Cal=Trak™ XL

Primary Gas Calibrator
Instruction Manual

IM-CAL-XL
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SIERRA®
EXPERIENCE OUR PASSION FOR FLOW!

GLOBAL SUPPORT LOCATIONS: WE ARE HERE TO HELP!

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IMPORTANT CUSTOMER NOTICE: OXYGEN SERVICE

Sierra Instruments, Inc. is not liable for any damage or personal injury, whatsoever, resulting from the use of Sierra Instruments standard mass flow meters or controllers for oxygen gas. You are responsible for determining if this mass flow meter or controller is appropriate for your oxygen application. You are responsible for cleaning the mass flow meter or controller to the degree required for your oxygen flow application.

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Introduction

Congratulations! You've chosen the Cal=Trak™ XL primary gas flow standard. The innovative Cal=Trak XL is a precise primary gas flow calibrator engineered for the calibration of high flow meters, within a space-saving, transportable design.

Before you get started, please take a few moments to review this manual and familiarize yourself with your Cal=Trak XL. If at any time you have questions regarding its operation, please contact Sierra through **www.sierrainstruments.com** or call us at **831.373.4402** to speak with one of our knowledgeable customer support representatives.

About Your Cal=Trak XL

Like all Sierra primary standards, the Cal=Trak XL is a positive displacement primary piston prover for gas flow measurements in either pressure or suction applications. Using its unique technology, it combines the accuracy of a primary calibrator with unequaled speed and convenience, providing gas flow measurements at the push of a button.

By nature, your Cal=Trak XL performs a primary measurement of volumetric flow. However, since pressure variations within any measurement system can cause ambiguous results, the Cal=Trak XL is generally used in a standardized mode, automatically converting its volumetric flow measurements to the flow that would exist under standard temperature and pressure conditions.

An excellent tool for the calibration of instruments that read in mass flow, your Cal=Trak XL measures flow from 5 LPM (Liters Per Minute) to 500 LPM within an accuracy of ±0.25% of reading standardized, using a temperature sensor and pressure transducer within the gas flow stream. Additionally, you can easily calibrate volumetric instruments (see **Setup – Readings**). Flow measurements can be taken manually (one reading at a time), or automatically in the continuous mode, with up to 100 measurements in an averaging sequence.

For your convenience, your Cal=Trak XL features an LCD display screen with magnification option, an On/Off button on the front panel, and a convenient touch pad control to enable you to quickly access various menu options and many user-definable settings. Menu navigation is intuitive, controlled by the right, left, up and down arrows on the touch pad.

Your Cal=Trak XL also includes an RS-232 port and serial cable.

Unpacking Your Cal=Trak XL

  Your Cal=Trak XL is a laboratory primary standard, and has been shipped in Sierra' rugged, reusable shipping container.

The Cal=Trak XL weighs 90 lbs / 41 kilograms. Unpacking by two people is recommended. The Cal=Trak XL can be lifted from the shipping container by verifying the nuts on the large inlet and outlet fittings are tight and lifting the Cal=Trak XL by grasping these fittings. While lifting the Cal=Trak XL from the shipping container, the top of the

Cal=Trak XL should be supported to prevent tipping.

Your Cal=Trak XL comes with the following:

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

Warnings

- The Cal=Trak XL is not intrinsically-safe and is not for use with explosive or flammable gases, or for use in explosive environments. If you choose to calibrate explosive or flammable gases with your Cal=Trak XL, please follow your organization's laboratory safety procedures, which typically require operation within an inert atmosphere. To enable use in an inert atmosphere, your Cal=Trak XL has two (2) 1/4" gas **Purge** fittings, located on its right side, and its electronics are isolated from the gas flow stream, contained within an internal, partitioned compartment.

- The Cal=Trak XL is not designed to be pressurized above 20 psiA (1379 mbarA) or for gas flows above 500Lpm. If pressurization reaches 19 psiA (1310 mbarA), the following warning will appear on the display on the main control panel: OVERPRESSURE! If this occurs, remove the overpressure situation, then choose "Reset" from the LCD display to clear this warning.

- The Cal=Trak XL does not contain user-serviceable parts and must be returned to the Sierra factory in Monterey, CA for maintenance.

Operating Your Cal=Trak XL

Connections

Your Cal=Trak XL should be placed on a steady, secure work surface. For optimum stability, the Cal=Trak XL has self adjusting feet at its base.

Locate both the Inlet (pressure) and Outlet (suction) fittings (see **Figure 1**) and remove their protective caps.

