

Ludlum 9-4 and 3100 Series Calibration Software Manual

December 2018

Version 2.0.5.0 and above

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Introduction

Getting Started

General Description

The Model 9-4 and 3100 Series Calibration Software is a useful software tool that allows reading and writing of many important parameters in Ludlum instruments via an FTDI serial port. Compatible Ludlum instruments include the Model 3100 and other instruments in that series and the Model 9-4, and may include others. (For the rest of this manual, when referring to the Model 3100, that will also include others in the Model 3100 series.) Instrument parameters may be loaded or saved to files, and an instrument parameter report may be printed. Current readings or measurements may be streamed from the instrument and viewed.

Software Prerequisites

Microsoft .Net 4.5 comes installed on most machines by default.

Minimum Requirements

- Supported Operating Systems: Windows 7 and higher (32-bit and 64-bit versions)
- Computer with Intel or compatible 1 GHz or faster processor (2 GHz or faster is recommended)
- Minimum of 256 MB of RAM (1 GB or more is recommended)
- 1 GB of free hard disk space.

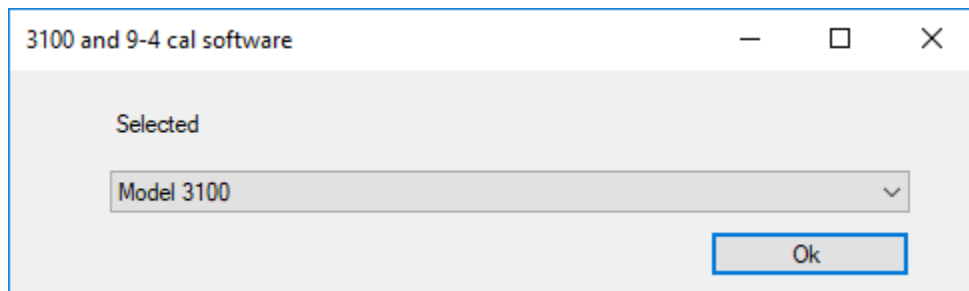
Installation

Run the installer MSI from the installation CD and follow the on-screen prompts to install the LMI Model 9-4 and 3100 Calibration Software.

How to Use Software

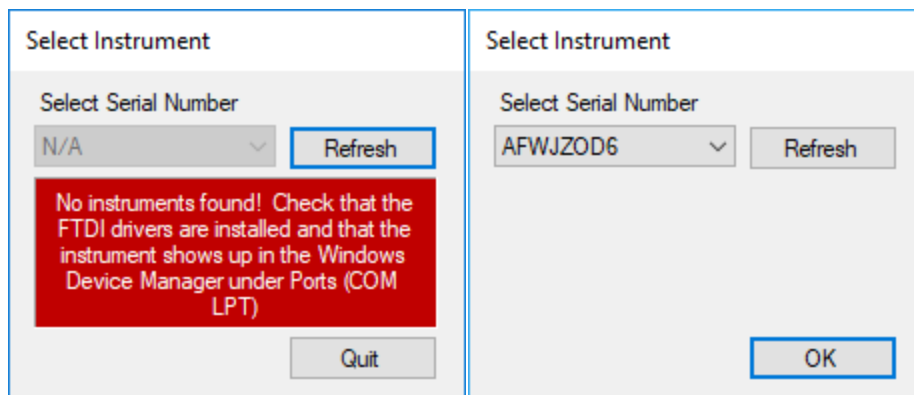
Instrument Model Selection Screen

This window is where the user selects an instrument to which to connect. Please select the proper instrument, or else experience errors.



Instrument Connection Screen

This window shows currently connected Ludlum instruments plugged into a compatible use dongle, and the Mac address of that dongle.



If one were to plug in an instrument after getting to this page, the user will have to hit the refresh button.

Model 9-4

Main Screen

The main screen consists of a tabbed interface separating the general calibration operations from the restore settings operations and a menu bar.

Menu Bar

The menu bar offers quick access to common functions including the File Menu, the Parameters Menu, and the Help Menu.

File Menu

- **Disconnect Instrument:** This menu item will disconnect from the instrument and take you back to the device selection screen.
- **Print:** This menu item will send a report of all parameters to a printer.
- **Exit:** This menu item will exit out of the software.

Parameters Menu

- **Update (Ctrl-U):** This menu item is the same as clicking on the "Update" button.
- **Load from File (Ctrl-O) 9-4 only:** This menu item loads in settings from a user-defined text file.
- **Save to File (Ctrl-S) 9-4 only:** This menu item will save the current settings to a user-defined file.
- **Reload All Data (Ctrl-R):** This menu item will reload all data from the instrument and refresh the restore values.
- **Print Parameters (Ctrl-P):** This menu item will send a report of all parameters to a printer.

