The piston oscillates between two piston measurement detectors and the time interval required for the piston to sweep the calibrated tube volume provides the volumetric flow rate. A temperature transducer located at the gas stream entrance to the tube measures gas temperature. A precision pressure sensor measures gas pressure in the measurement tube. From the gas temperature, gas pressure and a compressibility factor the volumetric gas flow rate is converted to a standardized gas flow rate. The 850 is controlled by the front panel touch screen or through commands sent through the Data Port.



System Placement & Location

Your 850 can be placed on a steady, secure work surface or mounted on a work cart for portable use. The 850 has self adjusting feet on its base. The inlet gas fitting (1/2-inch VCR® fitting) is located on the left side, the outlet gas fitting (1/2" VCR® fitting) is located on the right side. Remove the protective caps and connect to the gas source. The outlet port can be connected to an exhaust line or left open if inert safe gases are being measured.

	<h3>Hazardous Gas Warning</h3> <p>When measuring hazardous gases, the 850 should be placed in a vent hood as a safety precaution. The 850 can also be operated at sub atmospheric pressures as a safety precaution against accidental gas leakage.</p>
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Power

Plug your AC power adapter (supplied) into an AC wall outlet, and insert the DC output cord into the input power connection on the left side of the 850. Turn on the 850 with the ON-Off switch located on the right side of the unit.

Pressure Transducer Port

Located below the Gas In fitting is a test port for connecting to the internal pressure transducer. This is used for verifying the accuracy of the pressure transducer see DIAGNOSTICS screen.

Data Ports

A USB and a RS-232 interface are located on the right side of the 850. The data ports allow for control of the 850 and for recording flow readings. See appendix A for details on 850 data port commands. The USB to serial driver has to be loaded to enable the USB in your 850 to communicate to a PC. Use the included CD or visit <http://www.ftdichip.com/Drivers/VCP.htm>, download and run the driver suitable to your operating system.

Chapter 2: Getting Started

The power switch is located on the left side of the unit. When powered up an introduction screen appears followed by the home screen.

Operation Screen

- Select the Language to be displayed on the touch screen. Touch the arrows to scroll through the available languages.
- Select the default measurement mode: (Single) take a single reading, (Burst) take a series of consecutive readings equal to the number of readings selected in the average, or (Continuous) take continuous readings.
- Select REMOTE to set the 850 control from the Data Port. Note: Once in remote mode the touch panel is inactive until a command is sent to the data port to return control to the touch screen interface or the 850 is power cycled

Home Screen



Touch the following icons to view MEASURE, OPERATION, DATE/TIME DELAY, ABOUT, OR DIAGNOSTICS screen.

Operation Screen



Touch CONFIRM to save changes or Home to return to the home page without saving the changes.

Date/Time Delay Screen

- Set the Date, touch Date to highlight Day/Month/Year. Use the up and down arrows to set the highlighted segment.
- Set the Time, touch Time to highlight hour/minute/ AM- the up and down arrows to set the highlighted segment.
- Delay: When taking continuous or burst readings the will wait the entered delay interval between readings.



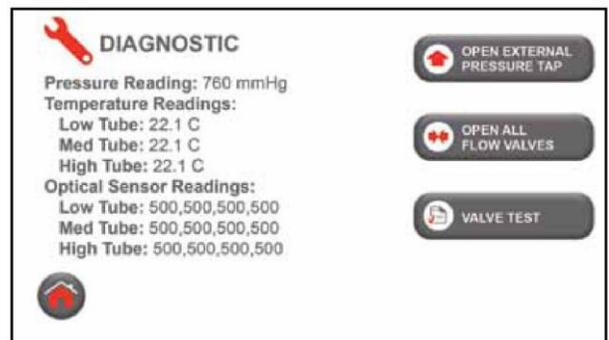
PM. Use
MLOne

Touch CONFIRM to save changes or the home button to return to the home page without saving the changes

About Screen

- Displays the serial number of the 850.
- Displays the firmware revision.
- Displays the revision of the touch screen firmware.
- Displays the date when the 850 was last calibrated and the authorized calibration laboratory that performed the calibration.
- For each tube the number of measurements taking since the last calibration is displayed followed by a calibration number associated with the tube. The calibration number represents the volume swept by the piston during a measurement.