Maintain only minimum amount of tubing necessary between your Cal=Trak XL and the flow source. As with any primary standard, the more internal ("dead") volume between your Cal=Trak XL and the flow restrictor (MFC, needle valve, or sonic nozzle), the more uncertainty (error) is added to the calibration process.
You're now ready to make the following connections (as needed), using Figures 1 and 2 as reference:

Power
Plug your AC power adapter (supplied) into an AC wall outlet, and attach its DC output cord to your Cal=Trak XL 's rear DC Power 12VDC, 3A connection.

Valve Actuation Air Source

Your Cal=Trak XL 's internal valve actuates by air pressure, and must be connected to a filtered oil free air source of at least 80 psi (5516 mbar) and no higher than 100 psi (6895 mbar). Using tubing (not supplied) and the 1/4" (6.35mm) Swagelok Valve Actuation Fitting on the rear of the unit, connect your laboratory air to your Cal=Trak XL . Turn on the air source, and verify that the pressure is between 80 and 100 psi (5516 and 6895 mbar) (pressure gauge not supplied).

Inlet (Pressure) and Outlet (Suction) Fittings

When using a pressure flow source, connect the gas flow to the 1.5" (38.1 mm) Swagelok® fitting
labeled **Inlet – Pressure**.
When using a suction flow source, connect the gas flow to the 1.5" (38.1 mm) Swagelok® fitting
labeled **Outlet – Suction**.

Your Cal=Trak XL 's internal pressure transducer is rated at 20 psig (1378 mbarg) maximum, or 5.3 psi (365 mbar) more than typical ambient pressure. When taking standardized flow measurements, we recommend that any tubing or exhaust system connected to your Cal=Trak XL 's outlet fitting have a maximum pressure drop of 3 psi (207 mbar).

When taking volumetric flow measurements, there should be no significant pressure difference (such as the pressure drop of restrictive tubing or filters) between your Cal=Trak XL and the point in the flow stream that is of interest (i.e., at its inlet or outlet fitting). If there is a significant pressure difference, there will also be a corresponding volumetric flow difference (from the Ideal Gas Law). In that case, your Cal=Trak XL 's indicated volumetric flow should be adjusted by a factor of the absolute pressure at your Cal=Trak XL , divided by the absolute pressure at the point of interest.

Overpressure Exhaust

When your Cal=Trak XL completes a flow measurement, its internal valve opens, releasing the gas from the flow cell and enabling the piston to drop to the bottom (reset). If for any reason the valve doesn't open, the piston will move to the top of the flow cell and a safety switch will automatically reset the Cal=Trak XL. If for any reason the valve doesn't open, the piston will remain at the top of the flow cell and pressure will build. To prevent over-pressurization of the flow cell, your Cal=Trak XL 's has an overpressure sensor that will reset the unit. Additionally the Cal=Trak XL has a mechanical pressure relief valve that exhausts the gas if over pressurization occurs through a 1/2" Swagelok® fitting (**Overpressure exhaust**). If this fitting is currently open to ambient and you don't want the gas to vent to atmosphere, you should connect a direct line from this fitting to your exhaust system; or, if your Cal=Trak XL is already directly connected to your exhaust system, you can "tee" a line from the **Overpressure Exhaust** fitting to your exhaust line.
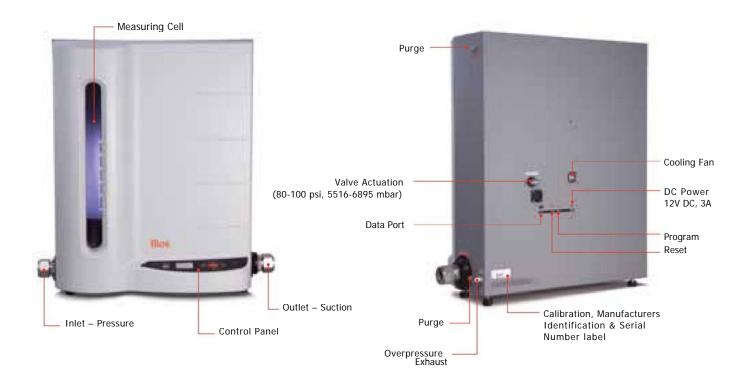
Purge Fittings

Your Cal=Trak XL is not intrinsically-safe for use with explosive or flammable gases (see **About Your Cal=Trak XL – Warnings**). If you choose to calibrate explosive or flammable gases with your Cal=Trak XL, please follow your organization's laboratory safety procedures, which typically require operation within an inert atmosphere. To enable use in an inert atmosphere, your Cal=Trak XL has two (2) 1/4" (6.25 mm) gas **Purge** fittings, located on its right side, and its electronics are isolated from the gas flow stream, contained within an internal, partitioned compartment.