Calibration Configurations Tab

The Calibration Configurations Tab is the tab which should have focus during the calibration and configuration of the Model 9-4 Main Board. Using this tab during configuration, the user can configure sampling, delays, and compensations required for proper operation of the Model 9-4. Using this tab during calibration, the user can calibrate the meter face, enter calibration constants for all ranges, and calibrate the pressure sensor.

Instrument Serial Number

This box is used to enter the six-digit serial number of the instrument being calibrated. This

value is used during print parameters to obtain a printout with the current instrument parameters and the instrument serial number.

Battery Calibration Constant

This value is the calibration constant for determining a low-battery condition. The value range is 1 to 65535.

Range Calibration Constants (X1 - X10K)

These values are the calibration constants for each range of the meter. The value ranges is 1 to 65535.

Calibration Low Pressure

This number represents the actual low pressure (kPa) that the instrument pressure sensor is exposed to when setting the low-pressure calibration. The range of this value is 0.00 to 115.00 kPa.

Calibration High Pressure

This number represents the actual high pressure (kPa) that the instrument pressure sensor is exposed to when setting the high-pressure calibration. The range of this value is 0.00 to 115.00 kPa.

Pressure Calibration Button

When the value of the calibration low or high-pressure is changed, this button is highlighted and enabled. Calibration low and high values are not sent to the instrument until the button is pressed and all the calibration steps are completed. The highlighted button state simply indicates changes have been made and serves as a reminder to send the information to the instrument. See the calibration section for details on the calibration procedures.

Temperature Compensation

When selected, the instrument readings will be corrected based on changes in ambient temperature.

Pressure Compensation

When selected, the instrument readings will be corrected based on changes in ambient pressure.

Meter Reset

When selected, the meter operates in the normal default mode.

Test Meter UCP

When selected, the meter needle is deflected towards the mark indicating the expected reading when the instrument is calibrated at the Upper Calibration Point.

Test Meter LCP

When selected, the meter needle is deflected towards the mark indicating the expected reading when the instrument is calibrated at the Lower Calibration Point.

Meter Full Scale

When selected, the meter needle is deflected to full scale and the Up and Down buttons are enabled. The Up and Down buttons are to be used to adjust the meter needle to exactly full scale. The 'Adjust By Value' is the numerical value the ADC value is adjusted by, and a larger number (max of 20) will make the needle move further each time a button is pressed. Fine tuning can be made by setting the 'Adjust By Value' to 1.

Meter Zero Scale

When selected, the meter needle is deflected to zero on the scale, and the Up and Down buttons are enabled. The Up and Down buttons are used just as they are used for Meter Full Scale; however, now the needle is being moved to exactly 0 on the display.

Battery Voltage

This indicates the instrument's current battery voltage.

Temperature

This indicates the ambient temperature of the instrument.

Uncompensated Pressure

This indicates the pressure measured by the instrument pressure sensor.

Compensated Pressure

This indicates the pressure measure by the instrument pressure sensor with the value compensated for the ambient temperature.

Pressure Sample Period

This indicates the amount of time, 1 to 36000 (where 1 equals 100 ms), between pressure and temperature samples used to determine the atmospheric pressure.

Electrometer Transient Delay

This indicates the amount of time 1 to 100 (where 1 equals 100 ms) the electrometer will hold and display the last reading after pressing the reset button in order to reduce transients resulting from the reset action.

Update Button

When pressed, the instrument is updated with values that have changed. When values have been changed, the Update button will be highlighted until the instrument has been updated with the new changes.

Restore Tab

The Restore Tab is the tab which should have focus if it is necessary to restore previously saved settings into a Model 9-4. Simply hold down the CTRL key and press O and select the file to load. Next, press Restore Parameters to load the previously saved parameters into the Model 9-4. In addition to the calibration constants seen on the Calibration Configurations tab, the restore feature also loads the following values.

Meter Full Scale DAC Value

This is the digital-to-analog converter numerical value (0 – 4095) that results in a specific analog voltage output to place the meter needle at the full-scale position.

Meter Zero Scale DAC Value

This is the digital-to-analog converter numerical value (0 – 4095) that results in a specific voltage output to place the meter needle at the zero scale position.

Low Pressure ADC Value

This is the analog-to-digital converter numerical value (0 – 1023) that results from the analog voltage from the pressure sensor, which represents the low-pressure value for the instrument.

