FlexCal
User Manual

MesaLabs

Proven DryCal® TECHNOLOGY

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1.0 Introduction

The FlexCal measures volumetric and standardized gas flow with a standardized flow accuracy of 0.5% of reading. It uses our Proven DryCal® Technology to measure gas flow and is manufactured in Mesa Labs accredited laboratory in Butler, N.J.

This manual will provide the information needed to operate your FlexCal. If at any time you have questions regarding its operation, please contact Mesa Labs through our website (drycal.mesalabs.com) or call us at 973.492.8400 to speak with a member of our professional customer service staff.

Your FlexCal

Your FlexCal comes with the following:

- AC Power Adapter/Charger
- USB Cable
- Leak Test Cap (1); Save for use during the Leak Test
- Calibration Certificate
- Manual

Carrying cases and accessories are available for purchase from Mesa or your distributor.


Enter
FlexCal
MesaLabs
Display
Suction Fitting
Pressure Fitting
Measuring Cell


Data Port
Charging Jack
Reset Button
Calibration Label

2.1 Battery

Charging, installing and monitoring your FlexCal battery

Your FlexCal battery is charged at the factory, but we recommend that you make sure it is fully charged before initial use.

- Connect the AC power adapter to the FlexCal's Charging Jack (12 Vdc).
- Plug the AC power adapter into an AC outlet.

Initial charging should take about eight (8) hours.

After the initial charge:

- You may continue to charge your FlexCal indefinitely simply by leaving it connected to the AC power adapter.
- Be sure to charge the battery at least every three (3) months, to maintain battery life.

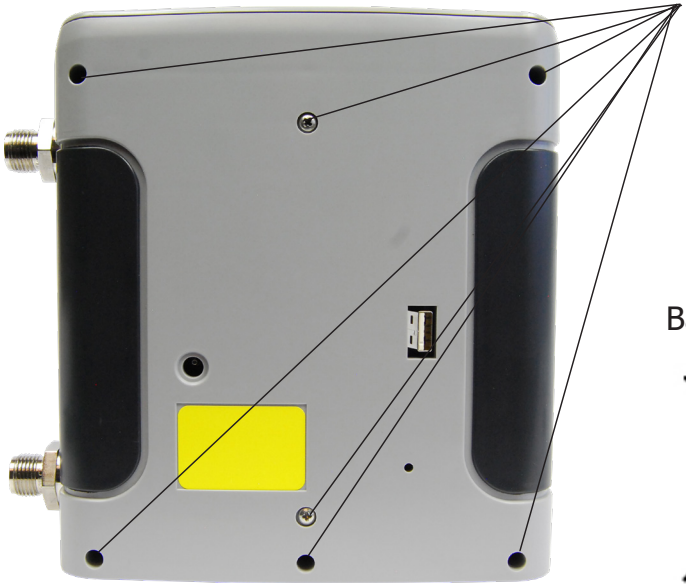
The battery symbol on the LCD display indicates your FlexCal's battery charge condition. A shaded battery icon indicates a full charge. As the battery voltage drops, the indicator will empty in 20% increments.

Disposal:

In compliance with the European Union CE directive 2006/66/EC the battery in your FlexCal should be removed for recycling prior to disposal of the FlexCal. The battery in the FlexCal is a valve regulated sealed lead acid battery. Please note that opening the FlexCal may damage connections so this procedure should only be used for battery disposal.

Procedure:

Remove seven Phillips head screws on the back of the FlexCal; one will be located under the calibration void label. Lift off the rear cover and disconnect the two pin connector from the battery to the printed circuit board. Lift the battery from the case.



