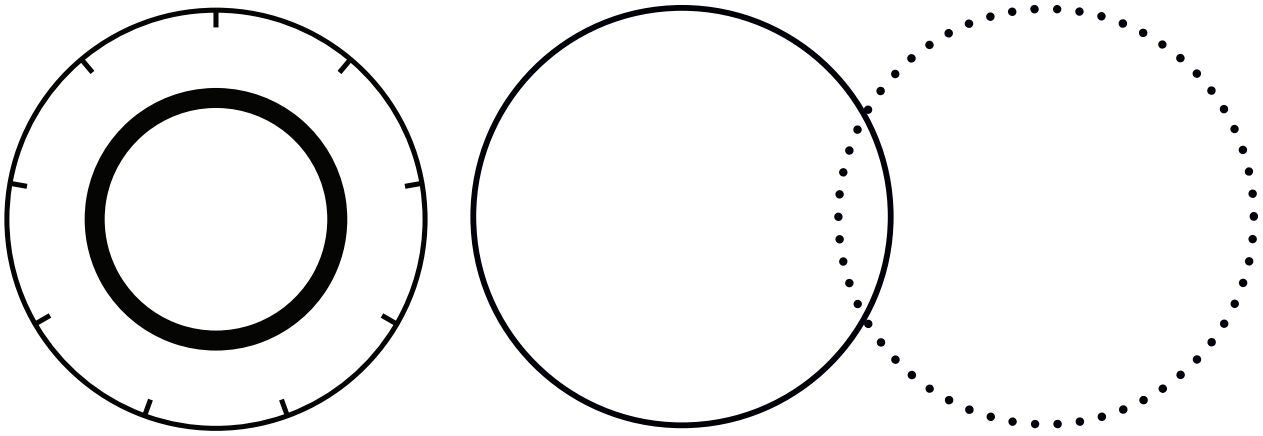
Coherent Meter Connection

User Manual



INNOVATIONS THAT RESONATE

COHERENT

User Manual
Coherent Meter Connection

COHERENT

Coherent Corp.
26750 SW 95th Ave.
Wilsonville, OR 97070
USA

Technical Support

In the U.S.:

Should you experience any difficulties with your laser or need any technical information, please go to our web site www.Coherent.com. Should you need further assistance, please contact Coherent Technical Support by e-mail customer.support@coherent.com or telephone, +1-734-456-3100. Please be prepared to supply the model and laser head serial number of your laser system, the description of the problem, and any attempted corrective steps to the Product Support Engineer responding to your request.

Telephone coverage is available Monday through Friday (except U.S. holidays and company shutdowns). Inquiries received outside of normal office hours will be captured by our automatic answering system and will be quickly returned the next business day.

Outside the U.S.:

If you are located outside the U.S., please visit www.Coherent.com for technical assistance, or contact your local Service Representative. Service Representative telephone numbers and addresses can be found on the Coherent web site.

Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that can occur at the same time with such services. Under no conditions do these support services affect the terms of any warranty agreement between Coherent and the buyer. Operation of any Coherent laser with any of its interlocks defeated is always at the operator's own risk.

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1 Introduction

1.1 Signal Words and Symbols in this Manual

This documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and ISO 7010.

1.1.1 Signal Words

Four signal words are used in this documentation: **DANGER**, **WARNING**, **CAUTION** and ***NOTICE***.

The signal words **DANGER**, **WARNING** and **CAUTION** designate the degree or level of hazard when there is the risk of injury:

DANGER!
Indicates a hazardous situation that, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.

WARNING!
Indicates a hazardous situation that, if not avoided, can result in death or serious injury.

CAUTION!
Indicates a hazardous situation that, if not avoided, can result in minor or moderate injury.

The signal word '***NOTICE***' is used when there is the risk of property damage:

NOTICE
Indicates information considered important, but not hazard- related.

Messages relating to hazards that can result in both personal injury and property damage are considered safety messages and not property damage messages.

1.1.2 Symbols

The signal words **DANGER**, **WARNING**, and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level:

This symbol is intended to alert the operator to the presence of additional information.

This symbol is intended to alert the operator to the presence of important operating and maintenance instructions.

This symbol is intended to alert the operator to the danger of exposure to hazardous visible and invisible laser radiation.

This symbol is intended to alert the operator to the presence of dangerous voltages within the product enclosure that may be of sufficient magnitude to constitute a risk of electric shock.

This symbol is intended to alert the operator to the danger of Electro-Static Discharge (ESD) susceptibility.

1.2 Preface

This manual contains user information for the LabMax Pro SIMM.

NOTICE

Read this manual carefully before operating the laser for the first time. Failure to follow the instructions and safety precautions in this manual can result in serious injury or death. Special attention must be given to the material in ’Safety and Compliance’ (p. 173), that shows the safety features built into the laser. Keep this manual with the product and in a safe location for future reference.

DANGER!

Use of controls or adjustments or performance of procedures other than those specified herein may result in hazardous radiation exposure.

1.3 Export Control Laws Compliance

It is the policy of Coherent to comply strictly with U.S. export control laws.

Export and re-export of lasers manufactured by Coherent are subject to U.S. Export Administration Regulations, which are administered by the Commerce Department. In addition, shipments of certain components are regulated by the State Department under the International Traffic in Arms Regulations.

The applicable restrictions vary depending on the specific product involved and its destination. In some cases, U.S. law requires that U.S. Government approval be obtained prior to resale, export or re-export of certain articles. When there is uncertainty about the obligations imposed by U.S. law, clarification must be obtained from Coherent or an appropriate U.S. Government agency.

Products manufactured in the European Union, Singapore, Malaysia, Thailand: These commodities, technology, or software are subject to local export regulations and local laws. Diversion contrary to local law is prohibited. The use, sale, re-export, or re-transfer directly or indirectly in any prohibited activities are strictly prohibited.

2 Description and Specifications

This section introduces the Coherent Meter Connection (CMC) software.

- For information about the features and functions of the Coherent Meter Connection software, see 'User Interface – Main Controls' (p. 21).
- For information about taking measurements using Coherent meters and sensors, see 'Measurement Modes' (p. 141).

2.1 Product Features

The Coherent Meter Connection software offers an easy-to use Windows-based interface to perform a wide range of analysis functions for instrument control and measurement. This includes:

- High-speed sampling modes up to 1 MHz
- Trending with Time and Power cursors
- Energy integration
- Tuning
- Data logging
- Statistics
- Histogram

2.1.1 Supported Products

The Coherent Meter Connection software supports Coherent sensors and meters, shown in Figure 2-1.

These devices offer a wide range of analytical functions, although some software functions may be limited by the capability of the sensor. Supported devices include:

- PowerMax®-Pro USB/RS power sensors
- PowerMax USB/RS power sensors

Figure 2-1. Products Supported

- EnergyMax USB/RS energy sensors
- LabMax-Pro SSIM Laser Power and Energy Meter
- LabMax Touch and Touch Meter Pro Laser Power and Energy Meters

Shop.coherent is the official e-commerce website for lasers, energy meters and sensors, fiber optics, and accessories. Available for US customers, the e-commerce service offers product search, product-specific filtering, and fast-and-easy checkout with prompt order and shipping confirmations.

2.1.2 System Requirements

It is recommended to use the most current and robust systems possible. Support is provided for the following operating system:

- Windows v10 (32- and 64-bit)

In addition, the workstation must meet the following minimum requirements:

- 4 GB of RAM
- 100 MB of available hard disk space

- 2.5 GHz or faster processor
- USB 2.0 high-speed port
- 1024x768 screen resolution
- Microsoft .NET Framework 4.0 or higher. If no version (or an older version) is found on the workstation, then the installation program installs a version of Microsoft .NET Framework.

3 Installation

This section shows how to install the software application.

- For information about the features and functions of the Coherent Meter Connection software, see 'User Interface – Main Controls' (p. 21).
- For information about taking measurements using Coherent meters and sensors, see 'Measurement Modes' (p. 141).

3.1 Before Work is Begun

3.1.1 Administrative Privileges

In today's world, it is a challenge for organizations to find a balance between implementing security requirements and managing the user experience.

Security processes and controls required to comply with industry-accepted standards, regulations, and certifications can impose constraints on user authentication and access. Such controls may block a software installation, making it appear as incomplete or non functional.

If there are difficulties with the BeamView.NET software installation, ***before* you call Coherent Technical Support,** check with your IT group first to determine if:

- The user has the administrative privileges required to install a new program.
- There are any internal security policies or controls in place that may render installation of a new software package incomplete.

Another option is to right-click in Windows and select 'Run as administrator'. For any executable (.exe) files, Coherent recommends to use this method for installation.

After those issues are resolved, then see 'Maintenance and Support' (p. 197) for details about how to contact Coherent for assistance.

3.2 Installation Instructions

Before installation is started, remember to save any data and close all other applications. The installation requires that you restart the workstation when installation is complete.

To install the software:

1. Download the software from the Coherent website:

   https://www.coherent.com/resources

NOTICE

The Coherent Meter Connection software is available in English only.