High Pressure ADC Value

This is the analog-to-digital converter numerical value (0 – 1023) that results from the analog voltage from the pressure sensor, which represents the high-pressure value for the instrument.

Restore Low Pressure

This is the low-pressure value, in kPa, that represents the low-pressure calibration point for the instrument.

Low Pressure Calibrated

If checked, this indicates that the value stored in the Restore Low Pressure text box is the result of an actual low-pressure calibration reading.

This is the high-pressure value, in kPa, that represents the high-pressure calibration point for the instrument.

High Pressure Calibrated

If checked, this indicates that the value stored in the Restore High Pressure text box is the result of an actual high-pressure calibration reading.

Calibration Temperature

This is the temperature, in Celsius, during the high-pressure calibration of the instrument.

Restore Parameters Button

When pressed, this button sends the values present in the Restore tab to the instrument to restore specific calibration values.

Model 3100

Menu Bar

The menu bar offers quick access to common functions including the File Menu, the Parameters Menu, and the Help Menu.

File Menu

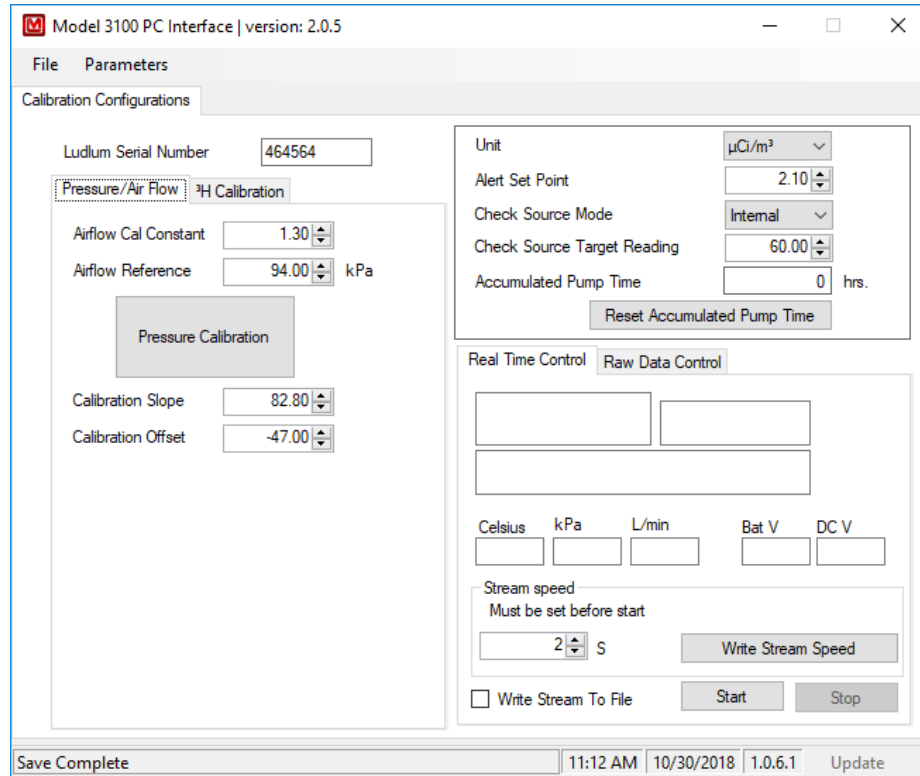
- **Disconnect Instrument:** This menu item will disconnect from the instrument and take you back to the device selection screen.
- **Print:** This menu item will send a report of all parameters to a printer.
- **Exit:** This menu item will exit out of the software.

Parameters Menu

- **Update (Ctrl-U):** This menu item is the same as clicking on the "Update" button.
- **Reload All Data (Ctrl-R):** This menu item will reload all data from the instrument and refresh the restore values.
- **Print Parameters (Ctrl-P):** This menu item will send a report of all parameters to a printer.

Main Screen

The main screen consists of a tabbed interface separating the general calibration operations from the restore settings operations and a menu bar.



Calibration Configurations Tab

The Calibration Configurations Tab is the tab which should have focus during the calibration and configuration of the Model 3100 Main Board. Using this tab during configuration, the user can configure sampling, delays, and compensations required for proper operation of the Model 3100. Using this tab during calibration, the user can calibrate the meter face, enter calibration constants for all ranges, and calibrate the pressure sensor.

Instrument Serial Number

This box is used to enter the six-digit serial number of the instrument being calibrated. This value is used during print parameters to obtain a printout with the current instrument parameters with the instrument serial number included.