Battery disposal:

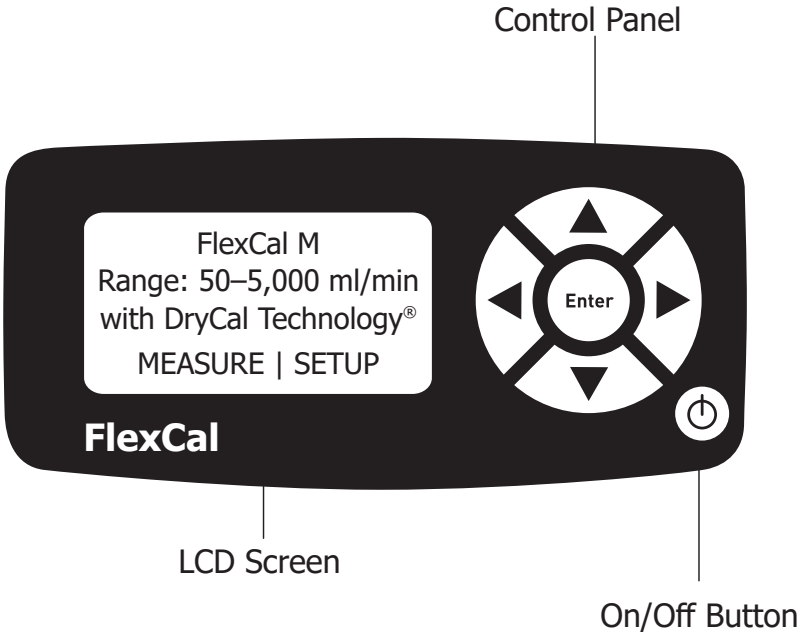
2.2 Activation
Turning your FlexCal on and off
Simply press the power button.

- Press the **On/Off** button for 1 second to turn on your FlexCal.
  - When first turned on, your FlexCal displays an opening screen showing the product name, model number and flow range.
  - Holding the power button down longer than 1 second will shut the unit off.
- Press the **On/Off** button for 3 seconds to turn your FlexCal off.

2.3 Connections
Attaching your FlexCal to a device

Connect device to be calibrated to the appropriate FlexCal port. FlexCal low and medium units have 1/4" ID tube Swagelok® compression fittings whereas FlexCal high flow has 3/8" ID tube Swagelok® compression fittings at their ports. Contact Mesa Labs for 3/8"-to-1/4" Swagelok® adapters to use 1/4" tubing.

- Connect tubing to outlet at top (suction fitting) when a device draws air (such as sampler).
- Connect tubing to bottom inlet (pressure fitting) for devices that push air in (pressure devices).



2.4 Display Screen
Understanding the screen components

The FlexCal provides a menu of operational settings and commands. The four directional arrow buttons on the control panel allow you to navigate through the menu and select the desired settings for your FlexCal. Your location within the menu is highlighted for easy identification.

2.5 Menu Navigation
Moving through operational menus

- Use the directional arrows ▲, ▼, ▶ and ◀ on the control panel to find your way through the menu.
- When your desired command is highlighted, simply press the **ENTER** button on the control panel.

2.6 Set-up
Customizing the FlexCal to your needs

You can customize your FlexCal in the Setup menu. Highlight **SETUP** in the introduction screen to enter the Setup Menu. Or, highlight **SETUP** after resetting and then exiting a measurement mode screen. The Setup menu has eight submenus. (Readings, Units, Time, Date, Preferences, Power, Diagnostics and About).

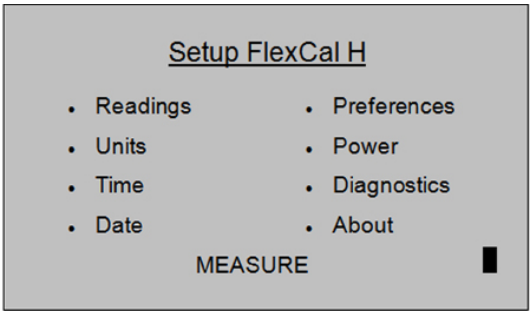
To select a submenu, use the directional arrow buttons to highlight the submenu and press the **Enter** button.