2. Run the set-up file, where the last two digits represent the current software build:

   `Coherent Meter Connection v1.2.x.x Release Setup.exe`

A Welcome screen like the one shown in Figure 3-1 is displayed for the installation. If there is a previous version of the software installed,

Figure 3-1. Welcome Screen

the message shown in Figure 3-2 displays. Click Yes to proceed and dismiss the dialog box.

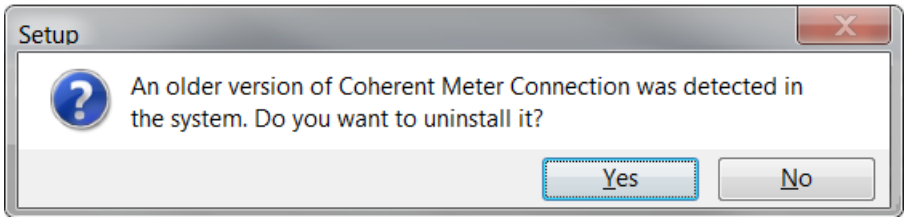

Figure 3-2. Uninstall Old Version of Software

3. Read the instructions, and then click Next. The general License Agreement for the software, shown in Figure 3-3, displays.

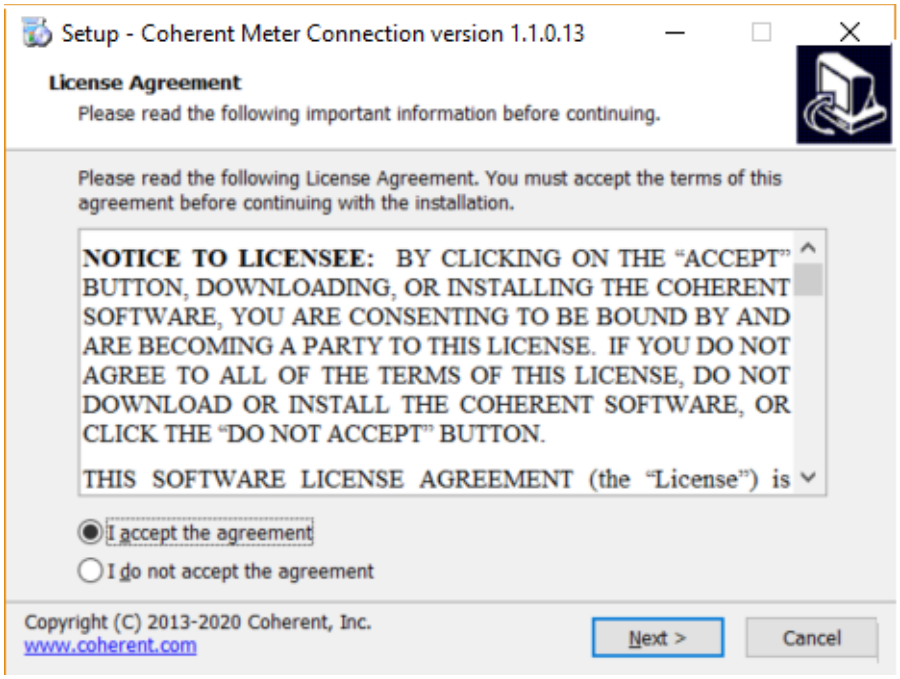

Figure 3-3. License Agreement

4. Scroll down to read the general software agreement. Note that the Next button is shown in gray until you click the radio button to **Accept** the terms and conditions. The Next button is then active; click Next to proceed.

5. A window like the one shown in Figure 3-4 displays. Accept the selection for the destination location or browse to select a directory on the workstation where you want to install the software, and click Next.

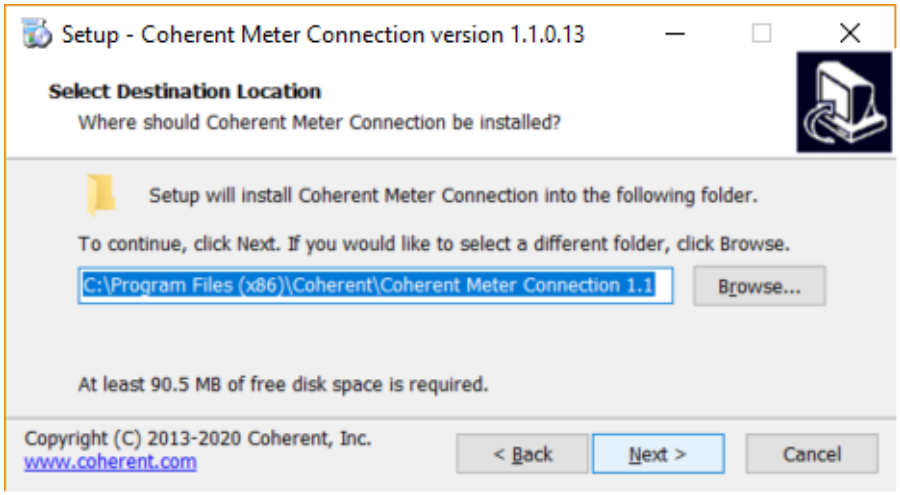

Figure 3-4. Select Directory to Install Software

6. Select a directory on the workstation for the Start Menu where the program is to be installed, as shown in Figure 3-5. Accept the selection or browse to a different location, and then click Next.

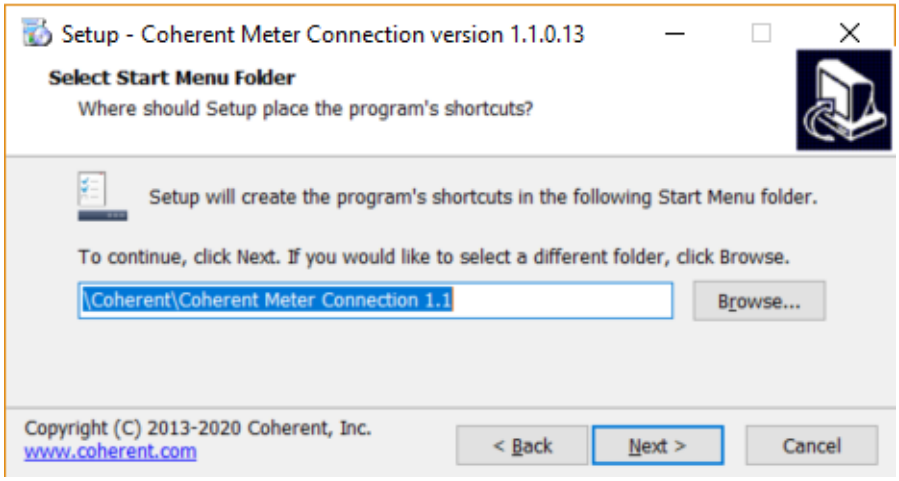

Figure 3-5. Select Start Menu Folder

7. To create an icon for a shortcut to the application on the desktop, click the check box, as shown in Figure 3-6, and then click Next.

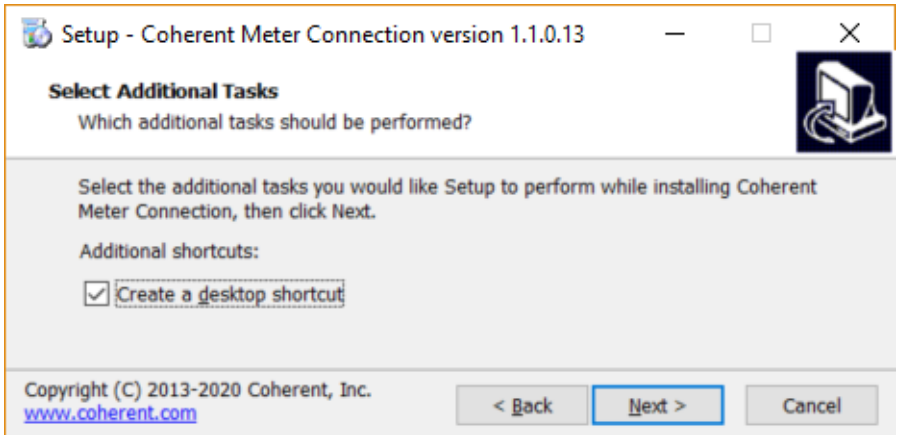

Figure 3-6. Create Desktop Icon

The Set-up Wizard is now ready to begin installation of the Coherent Meter Connection software on the workstation. Review the settings, as shown in Figure 3-7, and then click Install.

