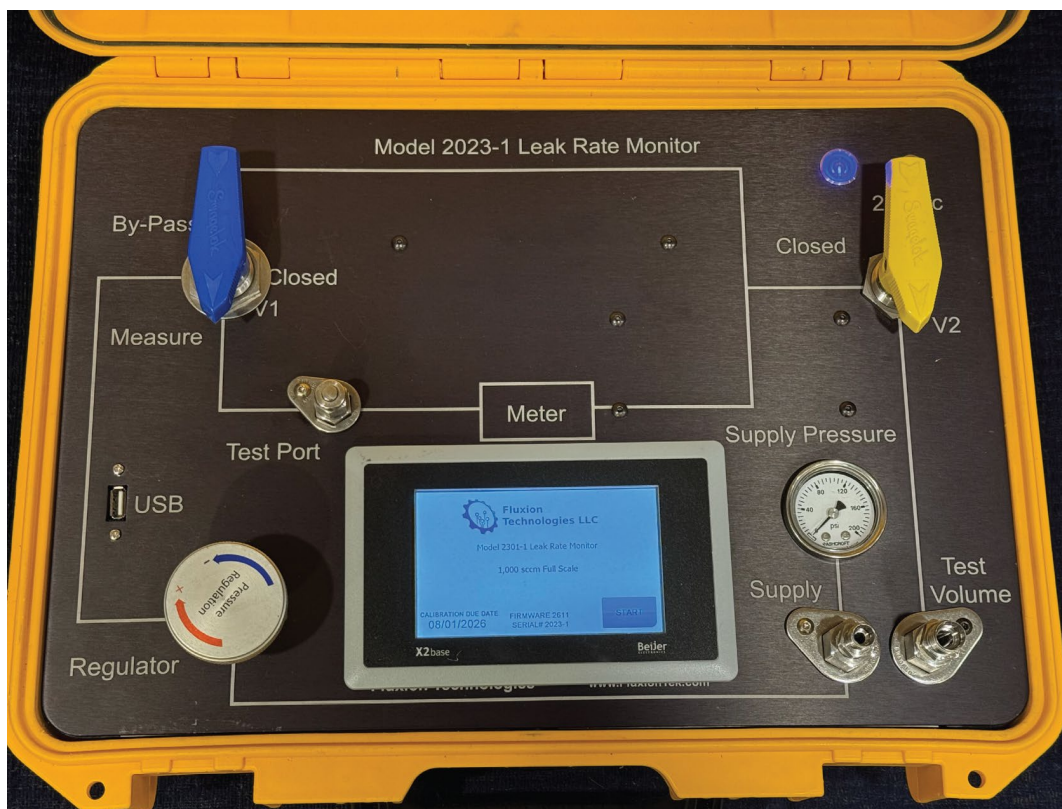




Fluxion Technologies, LLC.

Model 2023-1 Leakage Rate Monitor and Flow Standard

USERS MANUAL



Rev 03

July 1, 2026

Fluxion Technologies, LLC.

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The information in this manual has been carefully checked and is believed to be accurate. However, Fluxion Technologies assumes no responsibility for any inaccuracies or omissions.

Equipment specifications may be subject to change without notice.

The circuits and software contained in the Model 2023-1 are proprietary. Purchase of this product does not transfer any rights or grant any license to the circuits or software used in this product. Disassembling or decompiling of the software program by any means conflicts with copyright laws.

Important Safety Instructions

1. Only clean dry gases listed in the unit's specifications should be used.
2. Do not flush water into the monitor. This WILL damage the monitor. If water is flushed or believed to be in the monitor, immediately contact Fluxion Technologies LLC for technical assistance.
3. The monitor must be kept free of all oils, grease and solvents.
4. Always ensure that the inlet pressure of the monitor is less than the specified maximum inlet pressure of the system.
5. To power the monitor, connect only a clean 24Vdc power supply with center pin positive to the port labeled *24Vdc* or utilize the internal battery.
6. The 2023-1 is not an intrinsically safe device and must never be used in an explosive environment.

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1. DESCRIPTION

The model 2023-1 is a single range, compact, light-weight device used for performing leak rate tests on closed volumes. The model 2023-1 may also be utilized as a portable flow transfer standard.

The monitor utilizes 100% digital instrumentation that allows for improved stability and minimum instrument drift. This single range device is rated as having a 1,000 to 1 turn-down ratio. These units may be ordered with full scale ranges as high as 250 slpm or as low as 20 sccm. Note: units with full scale ranges as low as 0.5 sccm may be special ordered.

The 2023-1 may be calibrated by digitally setting the meters' zero and span using the touch screen display. The meters may also be zeroed prior to each use with a touch screen **Zero** button. As compared to thermal mass meters, the laminar flow elements used holds accuracy for a longer time. Also, unlike thermal mass meters, the meters do not need any warm-up time. The response time for change in flow rates is almost instantaneous. To minimize scatter, digital filters are present in the monitor's firmware.

The 2023-1 has a high precision bleeding and relieving pressure regulator to regulate test pressures and uses a high accuracy digital pressure meter to measure test volume pressures. A panel mounted dial pressure gauge is used to display the inlet pressure to the user for information only.

The monitor is powered by a 24 Vdc wall power supply or the internal rechargeable 24 Vdc battery that can continuously power the monitor for up to 10 hours.

2. OPERATION

2.1. Power Management

The Model 2023-1 is powered up by pressing the panel Power button. Power is supplied by either the 24 Vdc, 3-amp wall power adaptor, (center pin positive) or the internal rechargeable 24 Vdc 2 amp-hr battery. Note: connecting the wall power adaptor both powers the unit as well as charges the battery.

Note: Use only a dc power supply with ripple and spike free voltage.

The panel power jack is designed to connect to a barrel plug, 2.1mm I.D. x 5.5mm O.D. x 9.5mm, center pin positive.