In submenus, brackets (i.e., <...>) indicate different selection options. You can switch back and forth by pressing the forward or backward (◀ or ▶) arrow.

Highlight **CONFIRM** after making changes and press the **Enter** button to save the changes made.

'**Confirmed, New Settings Will be Retained**' message will appear in the screen for a brief period before it returns to Setup menu.

Highlighting **EXIT** and then pressing the **Enter** button will return you to the **SETUP** menu without saving any submenu changes.



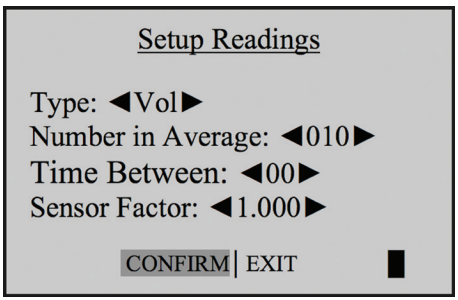
2.6a Readings

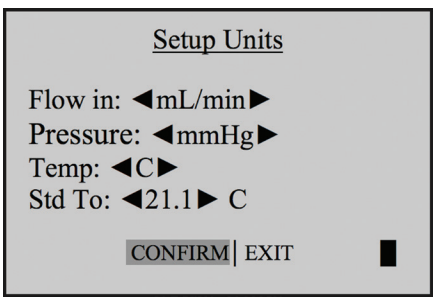
Choose the flow reading type to either volumetric '**Vol**' or standardized '**Std**'. Volumetric flow is the actual flow at the ambient temperature and pressure whereas the standardized flow indicates a flow rate at a specific temperature and pressure. Standardizing pressure is set to a default value of 760 mmHg whearas standardizing temperature is a user settable value set in '**Std To**' in the '**Units**' sub-menu.

Choose the number of measurements in the average from one to 100.

If you wish to incorporate a time delay between consecutive measurements, set **Time Between** from one to 60 minutes.

Set the Sensor Factor to any value from 0.200 to 3.000. Sensor factor scales the reading for calibrating MFCs and MFMs with surrogate gases. Sensor factor effects the flow rate measurement only when the reading '**Type**' is set to standardized '**Std**'.





2.6b Units

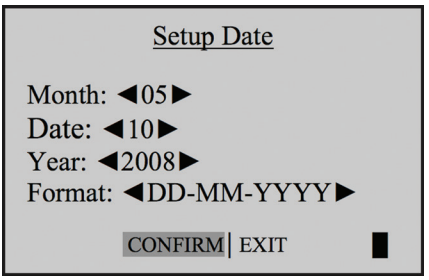
Measure gas **Flow** in cubic centimeters, milliliters, liters or cubic feet (all units are per minute).

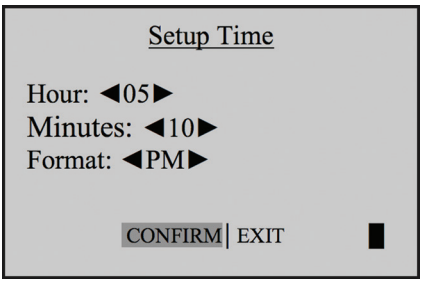
Measure **Pressure** in mmHg, kPa or PSI and **Temperature** in Celsius or Fahrenheit.

Set the standardizing temperature by setting '**Std To**' to a value from 0 to 50 deg C or 32 to 122 deg F. '**Std To**' effects the flow rate measurement only when the reading '**Type**' in the '**Reading**' sub-menu is set to standardized '**Std**'.

2.6c Time

Set the current time and the format. The format can be selected as **PM, AM**, or **24H**.





2.6d Date

Set the date and the format.

The format can be selected as **DD (day)-MM (month)-YYYY (year) or MM (month)-DD (day)-YYYY (year)**.