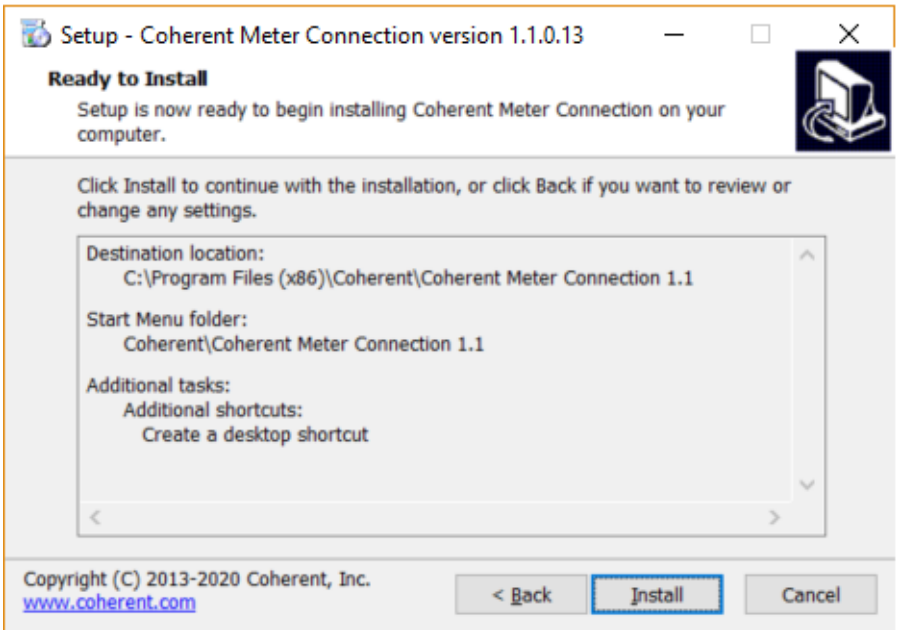

Figure 3-7. Review Set-Up before Installation Begins

On initial set-up, a message similar to the one shown in Figure 3-8 displays.

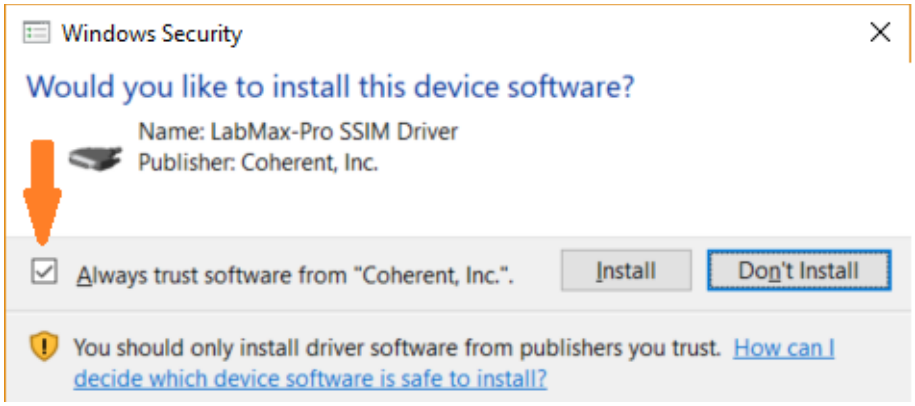

Figure 3-8. Install Coherent Device Drivers

8. Click the check box to 'Always trust software from 'Coherent, Corp.' and click Install. Device drivers included with the Coherent Meter Connection software are added to the installation.

   NOTE: On later installations of the software, the dialog box about device drivers is not displayed.

   A progress bar displays as files are extracted, as shown in Figure 3-9.

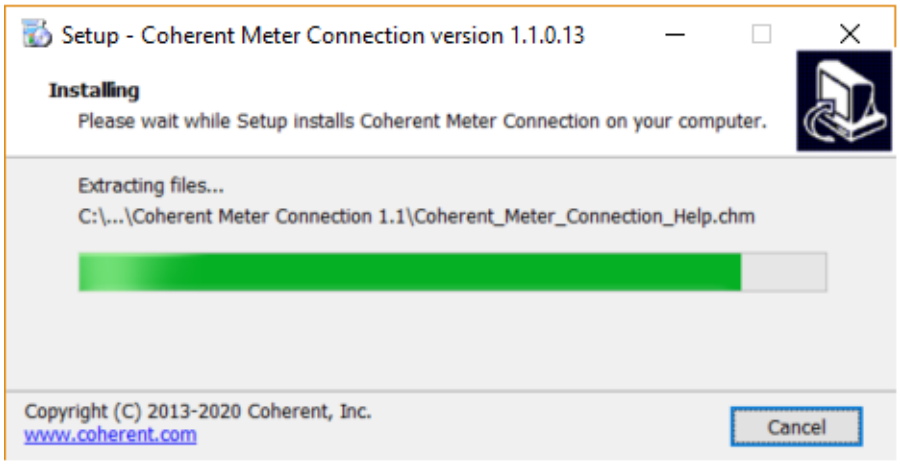

Figure 3-9. Progress of Installation

9. After all files are extracted, the screen shown in Figure 3-10 is displayed. Click Finish, to close the installation window.

Figure 3-10. Finish Software Installation

The Coherent Meter Connection software is now installed and the software is ready to be launched.

If you selected a short-cut (icon) to be set up during installation, it is now displayed on the workstation desktop, as shown in Figure 3-11:

Figure 3-11. Desktop Icon for Coherent Meter Connection

10. Double-click the icon to launch the Coherent Meter Connection software. A splash screen displays, like the one shown in Figure 3-12:

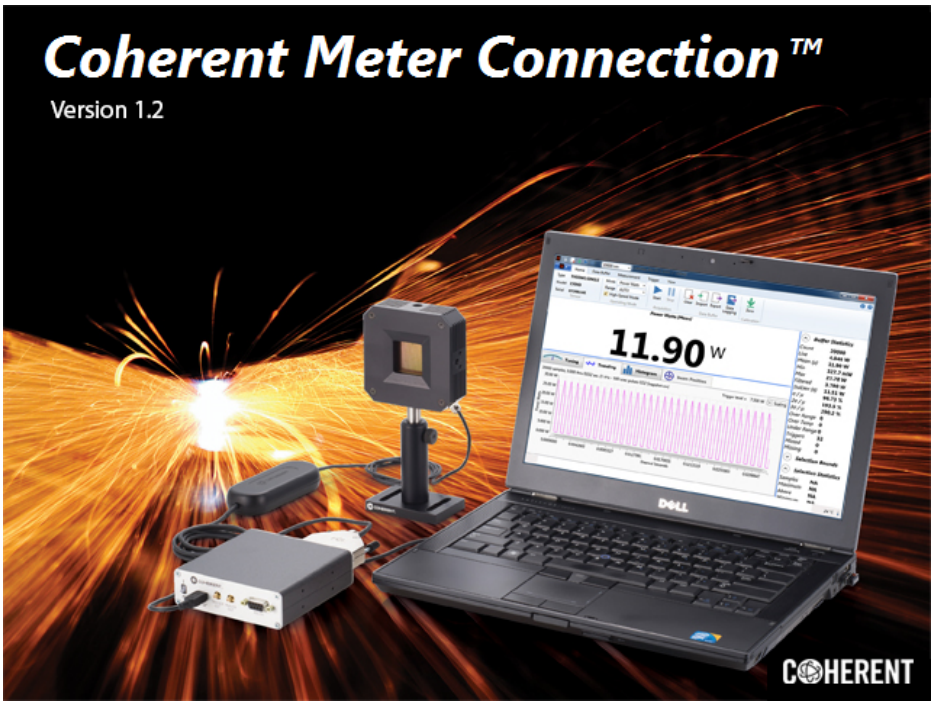

Figure 3-12. Splash Screen on Launch

3.3 Next Steps

Now that the software is installed:

- Connect the equipment.
- Go to ’User Interface – Main Controls’ (p. 21) to learn about the features and functions of the user interface.

3.3.1 Connect the Equipment

The Coherent sensor must be connected to a workstation or directly to a meter.

3.3.1.1 Connect Coherent Connection Meterless USB or RS Sensor to Workstation

To attach a sensor to a meterless USB or RS sensor, do the following:

1. Connect the Coherent sensor to a USB 2.0 port on a workstation. When using a Coherent RS-232 meterless sensor, connect the RS-232 cable directly to its corresponding serial port on a PC.
2. A power supply is required when an RS-232 meterless sensor is used. A power supply is optional for a USB sensor. Connect the cables and plug the power supply into an outlet.
3. Start the Coherent Meter Connection software, and then select the COM port for the sensor.

Figure 3-13. Sensor Installation

3.3.1.2 Connect Coherent Sensor with DB-25 Connector to a LabMax Meter

To attach a sensor to a LabMax Pro SIMM or LabMax Touch Meter, do the following:

1. Attach a Coherent sensor with a DB-25 connector to the LabMax-Pro SIMM or LabMax Touch/Touch Pro meter.
2. Attach the meter to a workstation with a USB 2.0 cable.

3. If the meter supports ethernet (LabMax Touch) and ethernet connection is to be used, do the following:

   a.) Attach the ethernet cable to the ethernet port on the PC. Refer to Figure 3-14.

   b.) Attach the other end of the ethernet cable to the ethernet port on the meter.

4. To complete ethernet setup, refer to the LabMax Touch Meter Operator's Manual. Connect the power supply to the LabMax-Pro SIMM or LabMax Touch/Touch Pro meter.

5. Set the power on the meter to ON. Start the Coherent Meter Connection software, and select the COM port for the LabMax-Pro meter.