Update Button

When pressed, the instrument is updated with values that have changed. When values have been changed, the Update button will be highlighted until the instrument has been updated with the new changes.

Pressure and Airflow Calibration

Airflow Calibration Constant

This represents the adjustment number to the flow reading to ensure it reads correctly. Default should be approximately 1.3.

Airflow Reference

This represents the pressure at which the airflow was calibrated. It should be the same number used to calculate the top point of the pressure slope.

Calibration Pressure Slope

This represents the slope of the line for the pressure calibration. If the pressure reading on the instruments do not seem to line up by different factors on the bottom and the top, then this should be adjusted.

Calibration Pressure Offset

This number represents the offset to the pressure (kPa) that the instrument pressure sensor reads. If both the top end and the lower end are off by about the same factor, then this should be adjusted.

Pressure Calibration Button

This starts the Pressure Calibration Wizard, automatically calculating the values for slope and offset based on the two kPa points you set for reference.

The screenshot displays the 'Model 3100 PC Interface' software window, version 2.0.5. The interface is divided into several sections for configuring the instrument's calibration and operation.

- File Parameters:** Includes a menu bar with 'File' and 'Parameters'.
- Calibration Configurations:**
 - Ludlum Serial Number:** 464564
 - Pressure/Air Flow:** ^3H Calibration
 - Meter Offset:** 0.200 V
 - Board ADC Value:** 2.500 V
 - Board ADC Offset:** 0.010 V
 - Electrometer Offset:** 2.100 V
 - Unit:** $\mu\text{Ci}/\text{m}^3$
 - Alert Set Point:** 2.10
 - Check Source Mode:** Internal
 - Check Source Target Reading:** 60.00
 - Accumulated Pump Time:** 0 hrs.
 - Buttons:** Refresh, Single Point Calibrate Calibration Constants, Electrometer Offset Wizard, Reset Accumulated Pump Time.
- Calibration Constants:**
 - 1 - 100 $\mu\text{Ci}/\text{m}^3$: 1000 Cal
 - 100 - 1,000 $\mu\text{Ci}/\text{m}^3$: 1000 Cal
 - 1,000 - 10,000 $\mu\text{Ci}/\text{m}^3$: 1000 Cal
 - Range Selection:** Auto
- Real Time Control / Raw Data Control:**
 - Units:** Celsius, kPa, L/min, Bat V, DC V
 - Stream speed:** 2 s (Must be set before start)
 - Buttons:** Write Stream Speed, Write Stream To File, Start, Stop.

The status bar at the bottom shows 'Save Complete', the time '11:11 AM', the date '10/30/2018', the version '1.0.6.1', and an 'Update' button.

³H calibration

Meter Offset

This value sets the offset for the meter. It is set in volts.

Board ADC Value

This button reads the value for the board ADC in volts. Please note to read this and properly ground the alarm potentiometer.

Note: The refresh button will quickly read this value when pressed.

Board ADC Offset

This value sets the offset for the board ADC in volts.

Electrometer Offset

This sets the offset for the electrometer ADC in volts.

Range Calibration Constants (X1 - X10K)

These values are the calibration constants for each range of the meter. The value range is 1 to 65535.

Range Selection

This selection manually sets which range the instrument should be in. It will reset to Automatic (0) each time the instrument is turned on and off. The manual range selection is used for calibrating the calibration constants.

Single Point Calibrate Calibration Constants

When pressed, this will bring up another window, which will assist in calibrations that use a single point.

Electrometer Offset Wizard

When pressed, this will bring up another window, which will assist in calibrating the electrometer offset.

Miscellaneous

Unit

This selects the unit for the device:

1. Micro curie per meter cubed
2. Mega becquerel per meter cubed

Alert Set Point

This sets the computer settable alert point for the Model 3100; the unit is the currently selected unit.

Check Source Mode

This sets what check source your instrument expects; it can use either the internal/simulated check source or an external one.

Check Source Target Reading

This sets the target reading for the check source check. The unit is the current one for the instrument.

Accumulated Pump Time

This number is a measurement in hours of how long the pump has been used. This number is accumulated during the life of the pump, and it may help with maintenance or replacement decisions.

Reset Accumulated Pump Time Button

This button will reset the accumulated pump run time to zero in case the pump is replaced.

Real Time Stream

This displays the contents of the screen, such as temperature in Celsius, pressure in Kpa, airflow in L/min, and battery in raw DC voltages.

Write Stream Speed

This value sets the current stream speed the instrument outputs in seconds. This must be set before starting the stream.