2.6e Preferences

Read Default

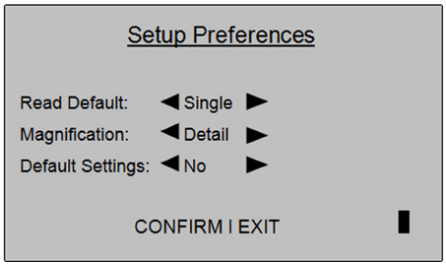
Allows you to select a preferred mode of measurement when the FlexCal is initially turned on.

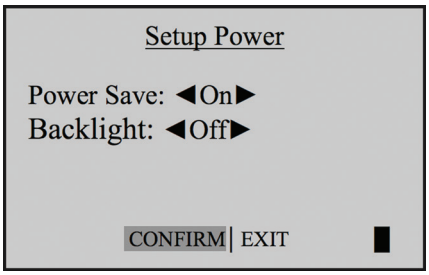
Magnification

It controls the amount of data on the display. Select <Zoom> to view only flow measurements in larger font, or select <Detail> to simultaneously view flow measurements, temperature, and pressure in a smaller font.

Default Settings

Select <No> to allow the 'Read Default' change. Selecting <Yes> will reset your FlexCal to the factory default settings. (Factory default settings are provided elsewhere in this manual.)





2.6f Power

Power Save

By selecting **<On>**, your FlexCal will save power by turning off after five minutes of inactivity. However, it will not turn off when connected to the AC power adapter/charger.

Select **<Off>**, and your FlexCal will remain on until you manually turn it off.

Backlight

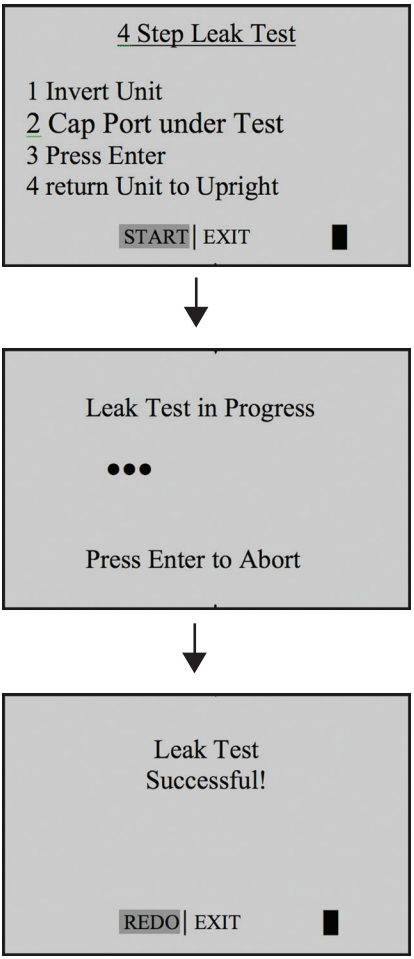
Select **<On>** to illuminate the LCD display or **<Off>** to conserve battery power.

2.6g Diagnostics

The FlexCal Leak Test is designed only to verify the internal integrity of the instrument and alert you to an internal leak. We recommend performing the Leak Test only as an intermediate quality control check or whenever the integrity of the instrument is questioned due to misuse or accidental damage.

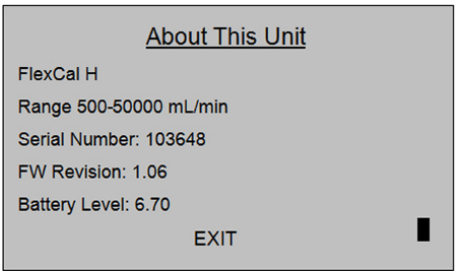
Please note that a leak test is not a substitute for a comprehensive examination of the unit's overall performance and it does not ensure that your FlexCal is operating accurately.

- Invert your FlexCal and allow the piston to travel to the top.
- Cap the port under test using the Mesa supplied leak test cap. Leave the other port uncapped.
- Press Enter on the control panel while the unit is still inverted.
- Return the unit upright. The leak test will progress.