Figure 3-14. Connect a LabMax Touch Meter to a PC with USB

Refer to the figures below for examples of setup for the LabMax Pro SIMM and for the LabMax Touch/Touch Pro meters.

Figure 3-15. Connect a LabMax Pro SIMM Meter

Figure 3-16. Connect a LabMax Touch Meter to a Sensor

4 User Interface – Main Controls

This section introduces the Coherent Meter Connection software, an easy-to-use interface that runs on a workstation. (*Note:* Workstation is the term used throughout this manual to refer to either a personal computer (PC) or a laptop computer.)

The components of the Main Window of the user interface include:

- 'Quick Start Icons' (p. 23)
- 'Drop-Down Menu' (p. 25)

For more details about the user interface, see:

- Tabs and toolbars across the top of the Main Window (p. 39)
- Viewing panels in the window (p. 77)
- Statistics Panel (p. 125)
- Tutorials about options to take measurements (p. 141)

4.1 Main Window

When you first launch Coherent Meter Connection, the splash screen is briefly displayed, then Main window is displays (shown in the example in Figure 4-1).

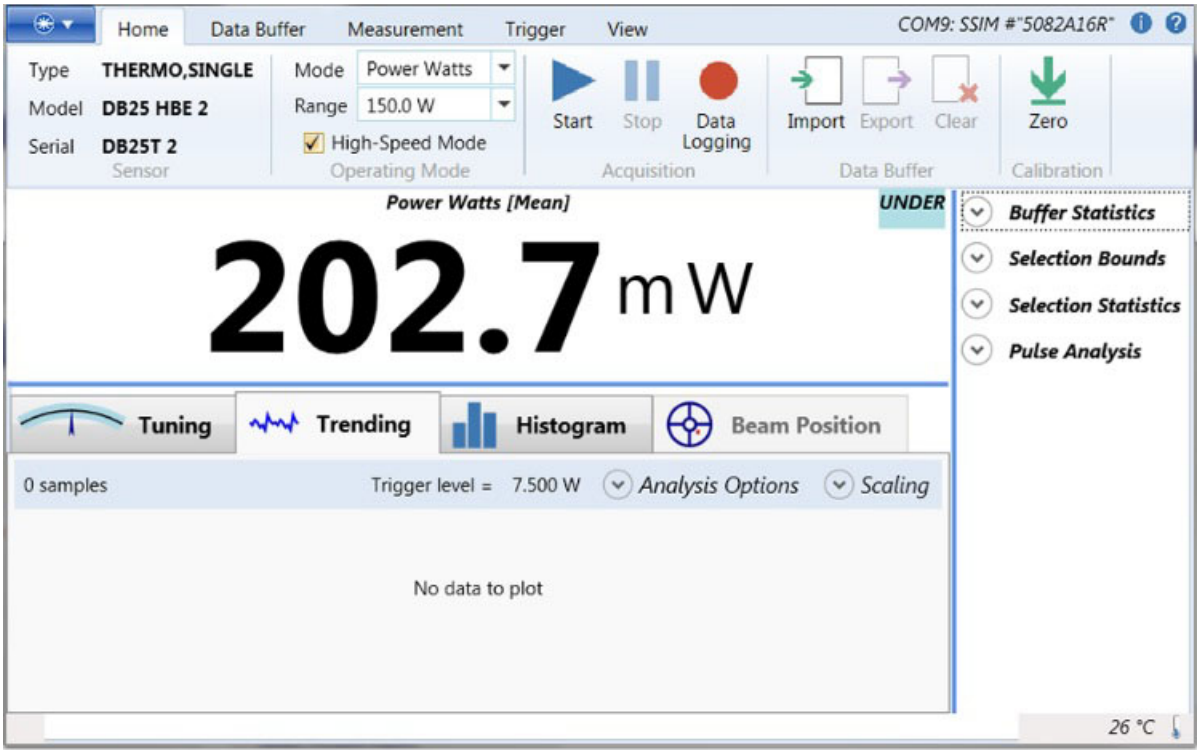

Figure 4-1. Coherent Meter Connection—First Window

The main window of the software displays quick start icons and information across the top of the window, plus a main drop-down menu. The tabbed areas in the tool bar and tabbed windows below the Graphics Panel display controls that are readily available.

4.1.1 Quick Start Icons

Figure 4-2 shows the row of quick start icons at the top of the Window. These icons are similar to commands in the drop-down menu or in the tool bars.

Figure 4-2. Coherent Meter Connection—Quick Start Icons

Table 4-1 shows these icons and a brief description of each. The description also lists any alternate locations in the software for the same command.

Table 4-1. Quick Start Icons

Icon	Description	Same function as…
	Access to Windows system menu	Includes standard Windows actions: Restore, Move, Size, Minimize, Maximize, and Close.
	Opens a COM port connection to the meter	Drop-down menu > Open Meter command.
	Clear the contents of the Capture Buffer	Drop-down menu > Meter Operation > Clear Buffer command. Also on the Home Tab > Clear icon.
	Measure the sensor's zero baseline	Drop-down menu > Meter Operation > Zero Meter command. Also on the Home Tab > Zero icon.
	Start streaming measurements	Drop-down menu > Meter Operation > Start Measurements command. Also on the Home Tab > Start icon.
	Stop streaming measurements	Drop-down menu > Meter Operation > Stop Measurements command. Also on the Home Tab > Stop icon.

4.1.2 Top of the Window

Figure 4-3 shows data displayed across the top of the window:

Figure 4-3. Data at Top of Main Window

Table 4-2 shows each item displayed, with a brief description of the data:

Table 4-2. Data Across Top of Window

Option	Example in Figure 4-3	Description
Wavelength	400 nm	Drop-down menu that displays the current wavelength
Software	Coherent Meter Connection v1.2.x.x	Lists the current version of the software and the build number, where the last two digits represent the current build
Sensor	DB25 HBE 2	Identifies the type of sensor attached to the meter
COM Port	COM4: SSIM # “0639B14R”	(Displayed under the top line) Identifies the COM port as well as the meter and serial number

The drop-down menu at the very top of the window displays the available wavelengths, as shown in the example in Figure 4-4.

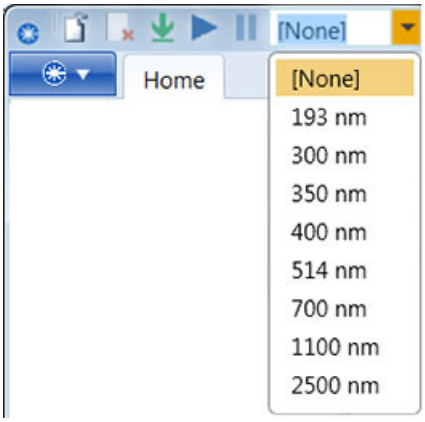

Figure 4-4. Quick Start —Laser Wavelength

If the wavelength for the laser being used is not visible, enter it in the list by either typing it directly or editing the Wavelength Table (see p. 57). The wavelength point you enter must be inside the normal range of operation for the sensor.

4.1.3 Drop-Down Menu

The drop-down menu in Figure 4-5 manages standard functions for the software.

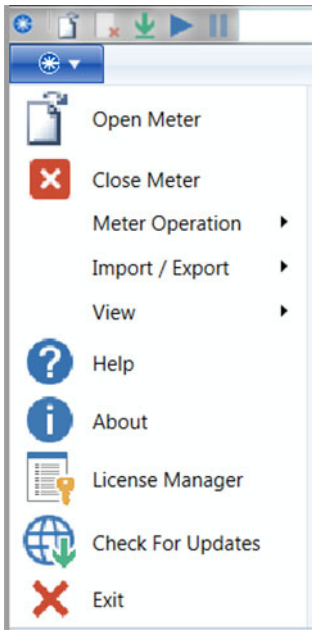

Figure 4-5. Coherent Meter Connection—Drop-Down Menu

The drop-down menu includes a variety of functions and settings:

- Open Meter
- Close Meter
- Meter Operation
  (Start | Stop | Clear | Zero)
- Import/Export
  (Settings | Import | Export | Reports | Data Logging)
- View
  (Error Log | Limits & Alarm | Pulse Analysis Wavelength Table)
- Help
- About

- License Manager (Add | Manage Certificates)
- Check for Updates
- Exit

Each of these functions are shown in the sections that follow.

4.1.4 Open Meter

Selecting the Open Meter icon from the drop-down menu displays a dialog box, like the one shown in Figure 4-6:

Figure 4-6. Drop-Down Menu—Open Meter

From the drop-down menu, select the appropriate communications port for the meter, as shown in the example in Figure 4-7:

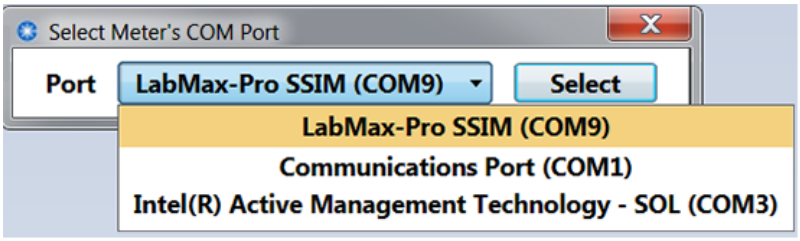

Figure 4-7. Drop-Down Menu—Open Meter Selections

4.1.5 Close Meter

Selecting the Close Meter icon from the drop-down menu closes the meter. The software is still active.