Write Stream to File

Checking this will open a new prompt to select a location to save a file of the output data.

Start

This button starts the streaming of data from the instrument to the computer.

Stop

This button stops the streaming of data from the instrument to the computer.

Calibration Constant Calibration Wizard Description

The screenshot shows a software window titled "M3100CalConstCalibrationWizard". The main heading is "Single Point Calibration". Below the heading, it says "Please enter the radiation reference value in μCi ." There is a text input field containing "0" and a "Take Readings" button. Below this is a "Count Time" dropdown menu set to "10 Seconds". A "Reading History" section contains an empty list box. At the bottom, there are fields for "Average Reading" (with a μCi label), "Back Calculated Cal Const", and "Calibration Constant" (with a "0" in a dropdown and an "Update" button). At the very bottom are buttons for "Retake Readings", "Stop", "Reset Radiation", and "Done".

1. Radiation Reference

This is where the user inputs the radiation the device is currently in for calibration.

2. Count Time

This allows you to select the amount of time to take a reading for the next run for the Calibration Constant Calibration Wizard. The longer the time one takes to select, the

more accurate the average will be.

3. Take Readings

Clicking this button will start taking Radiation Readings.

4. Reading History

This is the history for the Radiation Readings for the current run. The newest reading is always added to the top of the list.

5. Percentage Done Progress Bar

This indicates the progress of the current run of the Calibration Constant Calibration Wizard and how far to completion.

6. Average Reading

This displays the current average of the Radiation Readings.

7. Back Calculated Calibration Constant

This is the estimated Calibration Constant to get the Average Reading to match the Radiation Reference value.

8. Calibration Constant

This is the Calibration Constant to send to the device.

9. Update Button

Clicking this button will send the value in the Calibration Constant to the device.

10. Retake Readings

Clicking this button will clear the history of Radiation Readings and start taking the Radiation Readings again.

11. Stop Button

Clicking this button will stop the current run of taking the Radiation Readings.

12. Reset Radiation Button

Clicking this button will allow you to change the Radiation Reference value. Note that this will also force you to retake the Radiation Readings.

13. Done Button

Clicking this button will close the Wizard.

How to Use the Constant Calibration Wizard

1. Input the Radiation Reference value.
1. Select the count time for which to take the Radiation Readings.
2. Click the Taking Readings button to start taking Radiation Readings.
3. Wait for the progress bar to fill, indicating that the counting time has elapsed.
4. If the Average Reading is close to the Radiation Reference value, go to step 8.
5. Copy the Back Calculated Calibration Constant and/or adjust the Calibration Constant as needed – increase the Calibration Constant to increase the average or decrease the Calibration Constant to lower the average.
6. Click the Update button to send the new value to the device.
7. Restart at step 1.
8. Click the Done button to close the Wizard.

How to Stop Taking the Radiation Readings

1. Click either the Take Readings button or the Retake Readings button to start taking Radiation Readings.
2. Before the progress bar has filled, click the Stop button to stop taking readings.

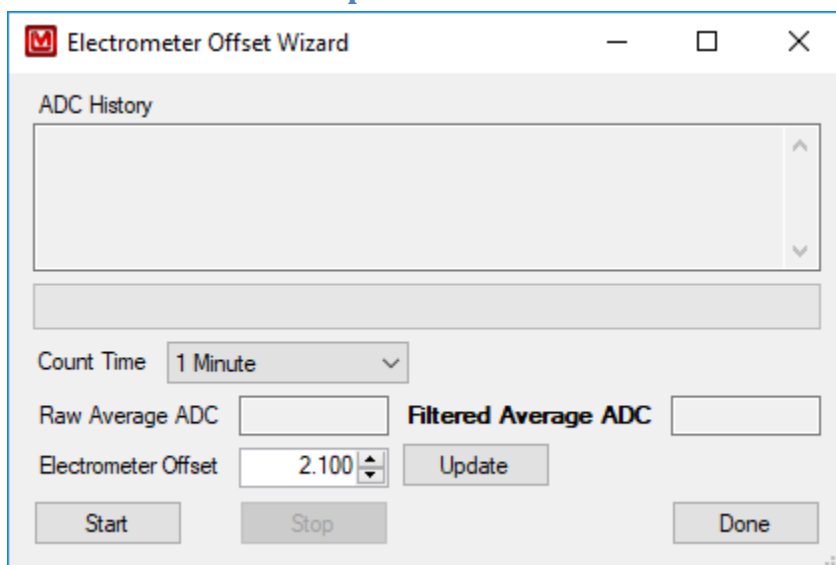
How to Change an Incorrect Radiation Reference Value after Taking the Radiation Readings

1. Click either the Take Readings button or the Retake Readings button to start taking Radiation Readings.
2. After ending the Radiation Readings, either by stopping them or waiting for the Readings to finish being taken, click the Reset Radiation button.