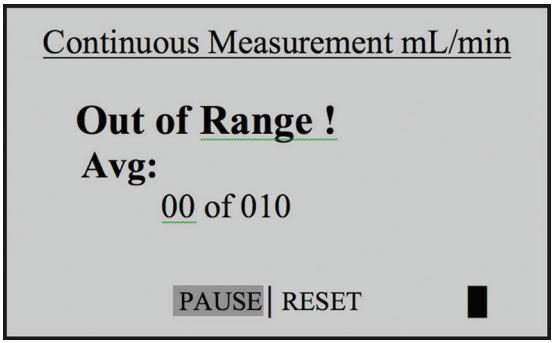
2.6h About

Tells you more about your FlexCal; a useful screen to refer to when speaking to a technical support representative or your distributor.



Out of Range

If the flow you are measuring is outside the FlexCal's flow range, the "Out of Range!" warning appears. Immediately lower or disconnect the flow. When the flow is within the proper range, select RESET to clear your FlexCal's last measurement.



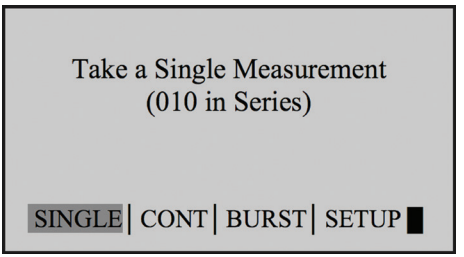
2.7 Measurements

Taking gas flow readings

To maintain the best possible accuracy and minimize thermal effects, Mesa Labs recommends fully charging your battery before taking measurements. If this is not possible, we recommend disconnecting your FlexCal from its AC power adapter/charger while taking flow measurements — or to run gas through your FlexCal for 10 minutes before starting the flow measurement.

First steps

- Press the **On/Off** button for 1 second to turn on your FlexCal. (Holding the On/Off button for longer than 1 second will cause the unit to shut off.)
- When first turned on, your FlexCal displays an opening screen showing the product name, model number and flow range.
- Press the **On/Off** button for 3 seconds to turn your FlexCal off.
- Connect device to be calibrated to the appropriate FlexCal port. Use ¼ inch diameter tubing.
- Connect tubing to outlet at top (suction fitting) when a device draws air (such as sampler).
- Connect tubing to inlet at bottom (pressure fitting) when a device pushes air.
- **Do not cap the unused port on the FlexCal.**
- Select the reading type to **Vol** or **Std**. Set '**Std To**' to the desired standardizing temperature.
- Choose the measurement type, **Single**, **Burst**, or **Continuous**, then press **Enter**.



2.8 Single Measurement

Each time the '**Enter**' button is pressed, one measurement will be made. When each subsequent measurement is made, the current flow and average of all prior readings will be displayed. **Note: (010 in series)** indicates the number of measurements. 10 is the factory-preset number. Define the number of measurement you prefer, from 1 to 100, by accessing the **SETUP** menu.

- **PAUSE** to terminate the current flow measurement but to leave the average flow measurement and previous flow measurement on the screen. This allows you to resume the flow measurement sequence if you wish to do so.

- **RESET** to terminate the flow measurement and clear the screen.

2.9 Burst Measurement

This setting functions in the same manner as '**SINGLE**', but measurements continue automatically until the preset number of measurements has been made. Operation then ceases, and the last reading and average are displayed.

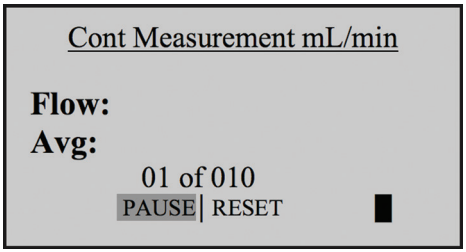
Note: (010 in series) indicates the number of measurements. 10 is the factory-preset number. You can define the number of measurement you preferred from 1 to 100 by accessing the **SETUP** menu.