To continue taking measurements, you must first select a meter using the Open Meter command.

4.1.6 Meter Operation

Selecting the Meter Operation option from the drop-down menu displays the options shown in Figure 4-8:

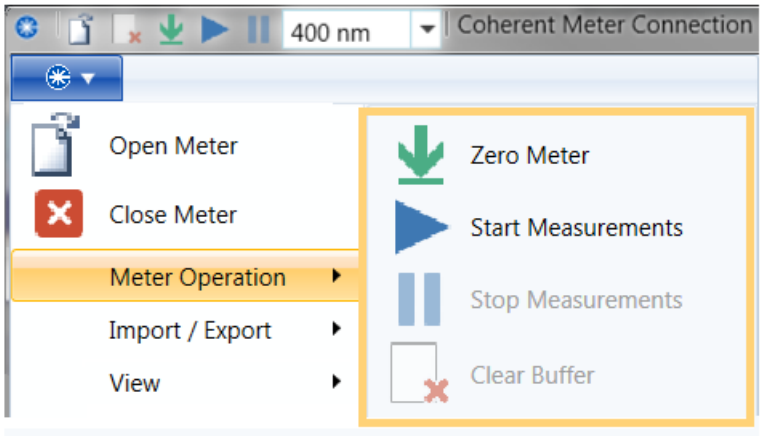

Figure 4-8. Drop-Down Menu—Meter Operation

Table 4-3 briefly shows each option:

Table 4-3. Meter Operation Commands

command	Description
Zero Meter	Zero the meter. This is done by reading measurements to establish a baseline (zero level) for all ranges. To ensure a valid calibration, cover the sensor during this operation.
Start Measure-ments	Begins sending measurement data from the meter, using the current settings. Most operating controls are disabled while acquisition is in progress. Data is saved and displayed in the user interface.
Stop Measure-ments	Stop the meter from sending measurement data. Data that has been collected may be viewed in the user inter-face.
Clear Buffer	Clears all data in the Capture buffer.

Selecting the Zero Meter command displays the dialog box shown in Figure 4-9:

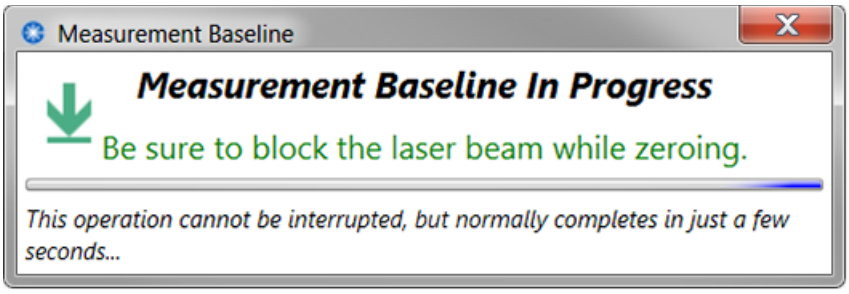

Figure 4-9. Drop-Down Menu—Zero Meter

This command automatically calibrates all ranges for the current sensor.

Changing sensors, changing modes, and switching between High-Speed and Standard Speed all require zeroing the instrument. Selecting Zero Meter zeros both channels in a single operation if the sensor supports both High-Speed and Standard Speed.

4.1.7 Import-Export

Selecting the Import-Export option from the drop-down menu displays the commands shown in Figure 4-10:

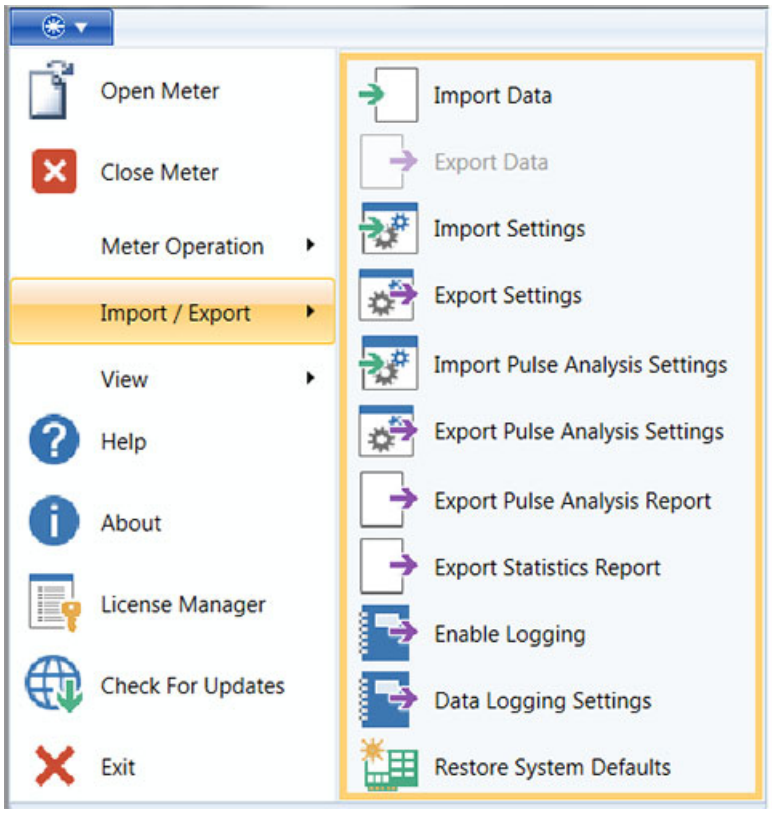

Figure 4-10. Drop-Down Menu—Import/Export Selections

The Import/Export options allow you to manage files and settings, as well as enable logging and restore system defaults. When you import or export, the standard desktop window is displayed. Browse to the location you want to use.

Table 4-4 shows the Import/Export icons and a brief description of each.

Table 4-4. Import-Export Commands

Command	Description
Import Data	Import captured data to the Acquisition Buffer from an external file. You will be prompted to specify a source file name using one of these formats: .csv, .tsv or .txt.
Export Data	Exports (saves) all captured data in the Acquisition Buffer to an external file. You are prompted to specify a destination file name using one of these formats: .csv, .tsv or .txt.
Import Settings	Allows a user to load parameters that were previously saved (exported) to an external file.
Export Settings	Allows the user to adjust parameters and save for future use. Saves the settings to an external file using one of these formats: .csv, .tsv or .txt.
Import Pulse Analysis Settings	Loads applications settings for Pulse Analysis that were previously saved (exported) to an external file.
Export Pulse Analysis Settings	Saves the application settings for Pulse Analysis to an external file.
Export Pulse Analysis Report	Saves the application settings for Pulse Analysis to an external file.
Export Statistics Report	Saves the application settings for Statistics to an external file.
Enable Logging	Toggles the Data Logging feature. Displays whether the feature is enabled.
Data Logging Settings	Launches the Data Logging dialog box. For details, see p. 44.
Restore System Defaults	Resets all internal settings to factory default.

4.1.8 View Command

Selecting the View option from the drop-down menu displays the options shown in Figure 4-11:

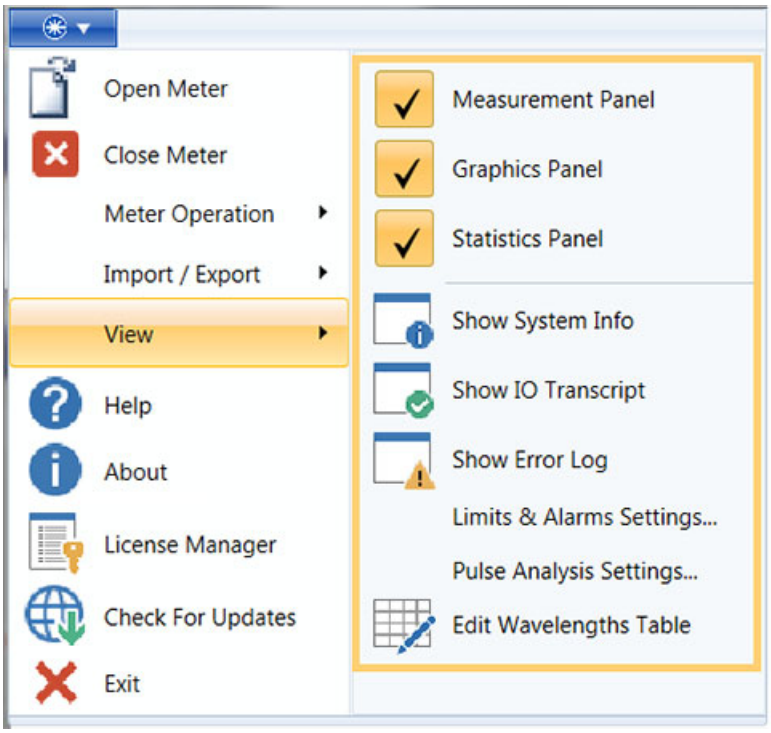

Figure 4-11. Drop-Down Menu—View Selections

The check boxes for panels at the top of the View menu allow you to display or hide the various areas in the window. These check boxes are also listed under the View tab (in the Visible Panels section of the toolbar).