2.2. Touchscreen Navigation

- When powered on, the 2023-1 monitor starts with the *Home screen*. As shown below, calibration due date, firmware number and serial number are displayed on the *Home screen*.



- To navigate to the *Test* screen, shown below, press the *Start* button.

The *Test* screen below is used to conduct leak rate tests.



- To return to the *Home* screen, simply press the *Home* icon button on the *Test* screen.

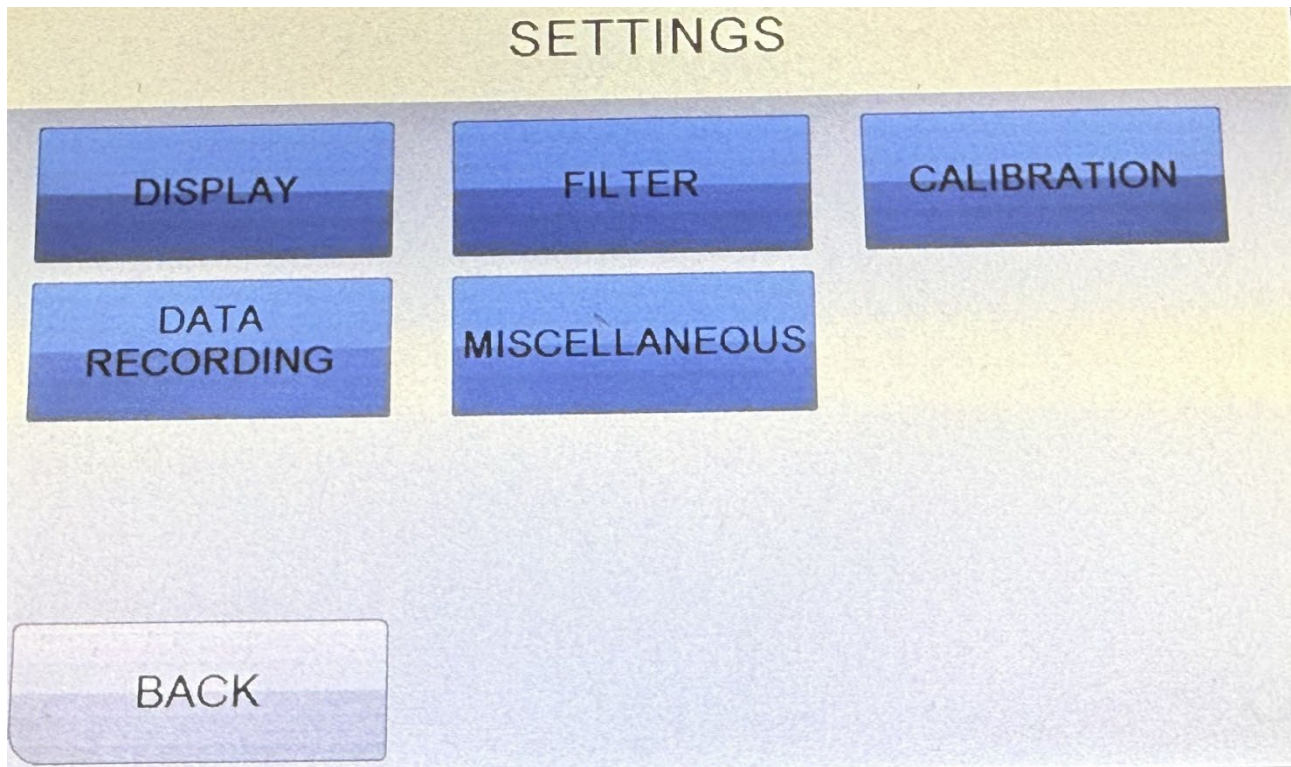
The gas to be measured is chosen by pressing the button labeled Air. Flow rate, pressure and Temperature units are chosen by pressing the unit's button for each. The Zero button may be used to zero pressure or flow rate. Note, only zero pressure when pressure is set to measure gauge pressure.

To measure the average values, press the Average button and continuously averaging values will start to be displayed until it is pressed again.

Time stamped data will be recorded on an inserted panel USB drive in Excel format by pressing the Record button. Data will continue to be recorded until the Record button is pressed again.

2.3 Settings

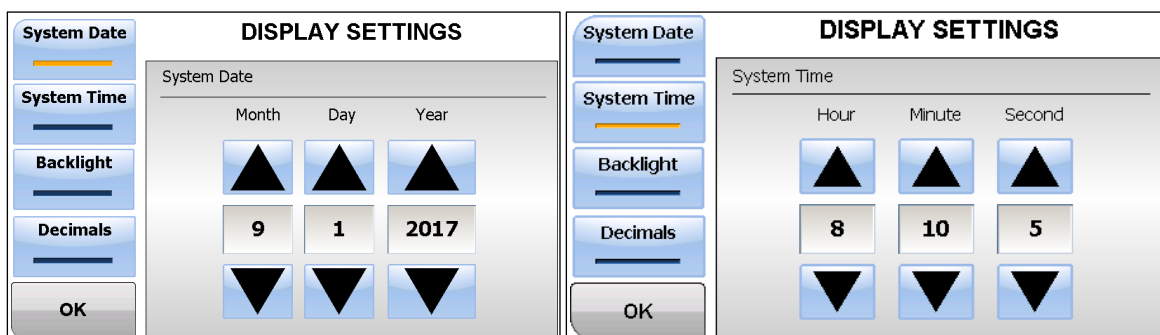
To go to the *Settings* screen, press the *gear* icon button on the *Test* screen.