How to Retake the Radiation Readings

1. Click the Take Readings button to start taking Radiation Readings.
2. Before the progress bar has filled, click the Stop button to stop taking readings.
3. Click the Retake Readings button.

Electrometer Offset Wizard Description



1. ADC History

This is the history of all readings for the current run of the Electrometer Offset Wizard. The newest reading is always added to the top of the list.

2. Percentage Done Progress Bar

This indicates the progress of the current run of the Electrometer Offset Wizard and how far to completion.

3. Count Time

This allows the user to select the amount of time to take reading for the next run for the Electrometer Offset Wizard. The longer the time taken in selecting, the more accurate the Filtered Average will be.

4. Raw Average ADC

This displays the current average of the ADC readings.

5. Filtered Average ADC

This displays the current well filtered average of the ADC readings.

6. Electrometer Offset

This is the Electrometer Offset to send to the device.

7. Update Button

Clicking this button will send the value in the Electrometer Offset to the device.

8. Start Button

Clicking this button will start taking the ADC values.

9. Stop Button

Clicking this button will stop the wizard from taking more ADC Readings.

10. Done Button

Clicking this button will close the Wizard.

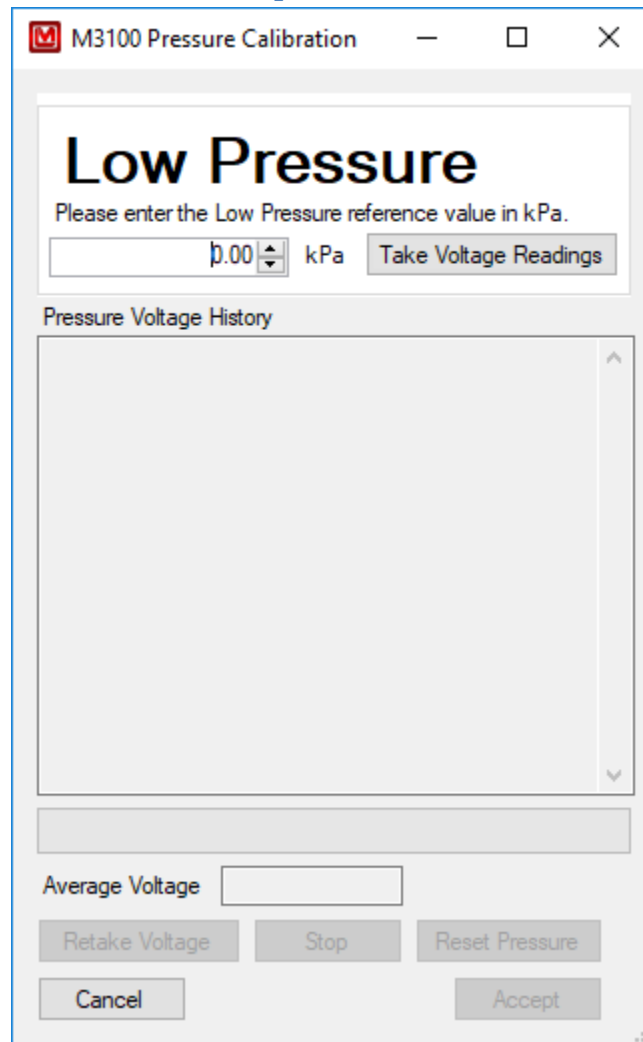
How to Use the Electrometer Offset Wizard

1. Select the count time for which you would take the ADC value.
2. Click the Start button to start taking ADC values.
3. Wait for the progress bar to fill, indicating that the counting time has elapsed.
4. If the Filtered Average ADC is close to zero, go to step 8.
5. Adjust the Electrometer Offset as needed – increase the Electrometer Offset to increase the average or decrease the Electrometer Offset to lower the average.
6. Click the Update button to send the new value to the device.
7. Restart at step 1.
8. Click the Done button to close the Wizard.

How to Stop the Electrometer Offset Wizard While it is Running

1. Click the Start button to start taking ADC values.
2. Before the progress bar has filled, click the Stop button to stop taking readings.

Pressure Calibration Wizard Description



1. Step Description

This shows which Pressure Calibration Window you are currently in.

2. Pressure Reference

This is where you input the pressure the device is currently in for calibration.