In Continuous or Burst mode, select:

- **PAUSE** to terminate the current flow measurement but to leave the average flow measurement and previous flow measurement on the screen. This allows you to resume the flow measurement sequence if you wish to do so.

- **RESET** to terminate the flow measurement and clear the screen.

Press **ENTER** again to begin another preset sequence.



2.10 Continuous Measurement

This setting functions in the same manner as 'BURST', but new sequences will automatically repeat until stopped by the user.

3.0 Data Port

3.1 DryCal Pro Software

Visit Mesa Labs' website to download your copy of DryCal Pro software (drycal.mesalabs.com/drycal-pro-software). DryCal Pro captures flow data from your FlexCal directly to a pre-configured table. The data can be exported to selectable Microsoft office environment.

To run DryCal Pro, you must have Windows® XP or 7, Microsoft Excel® 2003 and up, and a USB port.

3.2 FlexCal Firmware Upgrades

The FlexCal firmware is upgradable through the Data Port. Firmware up-grades and procedures for your FlexCal are available through DryCal Pro Software (drycal.mesalabs.com/drycal-pro-software).

4.0 Annual Maintenance and Calibration

Assuring top performance and accuracy

Your FlexCal is a precision measuring standard with moving parts machined to extremely close tolerances. Various environmental factors, product wear, drift of sensors, or inadvertent damage may adversely affect your FlexCal's measurement accuracy or general performance. For these reasons, Mesa Labs highly recommends having your FlexCal annually verified by an ISO 17025–accredited laboratory, such as Mesa Labs' Butler, NJ facility, to ensure its measurement integrity.

For the ultimate in FlexCal maintenance and to take advantage of any available firmware and mechanical upgrades, Mesa Labs offers an annual non-mandatory Recertification program. This is a service package that provides complete product refurbishment, testing and available upgrades; calibration and NIST-traceable calibration certificates.

Recertification includes a 90-day service warranty should any related labor or parts replacements prove faulty. Turnaround time is generally two weeks from time of receipt.

Third Party Calibrations Are Not Sufficient

Third party calibration laboratories cannot adjust your instrument. These other labs can only perform verifications, not calibrations and will only issue a NIST-traceable certificate that identifies that the instrument falls within claimed accuracy specifications. This means they cannot reset calibration points, perform repairs and maintenance with authorized parts, provide hardware and firmware updates or even check and change batteries.

5.0 Shipping

Tips and guidelines for sending your FlexCal to Mesa Labs

If you are sending your FlexCal in for repair or evaluation (rather than elective Recertification), contact Mesa Labs 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 a service quote. Follow online instruction for proper return procedure.

You can obtain a service quote through our automated web-based system at **drycal.mesalabs.com/request-an-rma**. Service quotes also can be obtained through email to **csbutler@mesalabs.com**, or by telephone at 973.492.8400. Our web site address is **drycal.mesalabs.com**.

Note: Mesa Labs will not evaluate or service your instrument without a service quote.

If we find the issues you have identified are application related and not product related, an evaluation fee will be charged.

Shipping

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

- Use adequate packing material. Whenever possible, use the original packing that came with your FlexCal. Or use a Mesa Pelican carrying case, which provides a hard case shell for protection of your valuable equipment.
- Use a major freight carrier (e.g., FedEx, UPS) that supplies tracking numbers.
- Insure your FlexCal. Mesa is not responsible for damage occurred during transit.
- Understand our mutual shipping obligations.

6.0 Storage

Protecting your FlexCal when not in use

If you need to store your FlexCal 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 FlexCal 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.
- Recharge the battery for at least 8 hours prior to reusing your FlexCal after storage.