About Screen Diagnostic Screen



Date/Time Delay Screen

Touch Home to return

Diagnostics Screen

- Observe the reading of the pressure transducer
- Observe the temperature sensor readings for each tube; the temperature transducers are located at the center of the incoming gas flow stream for each tube.
- Observe the readings from the twelve optical piston detectors. Each tube has four detectors two center measurement detectors are used for timing the piston displacement during a flow measurement. The right and left most detectors are used to initialize the piston location and as a safety in case a measurement detector fails. Readings for the detectors should be between 300 and 1026 unless a piston is located under a sensor in which case the reading should be less then 50.
- Touch (OPEN EXTERNAL PRESSURE TAP) connects the internal pressure transducer to the pressure port on the left side of the 850 under the inlet fitting. This allows the user to connect a reference pressure indicator to the internal pressure transducer for verification.
- Touch (OPEN ALL FLOW VALVES) will set all of the internal valves to an open condition. This can be used to perform leak verification testing. After opening all of the internal valves the user would:

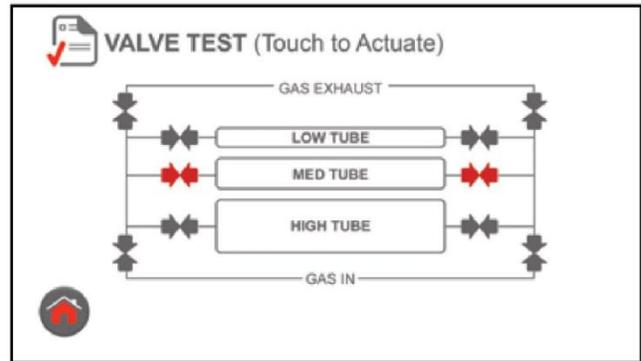


—Cap the outlet port

—Pressurized the 850 to a maximum of 20 PSIA or have a vacuum applied. —Close the pressure source or vacuum source to the 850. —Observe that the vacuum or pressure in the 850 is stable after allowing time for thermal stabilization of the captured gas.

- Touch (Valve Test) to be taken to a schematic diagram of the internal 850 valves

Valve Test Screen



Valve Test Screen

The valve test screen provides a schematic

representation of the CalTrak 850. Each one is shown as  .

A valve symbol in red indicates the valve is open and a valve in gray indicates a valve is closed. Touching a valve will change the state of the valve. Manual activation of individual valves can be used as a diagnostic tool to identify valve operation issues.

Measure Screen

The measure screen is the screen from which measurements are taken and the user can select units of measure and change measurement settings. If the 850 is being operated remotely the touch screen functions are inactive and the screen only displays measurement results.

Measure Screen

The flow reading displayed, Touching the box allows the user to select Flow Units, Volumetric or Standardized Flow, Standardization-Temperature and Number in Average

Shows Gas Pressure and Temperature, touch the box to change units

Touch to select a gas compressibility factor correction

Press to start a reading

Touching selects the measurement tube. High Tube is default. The CalTrak 850 will auto change to a different tube if the flow is outside the tube's flow range.

Press to toggle through measurement modes (Single, Burst, Continuous)

Measure Remote Mode Screen

Flow: 12.459 SLM @ STP 0 C, 760 mmHG Average: 12.556 (5 of 10)	
Gas Pressure: 77 mmHG Gas Temperature: 22.3 C	
Z Compression Factor: NONE	

OPERATING IN REMOTE MODE

Chapter 3: Notes

Out of Range!

If your Device Under Test is generating more flow than your 850's rated flow range of 50,000 ccm, the "Out of Range!" warning appears when you attempt to take a flow measurement. Immediately lower or disconnect the flow source.

Over Pressure!

If your 850 has an internal pressure that is greater than 14.9 psiA the "Over Pressure !" warning appears. This can occur before or during a flow measurement. You will need to determine the source of the over pressure. This is most likely caused by a restriction in the exhaust flow path.

Program

The recessed Program button, located on the rear of your 850, enables firmware updates. Please contact Sierra if you need a firmware update.

Reset Function

If your 850 fails to respond to commands, try resetting the unit by pressing the reset button on the back. This can be done easily with a bent paper clip. Please note that resetting your 850 will not affect your user settings. However, if you are in the middle of a calibration, your 850 will return to the home screen and you'll need to initiate a new flow measurement.