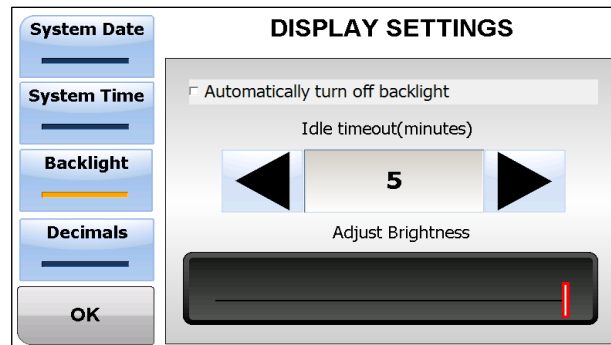
Display

The Display screen contains the date/time, backlight and flow rate display decimal settings.

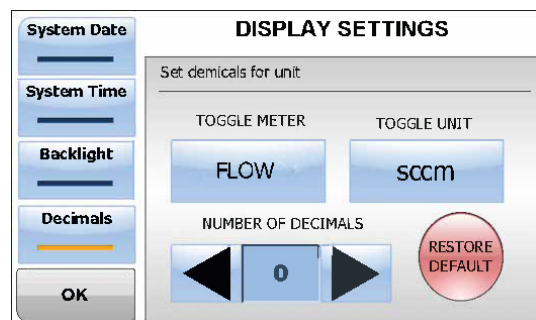
Date/Time: A user may set date and time by pressing the *System Date* or *System Time* button. This will open the screen below, for example. Here a user may change the item by using the *up* & *down* buttons.



Backlight: Here a user may set the brightness of the display. Users may also set the backlight to automatically turn off. To adjust the brightness, use the *left* or *right* arrow buttons or the slider bar. To enable the display to automatically turn off the backlight, simply select the option.



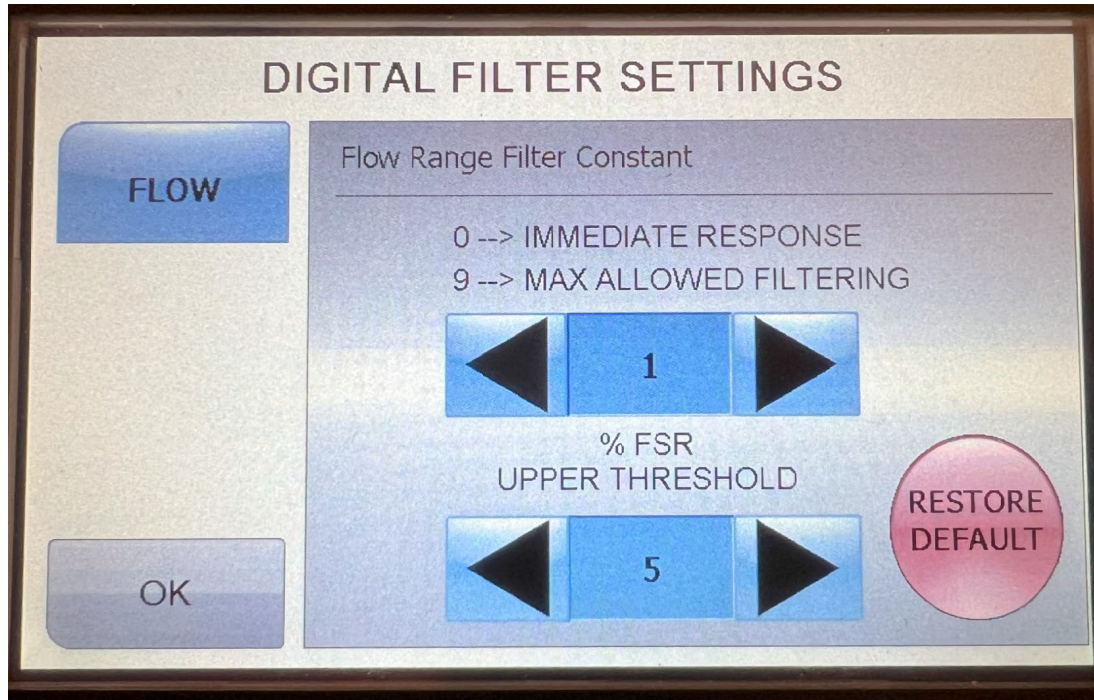
Decimals: Here a user may set the number of displayed decimals and engineering units for flow and pressure. To set decimal figures, select the desired units by pressing the *Toggle Units* button. Then, set the number of decimals using the *left/right* arrow buttons. Once set, no saving is required. To revert to factory settings, simply press the *Restore Defaults* button.



Filter

The *Filter* button is located on the Settings page. The filter screen shown below allows the user to set the filter constants for the flow meter. These constants may be set to integer values between 0 and 9. When the constant is set to 0 the filtering is in effect switched off. A value of 9 is the maximum possible filtering. The factory default value of filtering is 1. The choice of filter constants has no effect on the accuracy. It only affects the response time. The filters are used to dampen out small variations in flow rate readings due to noise.

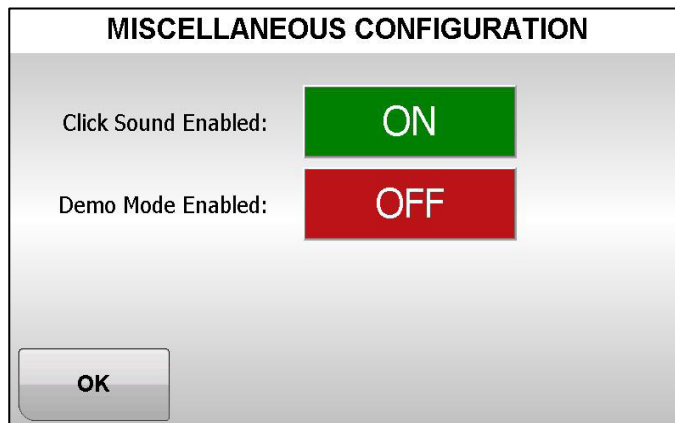
Filtering should only be used for small changes in flow rate. The user may set the maximum rate of change that filtering is applied to. This is done by setting the limit in terms of % of full scale per minute. This may be set to any integer value between 1 and 100. The factory default value is 5% of full scale. Values set by the users are stored in the non-volatile memory. To restore back to default values, simply press the *Restore Default* button.