3. Take Voltage Readings

Clicking this button will start taking the Voltage Readings.

4. Pressure Voltage History

This is the history for the Voltage Readings for the current run. The newest reading is always added to the top of the list.

5. Percentage Done Progress Bar

This indicates the progress of the current run of the Pressure Calibration Wizard and how long until completion.

6. Average Voltage

This displays the current average of the Voltage readings.

7. Retake Voltage Button

Clicking this button will clear the history of Voltage Readings and start taking the Voltage Readings again.

8. Stop Button

Clicking this button will stop the current run of taking the Voltage Readings.

9. Reset Pressure Button

Clicking this button will allow you to change the Pressure Reference value. Note that this will also force you to retake the Voltage Readings.

10. Cancel Button

Clicking this button will cancel the Pressure Calibration Wizard in its entirety, making no changes to the Pressure Calibration Slope and Pressure Calibration Offset fields as a result.

11. Accept Button

Clicking this button will either continue to the High Pressure Window (if you are in the Low Pressure Window) or calculate the Pressure Calibration Slope and Pressure Calibration Offset and close the High Pressure Window.

How to Use the Pressure Calibration Wizard

1. Input the Low Pressure reference value.
2. Click the Take Voltage Readings button.
3. Wait for the progress bar to fill, indicating that all of the Voltage Readings have been gathered.
4. Click the Accept button.
5. The Low Pressure Window will now close, and the High Pressure Window will open.
6. Input the High Pressure reference value.
7. Click the Take Voltage Readings button.
8. Wait for the progress bar to fill, indicating that all of the Voltage Readings have been gathered.
9. Click the Accept button.
10. The new values will be placed into the Pressure Calibration Slope and Pressure Calibration Offset fields. Remember to click the Update button to send these new values to the device.

How to Stop Taking the Voltage Readings

1. Click either the Take Voltage Readings button or the Retake Voltage button to start taking Voltage Readings.
2. Before the progress bar has filled, click the Stop button to stop taking readings.

How to Change an Incorrect Pressure Reference Value after Taking the Pressure Voltage Readings

1. Click either the Take Voltage Readings button or the Retake Voltage button to start taking Voltage Readings.
2. After ending the Voltage Readings, either by stopping them or waiting for the Readings to finish being taken, click the Reset Pressure button.

How to Retake the Voltage Readings

1. Click the Take Voltage Readings button to start taking Voltage Readings.
2. Before the progress bar has filled, click the Stop button to stop taking readings.
3. Click the Retake Voltage button.

Troubleshooting

Missing .Net (DotNet) Framework

DotNet Framework comes with most standard Windows desktops. However, if for some reason while installing or after installation you are still missing the .Net Framework, please go to the MSDN (Microsoft Developer Network) website and download 4.5 Framework for your machine.

No Devices Showing Up

1. Check to make sure everything is properly connected.
2. Make sure FTDI drives included on the CD are downloaded and installed properly.
3. If the drivers are correctly downloaded, check to see if Microsoft Windows is still installing the drivers for the instrument. This may take a few moments. (If you have multiple new instruments on a daily basis, FAQ question, "Calibration on different devices," may speed this up.)
4. Make sure the instrument is on, and if it is, try turning it off and then on again.
5. Change cable.
6. Check dongle. Sometimes while installing the driver, you may run into an issue, i.e. power shuts off, instrument unplugged, Windows update, etc. This may cause your driver to become corrupt, and the instrument will no longer show in the software. To check for this issue, follow these steps.

If none of the above solves your issue, please feel free to call Ludlum Measurements.

Calibration on Different Devices – first plug in

If your computer is running Windows 7 or higher, when a new device is connected to your computer, Windows may spend up to 15 minutes searching for the drivers through Windows Update. This is unnecessary and time consuming if you are plugging in different new instruments. In order to avoid this, you need to change some system settings on handling drivers:

Windows 7

- Click Start, right-click Computer, and choose Properties.
- In the Tasks list, click Advanced System Settings.
- On the System Properties dialog box, click the Hardware tab, and then click Windows Update Driver Settings.
- Finally, select "only if not found on local machine."