The menu options for System Information, I/O Transcript, and Error Messages are also available under the View menu (Visible Windows section of the toolbar).

For more details about these options, see ’User Interface – Tabs’ (p. 39).

- For Limits & Alarm Settings, see ’Limits & Alarms Settings…’ (p. 32).
- For Pulse Analysis Settings, see ’Analysis Options’ (p. 99).
- To change the Wavelengths Table, see ’Edit Wavelength Table’ (p. 57).

Table 4-5 lists the icons and a brief description of each under the View command.

Table 4-5. View Commands

Command	Description
Measurement Panel	Check boxes open or close the three primary panels in the user interface. Only one out of any of the three panels must be displayed; any of the two other panels may be hidden at the same time.
Graphics Panel	
Statistics Panel	
Show System Info	Displays a window that lists details about the system set-up for the meter and the attached sensor. This is useful when contacting Coherent Product Support.
Show IO Transcript	Displays a window showing the traffic between the meter and the PC application.
Show Error Log	Displays a window showing all error messages received so far in the current session. This window pops up automatically if an error is reported.
Limits & Alarms Settings…	Displays a dialog box to set notifications for values when taking power measurements (see p. 32). Note that Maximum values are not enforced.
Pulse Analysis Settings…	Displays a window to edit the entries of the pulse analysis settings.
Edit Wavelengths Table	Displays the Wavelength Table to edit the entries of the wavelength compensation table.

4.1.8.1 Limits & Alarms Settings...

Particularly when working with sensitive equipment, the Limits & Alarm settings help users track measurements and make sure sample is inside the operating range.

The Limits & Alarm License generates fault actions if the power or energy output goes outside a set limit (choose to display reverse color on-screen, stop data collection, and/or sound an audible alarm).

Selecting **Limits & Alarm Settings** from the View command in the main drop-down menu first displays a notice. This dialog box allows you to alarms to notify you when minimum and maximum limits are reached. Note that Maximum values are not enforced.

The Limits & Alarms dialog box is shown in Figure 4-12:

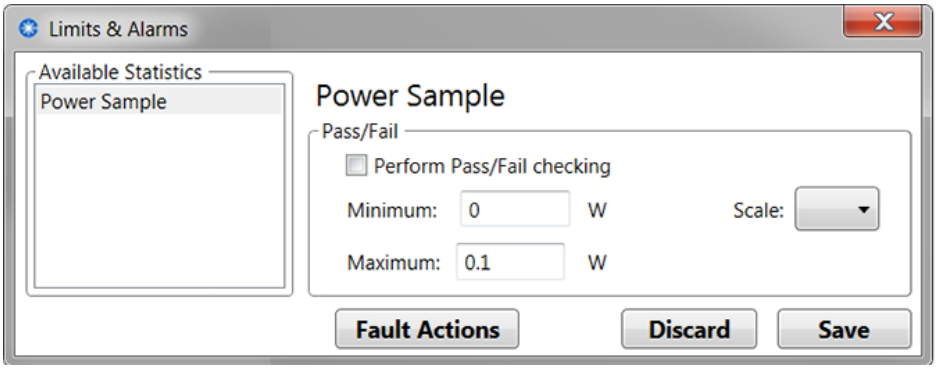

Figure 4-12. Limits & Alarms – Dialog Box

The Available Statistics area lists the measurement being taken (Power or Energy).

Click the check box for “Perform Pass/Fail checking” to enable Limits & Alarms. Any minimum and maximum values that you set are not used in any measurement sample until you click this check box.

You can change and set both the Minimum and Maximum values. The values you enter must be a positive number.

If you enter a negative number or values that exceed minimum levels for the device, an error message is displayed until you correct the setting. The Save button is disabled if an invalid value is entered.

Maximum thresholds are not enforced.

- In some cases, sensors can take higher power levels in excess of the maximum rating for short periods of time; however, the longer the exposure, the lower the level needs to be. (See the Coherent Laser Measurement and Control product catalog, which shows a chart of ‘exposure limits vs. power’ for various lasers.)

- In other cases, optional gain settings may be applied to measurements to cause a meter to report a higher power exposure.

Select the **scale** for these values from the drop-down menu in the dialog box, as shown in Figure 4-13:

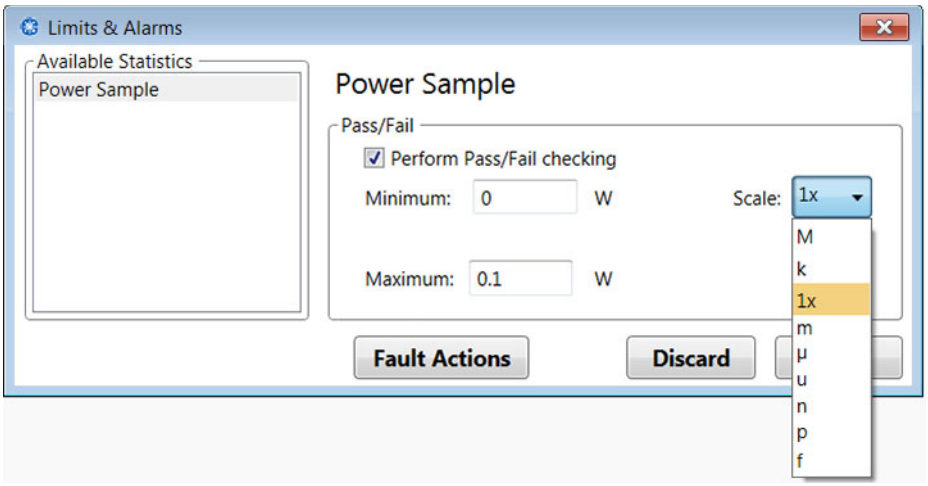

Figure 4-13. Limits & Alarms – Scale

Clicking Fault Actions displays the pop-up dialog box shown in Figure 4-14. Select any or all of these types of notification that you want to receive when limits are exceeded:

- Stop Acquisition
- Beep
- Reverse Background Color

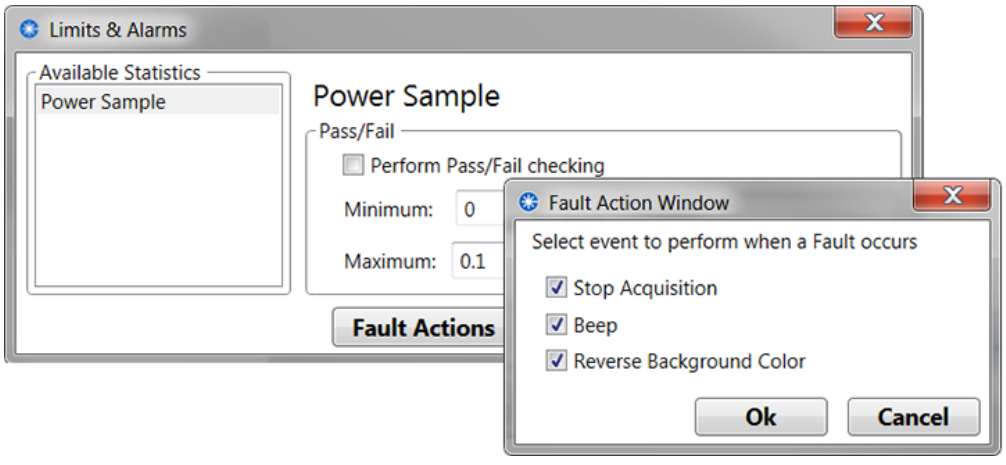

Figure 4-14. Limits & Alarms – Fault Notifications

Click the check boxes for the alarms and notifications options you want (shown in Table 4-6), then click OK.

Table 4-6. Limits & Alarms – Fault Settings

Option	Description
Stop Acquisition	Continues a running count in the Buffer Statistics panel unless this box is checked. Note that the sample count displayed at the bottom right of the window shows a different sample count unless you select the **Stop Acquisition** option.
Beep	Generates an audible notification with a beeping sound to alert you to an out-of-range situation.
Reverse Background Color	Reverses the background color of the display in the Graphics Panel.

After Fault Alarm sis selected in the Limits & Alarms dialog box, either:

- Click Discard in the dialog box to revert to any previous settings that you entered.
- Click Save in the dialog box to retain the settings you entered, which closes the dialog box.

A link to the dialog box is put on the top of the Statistics Panel, as shown in Figure 4-15. This link is displayed only if the Limits & Alarms are enabled.

Figure 4-15. Limits & Alarms – Link at Top of Statistics Panel

To open the Limits & Alarms dialog box, either click this link or use the main drop-down menu (View > Limits & Alarms).