Storage

To store your 850 for an extended period, please follow these guidelines:

- Always store it in a clean, dry place
- Cap Inlet and Outlet fittings

Chapter 4: Annual Maintenance & Calibration

Your 850 is engineered to provide years of reliable service, with appropriate care and maintenance. Sierra recommends annual calibration by an ISO17025-accredited laboratory, such as Sierra, to help ensure the best possible flow measurements, meet regulatory requirements and provide a bulletproof audit trail in the event of litigation. Should you encounter any problems with your 850, immediately contact Customer Service.

Recertification

Your 850 is a precision measuring standard with moving parts machined to extremely close tolerances. Various environmental factors, product wear, drift of the temperature sensors and pressure transducers or inadvertent damage may adversely affect your 850's measurement accuracy or general performance.

	<p>Recommended Calibration Recertification Interval</p> <p>It is recommended that the instrument be recalibrated and recertified on an annual basis.</p>
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For these reasons, we highly recommend having your 850 annually verified and serviced by our experienced personnel in our accredited ISO 17025 metrology laboratory. For those applications subject to regulatory or ISO requirements, verification by our accredited laboratory provides you with assurance of measurement integrity. Please note that while many accredited gas flow measurement laboratories may be capable of properly verifying the accuracy of your 850, Sierra is the only authorized service center in the USA for Sierra CalTrak products.

Outside the USA, please check with Sierra to determine if a local authorized Sierra CalTrak service center is available. Our elective Recertification program is a complete product service package that provides pre-validation at significant flow points; sensor calibration, full product testing, and available firmware upgrades; post-validation at significant flow points; and NIST-traceable Sierra CalTrak calibration certificates backed by our accreditation to ISO 17025, ANSI Z-540, and NIST Handbook 150 quality standards.

Recertification includes a 90-day service warranty should any related labor or parts replacements prove faulty. Turnaround time is generally two weeks within Sierra's facility from the date we received your 850. 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.

	<p>RMA Note – Returning Unit for Service</p> <p>Sierra will not evaluate or service your instrument without an RMA number. Go to http://www.sierrainstruments.com/rma to complete an RMA.</p>
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Shipping

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

When shipping your 850, please use the reusable shipping container that was supplied with your unit.

- Pack your instrument carefully. Please use the reusable shipping container that was supplied with your unit.
- **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 against damage in transit. 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)**

Appendix A: Product Specifications

WHY PRIMARY STANDARD?

CalTrak 850 is a true primary standard in every sense of the word, because its 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.

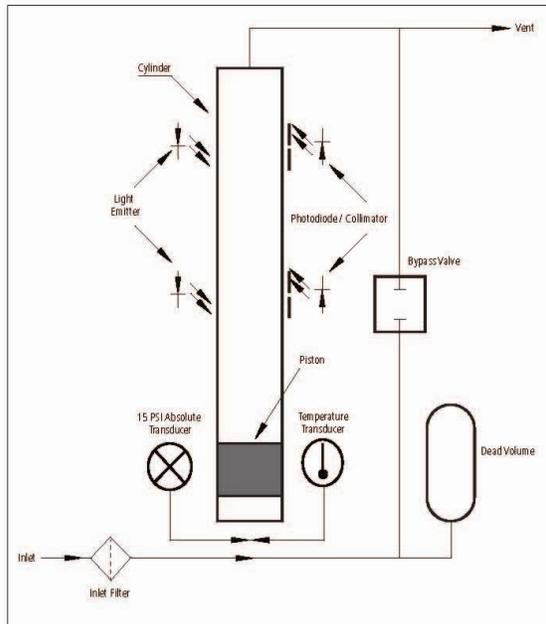
OPERATING PRINCIPLE

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 micro processor 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 850 Operating Principle



PERFORMANCE SPECIFICATIONS

Standardized Accuracy*

+/- 0.15% of reading (primary standard) and +/- 0.01 sccm across a flow range of 5 sccm to 50,000 sccm (50 slpm)

Volumetric Accuracy

+/- 0.15% of reading and +/- 0.01 sccm across a flow range of 5 to 50,000 ccm (50 L/min)

Time Per Measurement

Flow dependent (.5 to 60 seconds); typical 2 seconds

*Note: Volumetric accuracy (ccm or L/min) is same.