Miscellaneous

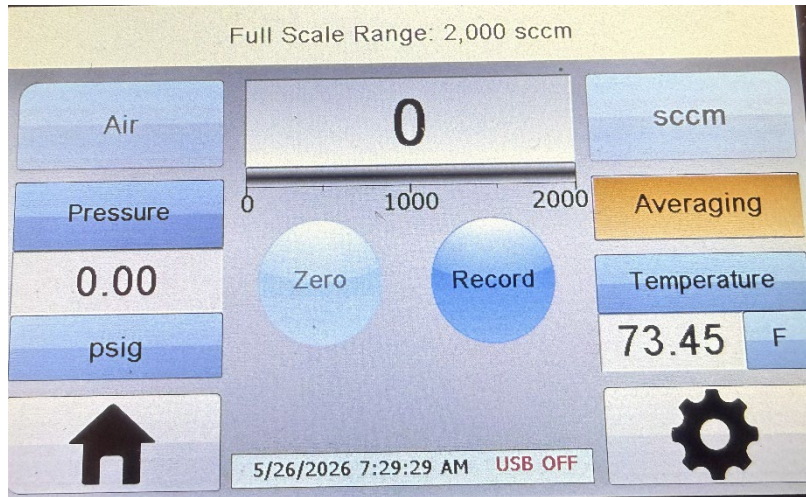
The *Miscellaneous* button is located on the Settings page. When pressed, the screen below will appear. The click sounds when buttons are pushed may be toggled on or off.

The option for demo mode may be absent on most units. Demo mode is only used to present simulated flow rates. **It should never be actuated for actual testing.**

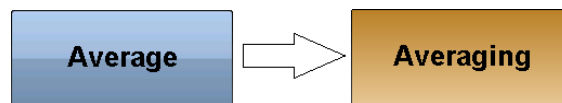


2.4 Averaging

To improve the stability of the measured flow rate, the user can average the measured flow rate. Averaging is especially useful when measuring small flow rates. When the measured flow rate has reached a reasonable level of stability, the user can actuate the *Averaging* button on the Test screen to enable real time averaging of the measured flow rate. The averaging begins when the button is actuated and continues until stopped.



To enable averaging, simply press the *Averaging* button on the Test screen as shown below.



Notice that averaging will disable range, gas type & flow units.

Note: Flashing numbers represent a flow rate that is above the range of the flow meter.

2.5 Recording

2023-1 enables the user to record test data to a USB drive. Both instantaneous single data sets as well as continuous data sets at user defined intervals can be recorded. A USB drive must be inserted into the panel *USB* port to enable recording. The text at bottom of the *Test* screen will show "USB On" in a green font when a USB drive is plugged in, or "USB Off" in red font when no USB drive is connected.

Once a USB drive is inserted into the panel *USB* port, the *Record* button will become functional. To record a single data set, simply press the *Record* button. A message will appear at the Bottom of the screen informing the user that a single data set has been recorded.

To start continuous recording hold down the *Record* button for 5 seconds. Upon release of the *Record* button, the Recording Options menu shall appear. Testing information as well as the recording interval may be entered. When the *Next* button is pressed, the user is prompted to enter any notes if desired and to *Start Recording*. While recording, a message at the bottom of the screen shall flash displaying the number of data sets recorded as well as the recording interval.

The continuous recording may be terminated at any time by pressing the red *Stop* button. A message at the bottom of the screen shall appear informing the user that continuous recording has stopped as well as the number of data points that have been recorded. The user cannot change the gas type during data recording.

Configuration

Navigate to and press the *Data Recording* button on the SETTINGS page. Date, time as well as the desired format for each may be set.

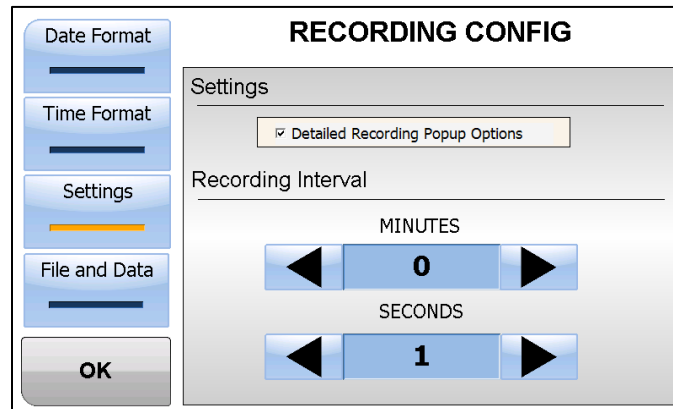
Date Format: The user-configured date format settings will immediately reflect on the data displayed. To set a new format, press clear, and begin the date format by selecting the desired characters.

The screenshot shows the 'RECORDING CONFIG' menu. On the left is a vertical sidebar with four buttons: 'Date Format' (highlighted with an orange bar), 'Time Format', 'Record Interval', and 'File and Data'. Below these is an 'OK' button. The main area is titled 'Date Format' and contains two input fields. The first is 'Today's Date' with the value '08/18/2015' and a 'Clear' button. The second is 'Format' with the value 'MM/DD/YYYY' and a 'Back' button. At the bottom of the main area are five buttons: 'M', 'D', 'Y', '/', and '-'.

Time Format: The user configured time format settings will immediately reflect on the displayed data. To set a new format, press clear, and begin the time format by selecting the desired characters.