Please note that electric current is still present within your Cal=Trak XL's gas flow stream, at the pressure sensor and temperature transducer.

Figure 1: Front View, Cal=Trak XL

Figure 2: Rear View, Cal=Trak XL

Measuring Cell

Inlet – Pressure

Control Panel

Outlet – Suction

Valve Actuation
(80-100 psi, 5516-6895 mbar)

Data Port

Purge

Purge

Cooling Fan

DC Power
12V DC, 3A

Program

Reset

Calibration, Manufacturers
Identification & Serial
Number label

Overpressure
Exhaust

Getting Started

To turn on your Cal=Trak XL, press the On/Off button in the lower right corner of the control panel for one second. To turn it off, press and hold the On/Off button for three seconds.

When turned on, your Cal=Trak XL 's LCD displays an opening screen indicating the product name, model number and flow range, and its cooling fan will turn on.

Navigating through your Cal=Trak XL's menu screens is easy and intuitive – simply use the four directional arrows on the control panel for toggling between menu options (right, left, up, down). Your location within each menu or menu item is highlighted (shaded). A menu item in angle brackets (< >) indicates that multiple options exist for that item; these options are displayed when that item is selected. To select highlighted or bracketed items, press ENTER at the center of the navigational display on the control panel.

When you're ready, visit the SETUP menu and take some time to explore your Defender's many user-definable settings (see Setup).

Customizing Your Calibration

Your Cal=Trak XL's calibrations may be customized and automated for your convenience. To customize each option, move between menu selections using the up and down arrows. When a selection is highlighted, use the right and left arrows to toggle between your choices for that selection. Press CONFIRM to save any changes and return to SETUP, or press EXIT to return to SETUP without saving any changes.

Setup

From the initial screen, choosing SETUP gives you access to many customizable options. If at any time you'd like to return your Cal=Trak XL to its factory default settings, navigate to Preferences, set Default Settings to "Yes" and then Confirm the changes. In each setup sub-menu, selecting CONFIRM applies the settings and returns to the main setup menu. Selecting EXIT returns to the main menu retaining the settings as they were originally.

READINGS. Select Volumetric flow or Standardized flow (volumetric flow corrected to specified temperature and pressure conditions, for calibrating instruments that read in mass flow, such as MFCs). Choose your preferred number of measurements in the average, from 1 to 100. If you'd like a delay between flow measurements (i.e., in order to time-profile MFCs to verify their long-term performance), set the "Time Between" from 1 to 60 minutes. 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).

UNITS. Depending on whether you've selected Volumetric or Standardized flow in the Readings menu, you may view flow measurements in liters or cubic feet (all units are per minute). Choose to view pressure in mmHg, kPa or psi, and choose to view temperature in Celsius or Fahrenheit. If you're measuring standardized flow, enter the temperature to which the gas flow volume will be standardized depending on the application. Pressure standardization is not adjustable, and is always 101.325 kPa, 760 mmhg, or 14.696 PSI of absolute pressure.

TIME. Set the current time in the format you prefer.

DATE. Set the month/date/year in the format you prefer.

PREFERENCES. Read Default offers a choice of Single, Continuous or Burst measurements; choose the type of flow measurement you will normally use. Once selected, your Cal=Trak XL always defaults to this setting when Measure is selected. Default Settings allows you to reset your Cal=Trak XL to the factory defaults. Magnification controls the amount of data on the display; choose Zoom to view only flow measurements in larger font, or choose Detail to simultaneously view flow measurements, temperature conditions, pressure conditions, and sensor factor in smaller font.

ABOUT. Tells you more about your Cal=Trak XL , a useful screen to refer to when speaking with a Sierra technical support representative or your Sierra sales representative.

Taking Measurements

Once you've finished customizing your Cal=Trak XL's SETUP and have confirmed your changes, select MEASURE to begin a set of measurements. MEASURE gives you access to the main menu, where you can choose between the following flow measurement options:

- Single. Each time the "Enter" button is pressed, one measurement is taken.

- Cont. When the "Enter" button is pressed, measurements continue automatically until stopped by the user.

- Burst. A single series of measurements is taken until the number of readings in the average is met.

To take a flow measurement, select the type of flow measurement you want, and then press ENTER. Your Cal=Trak XL will begin talking flow measurements. When taking flow measurements, the previous measurement, the running average of all measurements and the number of measurements in the average are provided simultaneously. The flow-cell viewing window lights each time the piston rises, and you will hear the internal valve clicking open and closed at the beginning and end of each flow measurement.