Technical data about your FlexCal

7.1 Models:

FlexCal L, from 5-500 ccm

FlexCal M, from 0.5-5 LPM

FlexCal H, from 0.5-50LPM

7.2 Measurements:

Standardized Accuracy: ±0.5% of reading
Time per Measurement: 1-15 seconds (approximate)
Type: Single, Continuous or Burst
Volumetric Flow Units: cc/min, mL/min, L/min, cf/min
Standardized Flow Units: scc/min, smL/min, sL/min, scf/min
Pressure Units (FlexCal): mmHg, PSI, kPa
Temperature Units (FlexCal): °C, °F

7.3 Basics:

Dimensions (H x W x D): 6.7 x 6.25 x 2.9 in / 170 x 159 x 73.5 mm
Weight: 3 lb/ 1.36 kg
Configuration: Integrated flow measuring cell, valve and timing mechanism
Temperature & Pressure Sensors: In the flow stream
AC Power Adapter/Charger: 12VDC, >250ma, 2.5 mm, center positive
Battery: 6V rechargeable, sealed lead-acid, 6-8 hours typical operation
Battery Operational Time (5 cycles/min): 3 hrs backlight on, 8 hrs backlight off

Pressure & Suction Fittings: ¼" ID Swagelok® fittings for Low and Medium models, 3/8" ID for High model
Display: Backlit graphical LCD

7.4 Usage:

Flow Modes: Suction or Pressure
Operating Pressure (Absolute): 15 PSI
Operating Temperature: 0-50°C
Ambient Humidity: 0–70%, non-condensing
Storage Temperature: 0–70°C
Warranty: 1 year; battery 6 months

DryCal Pro Software:

DryCal Pro Software System Requirements

- Windows® XP, Windows® 7
- Microsoft Excel® 2003 and up
- USB Port

8.0 Default Settings

Original factory settings for your FlexCal

The FlexCal is set with the following Default settings from the factory:

- Reading Type - Std
- Number in Average – 10
- Time Between – 0
- Sensor Factor - 1.000
- Flow Units – scc/min
- Pressure Units – mmHg
- Temperature Units – C
- Standardizing Temp – 21.1 deg C
- Measurement Mode – Single
- Magnification – Detail
- Backlight – On
- Power Save – On
- Time Format – 24 hour
- Date Format – MM-DD-YYYY

9.0 Limited Warranty

Outlining our responsibilities

Mesa Labs warrants equipment of its manufacture and bearing its nameplate to be free from defects in workmanship and material. We make no warranty, express or implied, except as set forth herein. Mesa's liability under this warranty extends for a period of one (1) year from the date of product's shipment. Mesa Labs warrants service performed on equipment at our factory for a period of ninety (90) days. During these periods, the warranty is expressly limited to repairing or replacing any device or part returned to the factory and proven defective upon evaluation. These warranty periods will not be extended under any circumstances.

Mesa assumes no liability for consequential damages of any kind. The purchaser, by acceptance of this equipment, shall assume all liability for consequences of its misuse by the purchaser, its employees, or others. This warranty is void if the equipment is not handled, transported, installed, or operated in accordance with our instructions. This warranty is void if any evidence exists that equipment has been opened, including breaking the DryCal warranty seal. If equipment damage occurs during transportation to the purchaser, Mesa must be notified immediately upon arrival of the equipment.

Acknowledgment and approval must be received from Mesa prior to returning parts or equipment for credit. To obtain a Return Material Authorization (RMA), contact csbutler@mesalabs.com with details of the warranty or service claim.

Mesa Labs periodically makes engineering changes and improvements on instruments of its manufacture. We are under no obligation to retrofit these improvements and/or changes into instruments which have already been purchased.

For refund of new products, equipment must be in a new and unused condition. A restocking fee of 30% of the product's value will be charged for returns after thirty (30) days. Mesa Labs will not accept any returns after ninety (90) days.

No representative of ours has the authority to change or modify this warranty in any respect

10.0 Troubleshooting

Mesa is ready to help you with any operational issue you may encounter with your FlexCal. But we may be able to save you some time by providing a short checklist of the questions most commonly asked of our customer service and technical specialists.