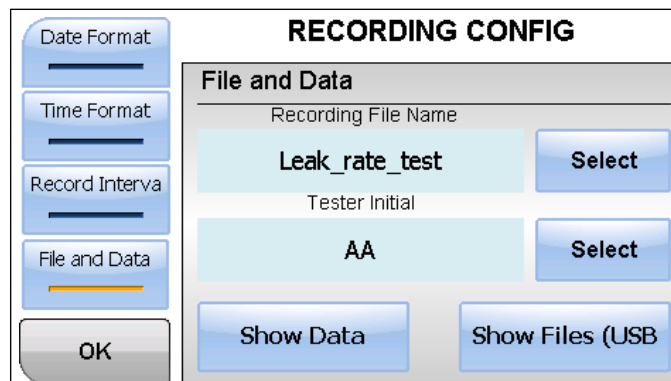
The screenshot shows the 'RECORDING CONFIG' menu with the 'Time Format' option selected in the sidebar. The main area is titled 'Time Format' and contains two input fields. The first is 'Current Time' with the value '06:44:08' and a 'Clear' button. The second is 'Format' with the value 'HH:MM:SS' and a 'Back' button. At the bottom of the main area are five buttons: 'H', 'M', 'S', ':', and '-'.

Recording Interval: Press the *Settings* button set the recording interval as shown in the screen below.



The screen shows the 'RECORDING CONFIG' window with the 'Settings' tab selected. On the left sidebar, buttons for 'Date Format', 'Time Format', 'Settings' (highlighted), 'File and Data', and 'OK' are visible. The main area contains a 'Settings' section with a checked 'Detailed Recording Popup Options' checkbox. Below this is the 'Recording Interval' section, which has two numeric input fields: 'MINUTES' set to '0' and 'SECONDS' set to '1'. Each field has left and right arrow buttons for adjustment.

Recording file name and Tester Initial: Press the *File and Date* button to set the Recorded data file name and tester's initials as shown below. Unless there has been a name defined in this screen, a default filename in CSV format will be saved.



The screen shows the 'RECORDING CONFIG' window with the 'File and Data' tab selected. On the left sidebar, buttons for 'Date Format', 'Time Format', 'Record Interval', 'File and Data' (highlighted), and 'OK' are visible. The main area contains the 'File and Data' section. It has two text input fields: 'Recording File Name' with the text 'Leak_rate_test' and 'Tester Initial' with the text 'AA'. Each field has a 'Select' button to its right. At the bottom of the main area are two buttons: 'Show Data' and 'Show Files (USB)'.

Preview

Both the files collected as well as the data in these files may be viewed by pressing either the *Show Data* or *Show Files* buttons and following the displayed menu options as shown on the screens below.

Select Recorded Data

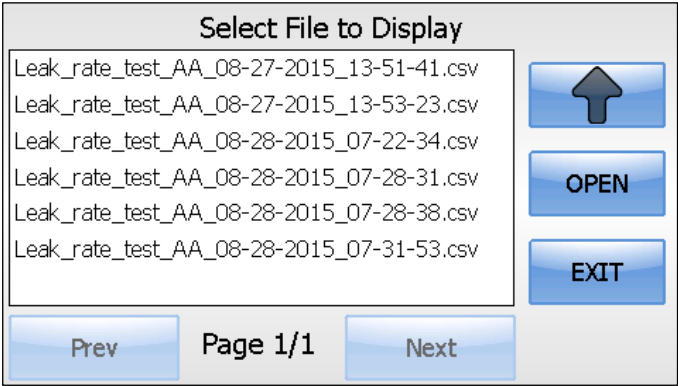
Start Time: 08/28/2015 07:28:31 Duration: 1 sec
 Start Time: 08/28/2015 07:28:38 Duration: 57 secs
 Start Time: 08/28/2015 07:31:53 Duration: 4 min(s)

Back Prev Pag Page 1/1 Next Pag Open

Date: 08/28/2015 **Leak Rate Data** Gas Type: AIR

Time	Inlet P(psig)	Test P(psig)	Flow Rate(sccm)	Meter
07:28:38	80.00	40.00	80	HIGH
07:28:39	80.00	40.00	80	HIGH
07:28:40	80.00	40.00	80	HIGH
07:28:41	80.00	40.00	80	HIGH
07:28:42	80.00	40.00	80	HIGH
07:28:43	80.00	40.00	80	HIGH

Back Prev Page 1/10 Next



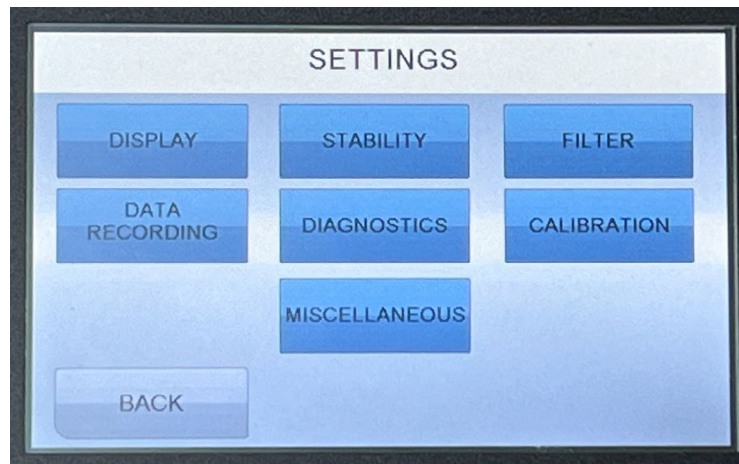
2.6 Calibration

The 2023-1 enables the user to calibrate the 2023-1's flow and pressure meters using the touch screen display. All calibration constants are instantaneously stored onto the meters. No calibration constants are ever stored in the touch screen display.

All calibration should be done only with dry air. The full recalibration of the 2023-1 will require the flow meter and the test pressure meter to be re-calibrated. Note: the test pressure meter is part of the flow meter. In all cases, the meter's flow standard conditions are defined as 68°F and 14.696 psia.

Navigating to the Calibration Screen

- Navigate to the Settings screen as described in section 2.3.
- On the *Settings* screen, press the *Calibration* button to navigate to the *Calibration* screen, shown below.