You can stop flow measurements at any time by choosing either PAUSE or RESET. PAUSE terminates the flow measurement but leaves the flow results on the screen and returns to the measurement menu. The set of measurements may be resumed where they were stopped by selecting SINGLE, CONT., or BURST . You may switch between continuous and burst modes at will but once single readings are selected RESET must be selected once or twice to return to the measurement menu to choose continuous or burst modes. RESET clears the screen, resets the average counter to 0, and returns to the measurement menu.

From the measurement menu, selecting EXIT returns the main menu. Choosing SETUP in the main menu allows you to further customize your Cal=Trak XL 's operation.

Using Sensor Factors

Your Cal=Trak XL is factory-calibrated with nitrogen or purified laboratory air, although you can run other gases, provided they are noncorrosive, non-condensing and noncombustible (like most primary standards, your Cal=Trak XL is not intrinsically-safe).

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), refer to the manufacturer's sensor factor.

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

Because a sensor factor other than your Cal=Trak XL 's default value of 1.000 modifies the actual flow to a "reported" flow, an exclamation mark (!) will appear next to any Cal=Trak XL measurement that is being adjusted according to a sensor factor when your display is set to Zoom (see SETUP, Preferences, Magnification). If your display is set to Detail, then no exclamation point appears. Rather, the sensor factor (SF) will be displayed, along with its value on the measurements screen along with the individual flow measurements.

Notes

Out of Range!

If your Device Under Test is generating more flow than your Cal=Trak XL 's rated flow range of 500 liters per minute, the "Out of Range!" warning appears when you attempt to take a flow measurement. Immediately lower or disconnect the flow source. When the flow is within the proper range, either choose "Reset" from the LCD display to clear the last measurement, or try to take another flow measurement.

You may verify your Cal=Trak XL 's flow range by navigating to SETUP, then About.

Over Pressure!

If your Cal=Trak XL has an internal pressure that is greater than 19.5 psiA (134.4 kpaA, 1008 mmHgA), the "Over Pressure!" warning appears. This can occur before or during a flow measurement. If the Cal=Trak XL is in the process of taking a flow measurement, the unit will open the valve; the piston will reset, and display the "Over Pressure!" warning. You will need to determine the source of the over pressure. This is most likely caused by a restriction in the flow path. It can also be caused by a faulty sensor allowing the piston to go to the top without resetting. When the source of the restriction is cleared, pressing any key will clear the fault.

Reset Function

If your Cal=Trak XL fails to respond to push-button 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 Cal=Trak XL will not affect your user settings. However, if you are in the middle of a calibration, your Cal=Trak XL will return to the initial measurement phase and you'll need to initiate a new flow measurement.

Storage

To store your Cal=Trak XL for an extended period, please follow these guidelines:

- Always store it in a clean, dry place

- Disconnect your lab's air supply from its
  Valve Actuation fitting

- Cap its Inlet and Outlet fittings

Accessory Items

These inlet/outlet fitting adapters are available at an additional cost from Sierra. Please check with Sierra directly for updated information.

Sierra Part Number	Description
100-436	Swagelok reducer used to reduce from a 1 1/2" Swagelok fitting to 1" tube OD, includes Nut and Ferrule Set 1 1/2"
100-437	Swagelok reducer used to reduce from a 1" Swagelok fitting to 3/4" tube OD
100-438	Swagelok reducer used to reduce from a 1" Swagelok fitting to 1/2" tube OD
100-439	Swagelok Nut and Ferrule Set 1 1/2"
100-440	Swagelok Nut and Ferrule Set 1"
100-441	Swagelok Nut and Ferrule Set 3/4"
100-442	Swagelok Nut and Ferrule Set 1/2"

Annual Maintenance and Calibration

Your Cal=Trak XL is engineered to provide years of reliable service, with appropriate care and maintenance. Sierra recommends annual calibration by an ISO 17025-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 Cal=Trak XL, immediately contact Sierra Customer Service.

Recertification

Your Cal=Trak XL 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 Cal=Trak XL's measurement accuracy or general performance.

For these reasons, we highly recommend having your Cal=Trak XL annually verified and serviced by our experienced Sierra personnel in our accredited ISO 17025 metrology laboratory, located in Monterey, CA. 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 Cal=Trak XL, Sierra is the only authorized service center in the USA for Sierra products. Outside the USA, please check with Sierra to determine if a local authorized Sierra service center is available.

Our elective Recertification program is a complete product service package that provides pre-calibration at significant flow points; complete product refurbishment, testing, and available upgrades; post-calibration at significant flow points; and NIST-traceable Sierra 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 to three weeks within Sierra' facility from the date we received your Cal=Trak XL. To obtain current Recertification pricing, please contact Sierra at **831.373.0200**, or visit our web site at **www.sierrainstruments.com**

Please contact Sierra to see if expedited service is available for an additional charge.