Notifications are displayed in the Main window in several locations, as shown in Figure 4-16.

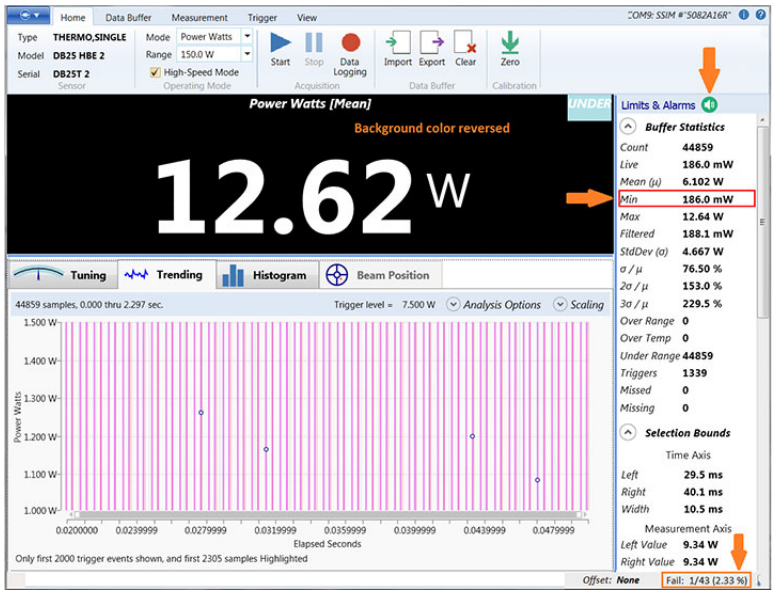

Figure 4-16. Limits & Alarms – Notifications in Main Window

4.1.9 Help

Selecting the Help option from the drop-down menu launches the viewer for embedded Help files for the Coherent Meter Connection software.

This information is also repeated in the toolbar by clicking the Help ( ) icon.

4.1.10 About

Selecting the About option from the drop-down menu displays information about the software and the company, like the one shown in Figure 4-17.

This information is also repeated in the toolbar by clicking the Information ( ) icon.

Figure 4-17. About Dialog Box

The dialog box includes a Check for Updates button.

4.1.11 Check for Updates

When the Check for Updates is selected from the main drop-down menu, the dialog box shown in Figure 4-18 displays:

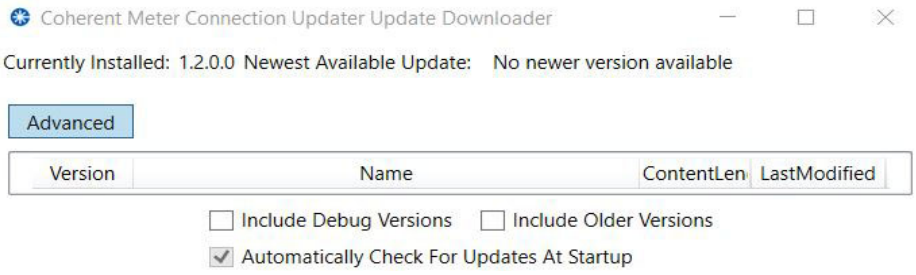

Figure 4-18. Check for Software Updates

If versions display in the list of any later software releases, and select the version you want to install by clicking on that line. Click Select to display the next window (Figure 4-19):

Figure 4-19. Check for Software Updates – New File

Click Download. The window displays a progress bar (Figure 4-20).

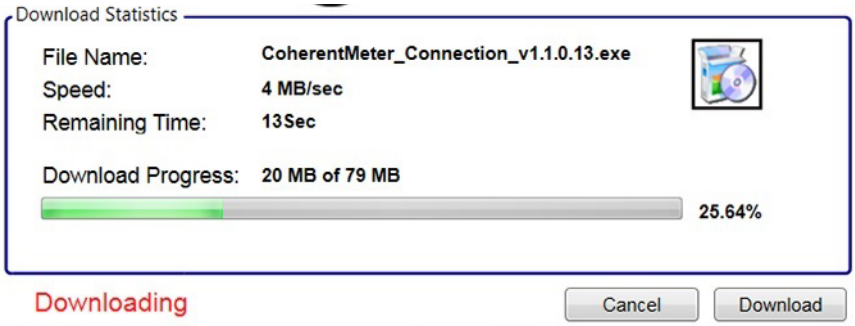

Figure 4-20. Check for Software Updates – Download File

4.1.12 Exit

Select the Exit option from the drop-down menu to exit the Coherent Meter Connection software application and close the window.

5 User Interface – Tabs

This section introduces the Coherent Meter Connection software, an easy-to-use interface that runs on a workstation. (***Note:*** Workstation is the term used throughout this manual to refer to either a personal computer (PC) or a laptop computer.)

Tabs and tool bars across the top of the window include:

- 'Home Tab' (p. 39)
- 'Data Buffer Tab' (p. 50)
- 'Measurement Tab' (p. 56)
- 'Trigger Tab' (p. 63)
- 'Data Buffer Tab' (p. 50)

5.1 Home Tab

The first tab in the tool bar ribbon is the Home tab, shown in Figure 5-1:

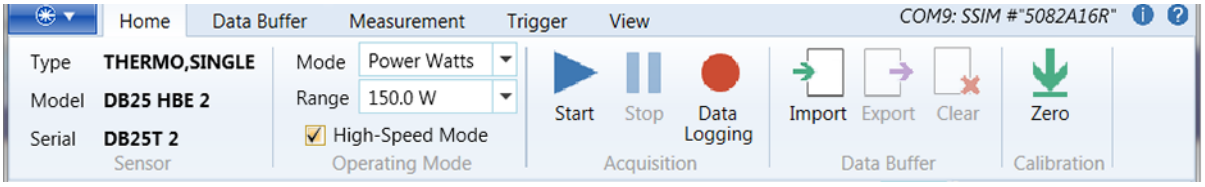

Figure 5-1. Home Tab in Toolbar

The Home tab includes the sections that follow:

- Sensor Identification (Type | Model | Serial Number)
- Operating Mode (Mode | Range | High-Speed Selection)
- Acquisition (Start | Stop | Data Logging)
- Data Buffer (Import | Export | Clear)
- Calibration (Zero)

Each of these areas are shown in the sections that follow.

5.1.1 Sensor Identification

Figure 5-2 shows the Sensor area on the Home tab:

Figure 5-2. Home Tab – Sensor Information

This section displays the properties of the currently connected sensor, including the type, model, and serial number of the current sensor.

If a sensor cannot be found (such as if not attached to the PC), the fields show 'None'. Note that the Model number is also listed at the top of the application window.

5.1.2 Operating Mode

Figure 5-2 shows the Operating Mode section on the Home tab.

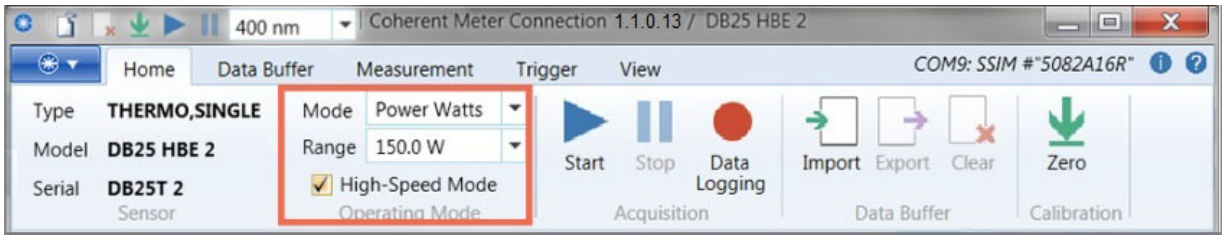

Figure 5-3. Home Tab – Operating Mode Settings

These are selectable:

- Mode
- Range
- High-Speed Mode (also used for Snapshot Mode)

  NOTE: When High-Speed Mode is not checked, the meter samples the power channel at a rate of 10 Hz.

5.1.2.1 Mode

This command selects the primary measurement to be performed by the meter, as shown in Figure 5-4.

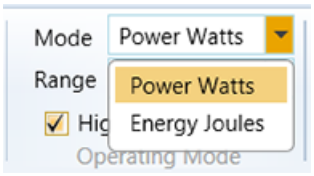

Figure 5-4. Home Tab – Select Mode

- Power Watts — Measure power in Watts.
- Energy Joules — Measure energy in Joules.

5.1.2.2 Range

Figure 5-5 shows the drop-down menu on the Home Tab used to select the full-scale operating range of the meter.

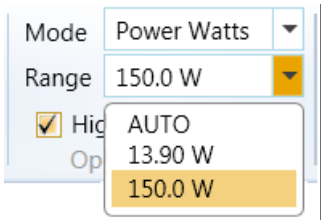

Figure 5-5. Home Tab – Select Range

Table 5-1 shows these options:

Table 5-1. Operating Mode Options

Option	Description
AUTO	Instructs the meter to adjust ranges (upward or downward), depending on the signal level. AUTO is not allowed for certain operations, such as when taking measurements in Standard-Speed or when using Snapshot Mode. • Some operating modes support an Auto Range option, in which case the meter changes ranges automatically to maximize accuracy and prevent Over Range. • When measurements exceed the operating range, the corresponding samples are flagged as Over Range.
Ranges Available	The specified ranges available depend on the sensor connected and the selected operating mode. Determined by individual sensor and meter.