Why won't my FlexCal turn on?
If the FlexCal will not turn on, verify that the battery has been charged. When connected to the AC power adapter/charger and power is present a small green indicator light should be visible through the front viewing window

My FlexCal won't respond to push-button commands.
If the FlexCal fails to respond to push-button commands, you can perform a hard reset of the FlexCal. This can be done by inserting a paper clip into the reset opening in the back of the unit.

I'm not sure I have my FlexCal connected properly.
Verify that the flow source is connected to the pressure port of your FlexCal for pressure sources or to the suction port for verifying suction pumps. The unused port should be at atmospheric pressure with any cap or plug removed. If you are calibrating a gas that requires an exhaust line to vent the measurement gas, ensure that the tubing is of sufficient diameter not to create a pressure drop greater then 5 inches of water.

How do I protect against leaks?
Ensure that hose and tube fittings are tight and leak free. The tubing connecting your flow source (pump, mass flow controller, needle valve, sonic nozzle or restrictor) to the meter should be kept as short as possible.

What do I do when my leak test fails?
First check to make sure that the leak test cap is on correctly and it is not leaking through the leak test cap itself. If the leak test cap is correct perform leak test both at the pressure and suction side. If it fails, contact Mesa Technical Support.

What's the best way to connect to the filter medium?
When calibrating sampling pumps best results are obtained with the filter medium connected to the pump and the FlexCal connected to the inlet side of the filter medium with a short piece of tubing.

Why am I experiencing a temperature increase in my FlexCal?
A temperature rise during initial battery charging, or while charging a fully discharged battery is normal. To maintain the best possible accuracy Mesa recommends fully charging your battery before

taking measurements. If this is not possible, we recommend disconnecting your FlexCal from its AC power adapter/charger while taking flow measurements – or to run gas through your FlexCal for 10 minutes before starting the flow measurement.

Why doesn't my piston return to the bottom of the cell?
If the piston fails to return to the bottom of the cell after a measurement this could be caused by:

- A discharged battery not providing enough power to operate the internal valve properly (Try charging the FlexCal)
- Bright light shining into the unit resulting in an overload of the internal optical sensors (Try to operate the unit in a shaded location)
- Moisture or dirt inside the cell (Return the FlexCal to Mesa for service)

What is Connecting Volume?
Connecting Volume is the gas volume between a flow generator and the instrument taking the measurement. Since gas is compressible, this gas can act as a spring between the flow source and the measurement instrument. For best accuracy this volume should be kept to a minimum.

We recommend keeping the tubing length between the gas flow generator and your FlexCal to no more then .5 meters/20 inches in length.

What is Sensor Factor?
Sensor Factor is a number that multiplies the measured flow to scale the reading for certain types of calibrations. It allows customers to scale a mass flow controller or meter when calibrated with alternate gases. Care should be exercised to always verify that the scaling factor is set correctly and we recommend always returning the scaling factor to 1.000 after completeing a calibration.

What is the difference between volumetric flow and standardized flow?
As we know from the ideal gas law, the volume of a gas changes with a change in temperature or pressure even when the number of molecules which constitute the mass remains the same. Volumetric flow rate is the rate at which a volume of a gas travels past a given location. **Volumetric Flow = As Measured Volume of Gas / Time**

Standardized (mass) flow rate is expressed as the rate at which the volume of a gas travels past a given location if the gas is at a specified temperature and pressure. From the ideal gas law if the temperature and pressure are held constant, the volume of the gas is proportional to the number of molecules. **Standardized Flow = Volume of Gas (at the standard temperature and pressure) / Time**

Our Commitment to You

We, Mesa Labs, strive to provide the closest NIST-traceable, legal defensibility of any flow calibration equipment manufacturer, and we actively maintain our NVLAP (NIST) ISO 17025 laboratory accreditation in order to support our claims and continually improve our quality system and laboratory proficiency. Thank you for purchasing our products. From all of us at Mesa, best wishes for many years of accurate, defensible primary flow measurements.

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