Sending Your Cal=Trak XL to Sierra

Please contact Sierra for an RMA (return merchandise authorization) number before sending your Cal=Trak XL to our factory for elective Recertification or other service. You can get an RMA number through our automated web-based system at **http://www.Sierraint.com/ContactUs/rmaform.aspx,** by email to **service@sierrainstruments.com** or by telephone at **831.373.0200**. Our web site address is **www.sierrainstruments.com.**

Sending your Cal=Trak XL to Sierra without an RMA number may result in return of the instrument without inspection or a substantial delay in service turnaround time.

When requesting an RMA number, provide your Cal=Trak XL serial number and revision level. Also describe any product issues you may be experiencing. Please keep in mind that Sierra will not begin evaluation and service of your Cal=Trak XL until you have approved our formal RMA quote.

If sending your Cal=Trak XL for repair or evaluation (rather than elective Recertification), please contact Sierra for technical support or troubleshooting assistance prior to shipping the unit. We will first attempt to resolve the situation over the phone or via email. If you've provided us with a detailed description of your Cal=Trak XL's issue and application details and we're unable to resolve the situation by phone or email, we'll issue you an RMA number for prompt return of your Cal=Trak XL for evaluation.

Please note that Sierra will make every attempt to verify your issue, as we want you to get the most out of your Cal=Trak XL. However, if we are unable to detect a product issue or if we determine that the issue is application-related rather than product-related, we reserve the right to charge an evaluation fee.

Shipping

When shipping your Cal=Trak XL, please use the reusable shipping container that was supplied with your instrument.

We highly recommend insuring the product against damage in transit, and using a standard freight carrier (e.g., Fed Ex, UPS) that provides tracking numbers and offers door-to-door delivery directly to Sierra. Please note that Sierra does not arrange, or pay for, shipment transfers from local airports to our facility, so we are not responsible for additional expense and transit time incurred through airport deliveries.

Sierra is generally not responsible for freight costs associated with shipments to and from Sierra, except in certain instances; please contact Sierra for information before initiating a shipment.

Sierra isn't responsible for damage that may occur during shipment.

Cal=Trak XL Specifications

Measurements:

Flow range: 5 to 500 SLPM

* At a gas pressure of 760 mmHg, and a gas temperature of 25° centigrade
  with standardization temperature set to 21.1 ° centigrade.

Accuracy, Volumetric & Standardized:
±0.25% of reading (15-30°C, from 5L to 500L)

Time per Measurement: 5-100 seconds (approximate)

Measurement Type: Single, Continuous or Burst

Volumetric Flow Units: L/min, cf/min

Standard Flow Units: sL/min, scf/min

Pressure Units: mmHg, psi, kPa

Temperature Units: °C, °F

Basics:

Dimensions (H x W x D): 34 x 32 x 12 in / 84 x 63 x 30 cm

Weight: 90 lbs / 41 kg

Temperature & Pressure Sensors: In the flow stream

Temperature Accuracy: ±0.2 °C (±0.36 °F)

Pressure: 19.5 psiA (1344 mbarA) maximum pressure

Pressure Accuracy: 0.05% FS

Power: 100-240V, 50-60Hz, 5 watts - external power module.
(the power adapter accepts an IEC 60320 C13 connector for use with any AC Power interface)

Shop air for internal valve actuation: 80–100 psi (5516–6895 mbar),
1/4″ (6.35 mm) Swagelok® compression fittings

Inlet and Outlet Fittings: 1.5″ (38.1 mm) Swagelok®
compression fittings

Purge Fittings: 1/4″ (6.35 mm) Swagelok® compression fittings

Over Pressure Fitting: 1/2″ (12.7 mm) Swagelok® compression fittings

Display: Backlit graphical LCD

Usage:

Flow Modes: Pressure or Suction

Gas Compatibility: Noncorrosive, non-condensing,
noncombustible gases, <70% humidity

Operating Pressure (Absolute): 19.5 psi ,1344 mbar

Operating Temperature: 15-30° C

Ambient Humidity: 0–70%, non-condensing

Storage Temperature: 0–70° C

Warranty: 1 year

Limited Warranty

The Sierra Cal=Trak XL 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. 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 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 International Corporation, transportation charges prepaid.

Notwithstanding the foregoing, Sierra Instruments shall have no liability to repair or replace any Sierra Instruments' 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 International Corporation;

2. When the serial number has been altered or removed; or

3. That has been repaired, altered or maintained by any person or party other than Sierra International Corporation'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.