- This will prompt you to enter the password (as shown below). The password is always the firmware number of the monitor, which is displayed on the *Home* screen.

Enter Password:			
7	8	9	←
4	5	6	.
1	2	3	+/-
0	ENTER	BACK	

Calibration Due Date

Set Cal Due Date: A user may set the calibration due date of the monitor using the up/down arrows and select the option to display the due date on the home screen if needed.

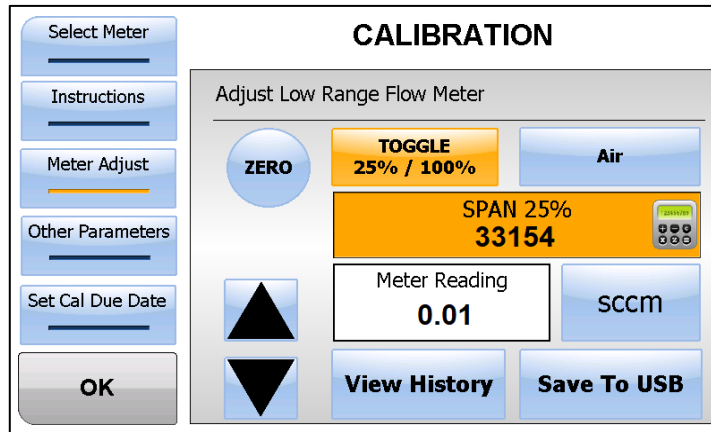
The due date will appear on the Home screen; a past due date will flash in red where as a future due date will remain solid green.

Flow Meter Calibration

With a selected meter, its respective calibration instructions and adjustment instructions can be found under the *Instructions* tab, as shown below.

Note: Use the below procedure for calibrating the flow meter. Before any adjustment can be made it is recommended that the *25% and 100% Span* values are noted down for the meter. These values can be keyed in using the calculator icon to restore them to a previous state if needed.

- Toggle to “Flow Meter” selection
- Once selected, switch to the adjust tab to calibrate the meter, as shown below



- **Note down the initial span values.** Span values can be toggled through using the *Toggle 25%/ 100%* button, to display span values for 25% and 100% of full scale. This is important in order to restore the meters back, if needed.
- Select the calibration gas to air by using the toggle button, select the desired units using the units toggle button.
- Then zero the meter at no flow/pressure conditions using the *Zero* button.
- Set flow rate to 100% of the selected meter's full scale. Select Set Span to 100% by pressing the *Toggle 25%/ 100%* toggle button.
- Ensure a steady flow is established.
- Compare the meter reading with that of the standard. If not under specification, adjust the reading by using the up/down buttons or changing the span value using the calculator icon to match the meter's readings to that of the standard. Once the reading is within that of the meter's specified accuracy relative to the standard, move to the next step.
- Repeat the previous 3 steps, with the flow rate and *Span* set to 25% of the selected meter's full scale. Once the reading is within that of the meter's specified accuracy relative to the standard, move to the next step.
- Verify the adjustment by testing the meter's accuracy at 25%, 50%, 75% and 100% of full scale of the selected meter. If meter reading doesn't fall within the specified accuracy, re-adjust the readings at 25% and 100% of full scale of the selected meter.

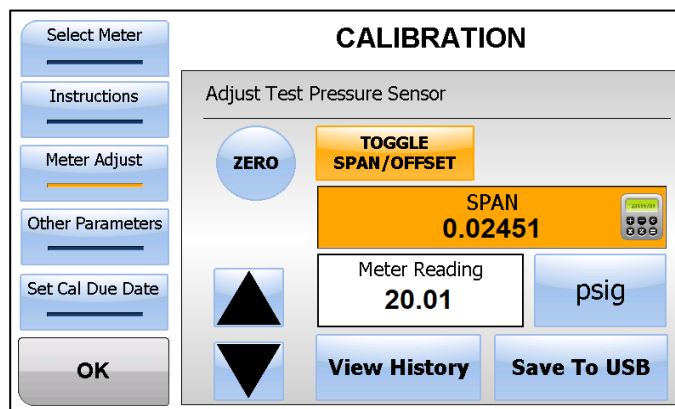
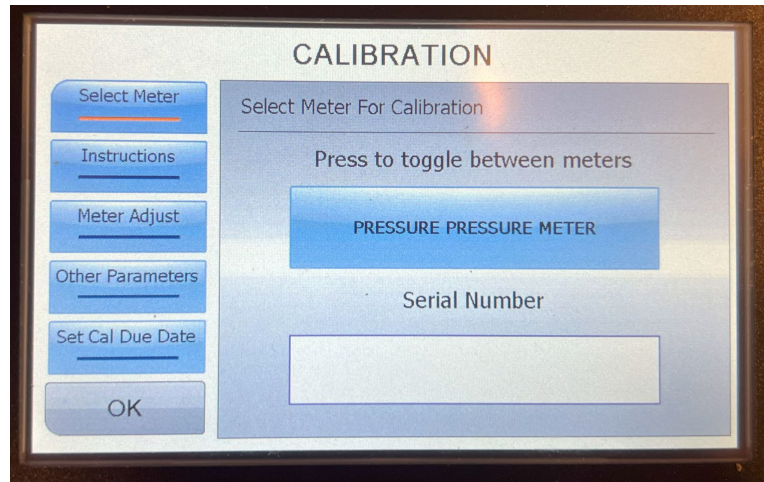
Once satisfied, no saving of calibration values is needed. As the meter is adjusted, calibration constants are immediately updated on the meter. No calibration constants are stored in the touchscreen display.

Test Pressure Meter Calibration

- On the *Calibration* screen, select the test pressure meter under *Select Meter* tab.

Once selected, switch to the adjust tab to calibrate the test pressure meter, as show below.