OPERATION SPECIFICATIONS

Flow Ranges

5 sccm to 50,000 sccm (50 slpm)*

Low Tube: 5 sccm to 500 sccm*

Medium Tube: 350 sccm to 5,000 sccm*

High Tube: 3,500 sccm to 50,000 sccm*

*Note: At gas pressure of 760 mmHg, (1 atm) and a gas temperature of 25°C (77°F) with standardization temperature set to 21.1°C (69.98°F)

Operating Pressure

+/- .5 psia (0.03 barA)

Temperature Range

15°C to 30°C (59°F to 86°F)

Temperature Range Storage

0°C to 70°C (32°F to 158°F)

Inlet and Outlet Fitting

1/2-inch VCR® fitting

Gas Compatibility

Gases compatible with (316/304 SS, borosilicate glass, Teflon®, AFLAS® elastomeric)

Compressibility Factor Correction

User selection of gases to apply NIST REFPROP compressibility factor correction for non-ideal gas behavior

Approvals

RoHS and CE Compliant

Digital Communication

RS-232 and USB

Warranty

1 year; battery 6 months

PHYSICAL SPECIFICATIONS

Dimensions

Height: 15 inches (56 cm)
 Width: 22 inches (38 cm)
 Depth: 13 inches (33 cm)

Weight

62 lbs (28 kilograms)

Configuration

Multiple cells eliminate switching tubes

User Interface

Touch screen or via commands through data port

POWER REQUIREMENTS

Wall-mounted power supply

Input: 100-240 VAC, 1.5 A (max), 50-60 Hz
 Output: 24VDC, 3.0A

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

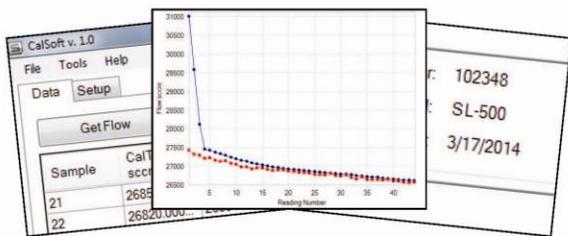
CalSoft™ Software

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

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.

SmartTrak 100 Mass Flow Controller



850 PRODUCT VIEWS

CalTrak 850 Dimensional Drawing



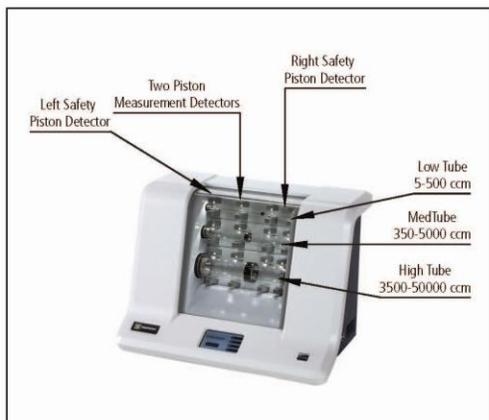
CalTrak 850 Side View



850 PRODUCT FEATURES

4

CalTrak 850 Front View



CalTrak 850 Side View



ORDERING THE CALTRAK® 850

850

Instructions: To order a CalTrak 850, please fill in each feature number block by selecting the codes from the corresponding features below.

Primary Flow Standard; CalTrak® 850

CalTrak 850	CalTrak 850 is a positive displacement primary piston prover for gas flow measurements with three measurement tubes for measuring gas flow. CalTrak 850 measures flow from 5 sccm to 50,000 sccm (50 slpm) within an accuracy of +/-0.15% of reading and +/- 0.01 sccm across flow range 5 to 50,000 sccm (50 slpm). The 850 also has a volumetric accuracy of +/-0.15% of reading and +/- 0.01 ccm across flow range 5 ccm to 50,000 ccm (50 L/min). Designed for the common gases used in the semiconductor industry, the CalTrak 850 comes complete with universal 100-240V AC power adapter/charger, NIST-traceable calibration certificate, manual, Swagelok® fittings and case.
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Appendix B: Data Port Commands

850 Bi-Directional Communications Protocol

To enable Sierra customers to integrate their 850 primary piston prover with their unique applications, our 850 come standard with a bi-directional communication protocol. Using ASCII commands sent through your 850's RS232 serial port or USB port, this protocol enables you to control and customize your 850 system's operation (serial cable supplied by Sierra). For your convenience, the ASCII commands are referenced in the following tables.