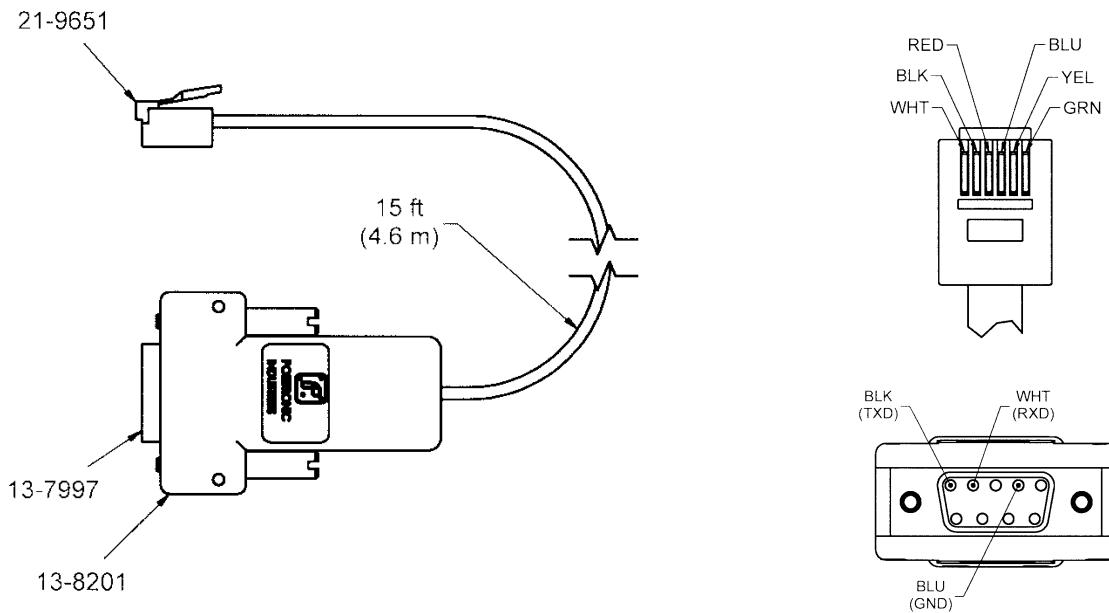
Windows 8 and 10

For Windows 8 (and higher), you only get the choice of using Windows Update always or never.

- Search for "Change device install" in the Windows 8 Start menu and select "change device installation settings."
- In answer to the question "do you want Windows to download driver software," choose "no, let me choose what to do," and then select "never" and save changes.

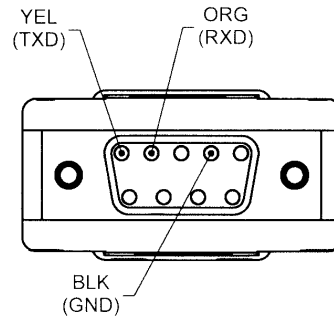
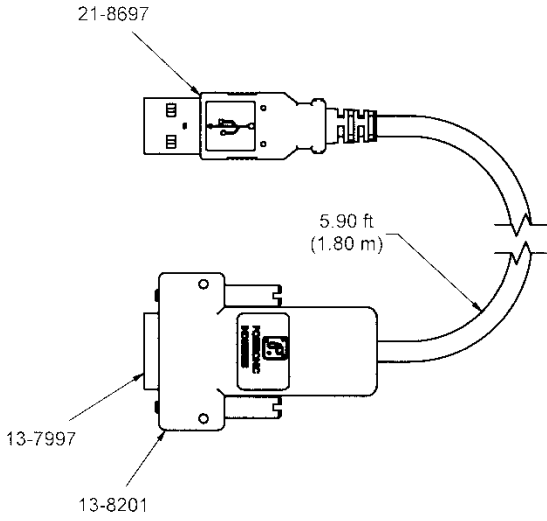
Cables

LMI wiring on the Model 3100 9-pin D connector has the two required relay connections - one for sampling and one for alarm – which makes it non-standard, so when Ludlum Measurements supplies a software kit, it has an adapter cable (LMI part # 8303-1038). This cable can be used in conjunction with cables a user already has. Cable 8303-1038 has a phone connector at one end and a 9-pin D connector at the other end. At the computer, this adapter can connect the Model 3100 directly to a USB adapter. If the user has a long cable stretching over to a gamma calibration range, an easily obtained RJ12 phone coupler may be needed to join the two cables (shown below, left).



In the above, top-right figure, the phone plug is shown up close. The lower-right figure above is the 9-pin D connector portion of the cable depicted up close.

Ludlum Measurements also makes a one-piece cable that goes directly from a USB connection (from a PC) to a 9-pin D connector (Model 3100), skipping the phone coupler. LMI can supply this cable as needed. The part # for this cable is 8520-159. Again, this cable is custom made because of the non-standard wiring on the 9-pin D connector. See the following figures.



The left figure shows the RS-232 to USB cable for direct connection to a PC. The above figure depicts the 9-pin D connector portion of the cable up close.