OPERATION

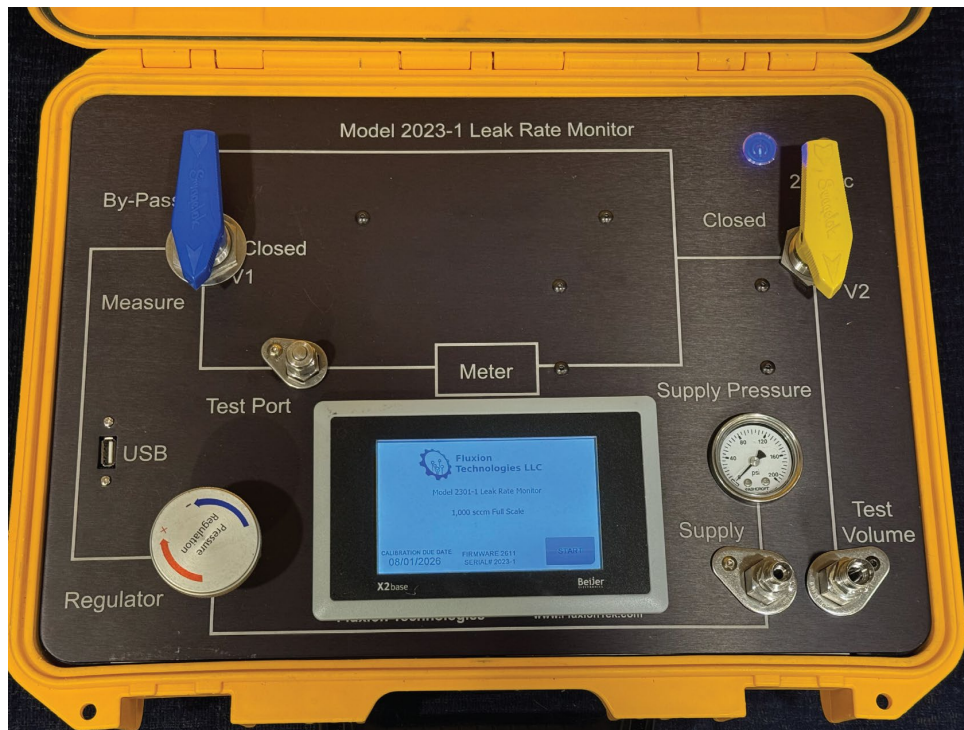


- Note the initial span/offset values. Span/offset values can be toggled through using the *Toggle Span/Offset* button.
- Select the desired units using the units toggle button.
- To adjust the span to match the standard, pressurize the 2023-1 to 100%FS of the test pressure meter and adjust the span constant in order to adjust the read pressure value, if necessary. To adjust the span constant, use the up/down arrows or the calculator icon. Once satisfied, no saving of calibration values is needed as it is instantaneous.
- To adjust the zero of the meter to match the standard, vent the 2023-1. If the reading is not within specifications, zero the meter by pressing the *Zero* button. It is not necessary to adjust the offset value unless needed.

Notes: When adjusting the meters, keep the *up/down* button pressed for a longer time to change the meter reading quicker or use the calculator icon to input exact values

2.7 Flow Path Configurations/ Valve Operations

The below image illustrates the valves and ports that are of importance to the general operation of the 2023-1. The identified ports include the *Supply* port, *Test Port* & the *Test Volume* port. The valves identified are V1 (blue) V2 (yellow).



Valve V1 allows a user to isolate the onboard pressure regulator and *Supply* port from the *Test Port*. V1. It also allows the user to choose between measuring the flow rate or by-passing the flow meter to quickly fill the test volume. Valve V2 allows a user to isolate the 2023-1 from the *Test Volume* port. Test pressure is sensed on the meter side of V2.

Quick reference guide for various flow path configurations and valve operations is shown below.

Configuration	V1	V2	Cal Port	Test Volume Port
Pretest Leak Check	Closed	Open	Capped	Capped
Slow Fill	Measure	Open	Capped	Connected to Test Volume
Quick Fill	By-Pass	Open	Capped	Connected to Test Volume
Leak Rate Test	Measure	Open	Capped	Connected to Test Volume
Flow Meter Calibration	Closed	Open	Supply from flow standard	Vent to Atmosphere
Pressure Meter Calibration	Close	Closed	Supply from pressure standard	Any

Pretest Leak Check

Pretest leak checks are to be conducted to ensure there are no leaks inside the 2023-1.

- Before beginning this check, ensure that flow and pressure readings are zeroed.
- Cap the *Test Volume* port
- Provide a supply pressure of at least 80 psig to the *Supply* port.
- Ensure that valve V1 is set to *Measure*, V2 is set to Open and set the pressure regulator to approximately 60 psi.
- Close V1 and monitor the screen test pressure reading for any drop in pressure.
- If a significant pressure drop rate is detected, please contact Fluxion Technologies LLC for further assistance.

Fill Test Volume

To slow fill a test volume, follow the below procedure:

- Provide a supply pressure at least 20 psig above the required test pressure to the *Supply* port with V1 closed.
- Connect the test volume to the *Test Volume* port.
- Set V1 to measure and close V2.
- Use the pressure regulator to set a desired test pressure as indicated with the screen test pressure reading.
- Open V2 to fill the test volume.
- Re-adjust regulator to achieve tests pressure if required. Once test pressure has been reached, the pressure regulator will control the test pressure set.
- Read the flow rate from the test screen and record the leakage rate when the indication becomes stable.

Quick Fill Test Volume

For large test volumes, the quick fill setting speeds up pressurization.

- Connect the air or nitrogen supply to the *Supply* port.
- Connect the test volume to the *Test Volume* port. Ensure the V1 is set to By-Pass.
- With V2 closed use the pressure regulator to set a desired test pressure.
- Then open V2 to quick fill a test volume. Once test pressure is close to/reached the desired test pressure, the user can switch V1 to *Measure* to maintain test pressure.