Commands

\$SET COMM DC	
Purpose	Transfers the control of 850 back to touchscreen
Syntax	\$SET COMM DC<cr>
Parameters	None
Query reply	
Remarks	Stops flow measurements; Transfers the control of 850 back to touchscreen
Example	\$SET COMM DC<cr>
Reply	None

\$RESET DC	
Purpose	Resets all flow measurements and flow averages
Syntax	\$RESET DC<cr>
Parameters	None
Query reply	\$ACK 0
Remarks	Stops flow measurements; clears the current flow measurement; resets the flow average and measurement number
Example	\$RESET DC<cr>
Reply	None

\$STOP DC	
Purpose	Stops flow measurements
Syntax	\$STOP DC<cr>
Parameters	None
Query reply	\$ACK 1
Remarks	Stops flow measurements
Example	\$STOP DC<cr>
Reply	None

\$GET DS DC	
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Purpose	Initiates a single flow measurement and acquires the data stream
Syntax	\$GET DS DC<cr>
Parameters	None
Query reply	
Remarks	Reads flow data, including: Flow; flow average; flow units; measurement number; number in the series, temperature; temperature units; pressure; pressure units; standardized (Std.) temperature; Std. temperature units; Gas compression factor; time; date; cell id;<cr><lf>
Example	\$GET DS DC<cr>
Reply(Std.)	760.11,760.11,sc/m, 01,10, 23.1, C, 760.6, mmHg, 21.1, C,1.0005,12:35 PM,06/15/00,H<cr><lf>
Reply(Vol.)	760.11,760.11,cc/m, 01,10, 23.1, C, 760.6, mmHg, ,,12:35 PM,06/15/00,H<cr><lf>

\$GET PI DC	
Purpose	Reads the product information
Syntax	\$GET PI DC<cr>
Parameters	None
Query reply	
Remarks	Reads product information, including: Product; model; serial number; revision level; calibration constant; stroke counter, <cr><lf>
Example	\$GET PI DC<cr>
Reply	850,H,100503,1.07,4902111210,00000508222<cr><lf>

\$SET CELL DC	
Purpose	Sets the flow tube the measurement takes place
Syntax	\$SET CELL DC X<cr>
Parameters	0-2, 0-Medium, 1-Low, 2-High
Query reply	None
Remarks	Determines the flow tube the measurement takes place
Example	\$SET CELL DC 1<cr>
Reply	None

\$SET GAS DC	
Purpose	Sets the type of gas being measured
Syntax	\$SET GAS DC X<cr>
Parameters	0-21, 0-Air,1-NH3,2-Ar,3-CO2,4-CO,5-C2H6,6-C2H4,7-He,8-H2,9-CH4,10-N2,11-N2O,12- O2,13-C3H8, 14-C3H6,15-R14,16-R23,17-R116,18-RC318,19-SF6,20-SO2,21-Xe
Query reply	None
Remarks	Sets the type of gas being measured
Example	\$SET GAS DC 1<cr>
Reply	None

\$GET GAS DC	
Purpose	Reads the type of gas being measured
Syntax	\$GET GAS DC<cr>
Parameters	None
Query reply	None
Remarks	Reads the type of gas being measured
Example	\$GET GAS DC<cr>
Reply	1 (0-21, 0-Air, 1-NH3, 2-Ar, 3-CO2, 4-CO, 5-C2H6, 6-C2H4, 7-He, 8-H2, 9-CH4, 10-N2, 11- N2O, 12-O2, 13-C3H8, 14-C3H6, 15-R14, 16-R23, 17-R116, 18-RC318, 19-SF6, 20-SO2, 21 Xe)

\$GET PRES DC	
Purpose	Reads the gas pressure in the flow tube
Syntax	\$GET PRES DC<cr>
Parameters	None
Query reply	None
Remarks	Reads the gas pressure
Example	\$GET PRES DC<cr>
Reply	759.9

\$GET TEMP DC	
Purpose	Reads the gas temperature in the flow tube
Syntax	\$GET TEMP DC<cr>
Parameters	None
Query reply	None
Remarks	Reads the gas temperature in the flow tube
Example	\$GET TEMP DC<cr>
Reply	23.25, 23.23, 23.26

Command Not Recognized

If a command is not recognized, you'll receive the following return: !NAK 12.

Cable

The RS-232 serial cable connecting your 850 to the PC should be a 1 to 1 connection, 9-pin d-sub female. A Null Modem cable should not be used.

Serial Interface

Baud Rate 9600

Data Bits 8 Parity None Stop Bits 1

Flow Control None

Appendix C: Warranty Policy

LIMITED WARRANTY POLICY- REGISTER ONLINE

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

Register now at www.sierrainstruments.com/register. Learn more about Sierra's warranty policy at www.sierrainstruments.com/warranty.