Leak Rate Test

After the test volume has been filled:

- Leave the pressure regulator at the set test pressure used to fill the volume or adjust as needed,
- Set V1 to Measure and V2 to open.
- Verify that the flow units, range and gas are set correctly.
- Read the flow rate from the Test Screen. When the leak rate is seen to be stable, record the value.

Depressurize monitor

Ideally, all test volumes are depressurized through a vent line located between the test volume and the monitor with the monitor isolated. This eliminates the possibility of flushing water and/or contamination into the monitor

3. CARE AND MAINTENANCE

Test Pressure Meter

No periodic maintenance is required on the test pressure meters.

Flow Meter

No periodic maintenance is required on the flow meter

Battery

No periodic maintenance is required on the batteries.

Precision Pressure Regulator

No periodic maintenance is required on the precision pressure regulator.

Repair and Replacement of Meters

If a defective flow meter or pressure meter is discovered, it may be replaced with a new equivalent device. No adjustments are required to bring the monitor to full calibration after such a replacement.

Although no calibration of the display is ever required, the touch screen display requires programming to work with the ranges of the flow meters.

4. SPECIFICATIONS

System

Max. Inlet Pressure: 170 psig

Max Test Pressure: 90 psig (unless specified)

Operating Temperature Range: 40°F to 120°F

Power: 24 Vdc power supply



High Accuracy Pressure Regulator (1)	Max. Inlet pressure: 170 psig Outlet Pressure: 0 to 90 psig Less than 0.1 SCFM Air Consumption Operating Temperature Range: 40°F to 120°F
Color Touch Screen Display (2)	Screen Size: 5" Diagonal Rugged Touch Screen Display
Flow Meter	Laminar Flow Element (LFE) meter Max Inlet Pressure: 170 psig Range: 0.1 to 100% of full scale, 1000 to 1 Ratio Accuracy: $\pm 1\%$ of reading or $\pm 0.1\%$ of full Scale whichever is greater, after tare Repeatability: $\pm (0.1\% \text{ of reading} + 0.02\% \text{ of full scale})$ Typical response time: less than 10 ms
Test Pressure Meter	Full scale: 100 psig or user specified Accuracy: 0.5% of full scale after tare
Inlet Pressure Meter	Full Scale: 0-200 psig Accuracy: 2% of Full Scale Operating Temperature Range: 40°F to 120°F

Note:

- (1) Test regulators shimmed with washers to limit pressure to about 75 psig to protect flow meters. These may be removed by unscrewing handles and removing washers.
- (2) The default password for the touch screen firmware is the firmware number of the unit as displayed on the unit's Test Screen. When the monitor is powered, the first screen displayed is the Test Sc

5. TROUBLESHOOTING/ERROR MESSAGES

5.1. General Troubleshooting

The below table details various problems, their possible causes and solutions.

Error Message	Possible Causes	Solutions
<i>"Zeroing flow meters not allowed with reading exceeding 1% of range limit."</i>	➤ Flow present during zeroing of Flow meter.	➤ Close V1 & V3 before zeroing flow meters. ➤ Check for internal leaks
<i>"Zeroing test pressure meter not allowed with reading exceeding 10% of range limit."</i>	➤ Pressure present during zeroing of test pressure meter.	➤ Ensure test volume port is vented to atmosphere.
<i>"Warning maximum supply pressure reached! Reduce supply pressure!"</i>	➤ Supply (inlet) pressure greater than system specified.	➤ Reduce supply pressure to less than system specification.
<i>"Warning: Max test pressure reached!"</i>	➤ Test pressure greater than system specification.	➤ Reduce test pressure to less than system specification.

For hardware/software related problems and assistance with problems reported by the diagnostics feature, please contact:

Fluxion Technologies, LLC.

Web: www.FluxionTek.com
Email: Sales@FluxionTek.com

6. WARRANTY AND RETURNS

Fluxion Technologies warrants this monitor to be free from defects in material and workmanship and to provide satisfactory service for a period of 90 days from the date of purchase. If the monitor should malfunction, it must be returned to the factory for evaluation.

Fluxion Technologies will issue a Return of Merchandise Authorization number (RMA) number immediately upon phone or written request. Upon Fluxion Technologies' s examination of the monitor, if it is found to be defective, the monitor will be repaired or replaced at no charge. However, this WARRANTY is VOID if the monitor shows evidence of tampering, damage as a result of excessive corrosion, current, heat, moisture or vibration, improper specification, misapplication, misuse or other operating conditions outside the control of Fluxion Technologies, LLC.

These monitors are intended to be installed and used only by qualified personnel. No warranty extended herein will apply if such monitors are installed or used by unqualified personnel. There are no other warranties except as stated herein. There are no other warranties, expressed or implied, including but not limited to the implied warranties of merchantability and of fitness for a particular purpose. Fluxion Technologies is not responsible for any bodily injuries or death caused to personnel and damages or losses caused to other equipment, whether direct or indirect, incidental, special or consequential, which the purchaser may experience as a result of the installation or use of the product. The buyer's sole remedy for a breach of this agreement by Fluxion Technologies or any breach of any warranty by Fluxion Technologies shall not exceed the purchase price paid by the purchaser to Fluxion Technologies for the monitor or monitors or equipment affected by such breach.

Every precaution for accuracy has been taken in the preparation of this manual. However, Fluxion Technologies neither assumes responsibility for any omissions or errors that may appear nor assumes liability for any damages that result from the use of the products in accordance with the information contained in the manual.

Direct all warranty and repair requests / inquiries to

Fluxion Technologies LLC.

Email: Sales@FluxionTek.com

The designated RMA should then be marked on the outside of the return package.

To avoid possible delays, be sure to include:

1. The returnee's name, address and phone number.
2. Model and serial number of the returned monitors.
3. Repair instructions, if known.