5.1.2.3 High-Speed Mode

The check box for High-Speed Mode shown in Figure 5-6 enables or disables High-Speed Mode. Click this check box to start High-Speed data acquisition at a 20 kHz sampling rate.

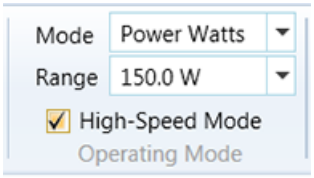

Figure 5-6. Home Tab – Check Box for High-Speed Mode

High-Speed Mode is available when using PowerMax-Pro technology and pyroelectric energy sensors. When used with PowerMax-Pro sensors, this mode is typically used to analyze modulated lasers with pulse lengths greater than 10 microseconds. Some sensors can only operate at a single speed, in which case the check box is shown in gray, and the check box indicates only the allowed speed.

Data acquisition can occur at High-Speed (approximately 20K samples/second) or standard speed (approximately 10 samples/second). While High-Speed acquisition acquires samples faster than Basic-Speed acquisition, the numerical resolution is lower. High-Speed Mode is required when using Snapshot Mode.

5.1.3 Acquisition

Figure 5-7 shows the Acquisition section on the Home tab. Acquisition commands include the Start, Stop and Data Logging icons.

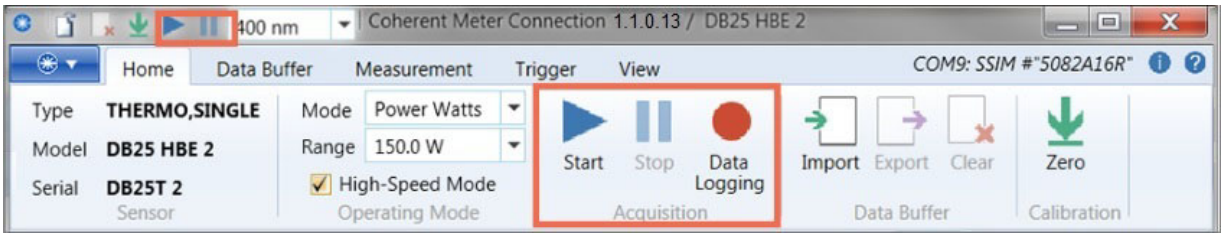

Figure 5-7. Home Tab – Data Acquisition Controls

5.1.3.1 Start

This command begins sending measurement data from the meter. The data is saved and displayed by the User Interface. The same Start icon is available at the top of the window in the Quick Start section, as shown in Figure 5-8.

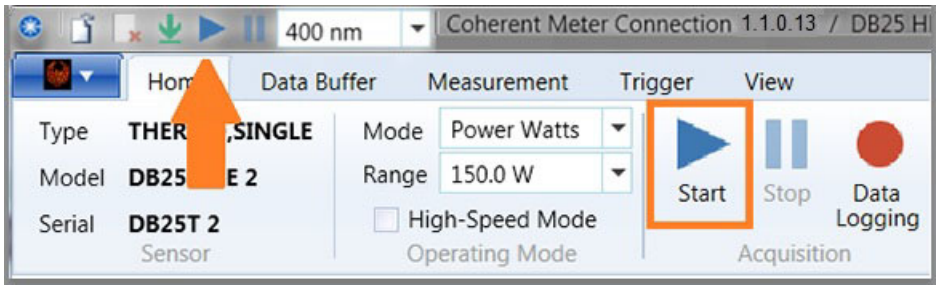

Figure 5-8. Home Tab – Start Icon

5.1.3.2 Stop

This command stops the meter from sending measurement data. Data that has been collected may be viewed in the User Interface or saved to a file.

The same Stop icon is available at the top of the window in the Quick Start section, as shown in Figure 5-9.

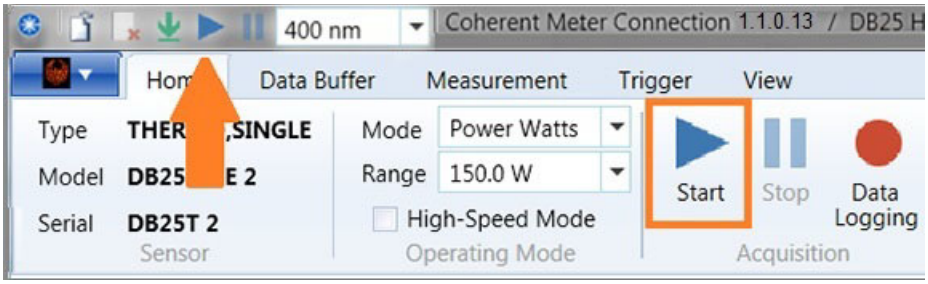

Figure 5-9. Home Tab – Stop Icon

5.1.3.3 Data Logging

On the Home Tab, the Data Logging icon toggles the Data Logging feature on and off. This feature is also available in the Data Logging Settings dialog box, displayed when you click the Data Logging icon.

The Data Logging Button toggles the Data Logging feature; click once to toggle the feature on or off.

When Data Logging is enabled, the icon is highlighted in the toolbar, as shown in Figure 5-10. Whenever logging is enabled, the button's background is highlighted to give a clear indication that logging is enabled.

Figure 5-10. Home Tab – Data Logging Icon

This feature can be enabled or disabled whether the meter is stopped or running; however, actual data logging can only be performed when the meter is acquiring data, and then only if logging is enabled when the user clicks Start. Currently, it is not possible to toggle logging while the meter is running.

After this setting is enabled, data logging begins when the Start button is clicked and continues until the meter stops or you manually set the feature to off while the meter operates.

Various logging options are controlled by the Data Logging Settings dialog box. Right-click on the Data Logging icon to display a context menu, shown in Figure 5-11.

This menu allows users to examine and modify the Settings, and provides another way to toggle logging on or off.

Figure 5-11. Home Tab – Data Logging Context Menu

- Select Enable Logging to toggle the logging feature ON or OFF.
- Select Data Logging Settings to display the dialog box shown in Figure 5-12, with the options that follow provide explicit control over settings.

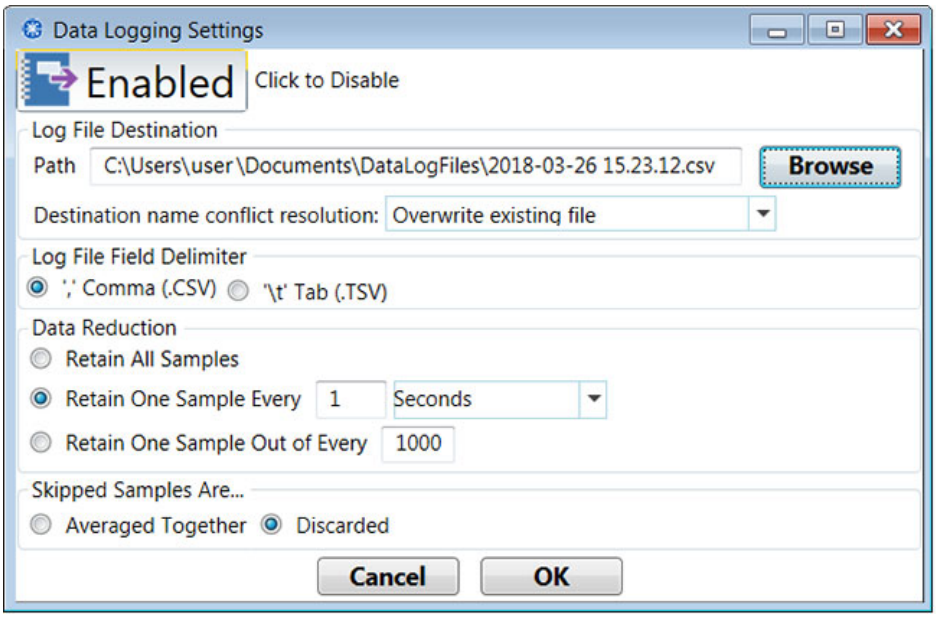

Figure 5-12. Home Tab – Data Logging Settings Dialog Box

Settings in this dialog box are shown in the sub-sections that follow.

After you select options:

- Click OK in the dialog box or press Enter on the keyboard to confirm changes to the settings in the dialog box.
- Click Cancel makes no changes; the original setting remains unchanged.

5.1.3.3.1 Enabled

The button at the top of the dialog box shown in Figure 5-12 clearly shows whether Data Logging is currently enabled.

- Click the Enabled button in the dialog box to toggle the Data Logging feature on and off (this provides the same functionality as the button on the Home Tab).

5.1.3.3.2 Log File Destination

Select the file name and path to be used for the destination of a log file:

- Path: Displays the currently selected destination file path for the data log.
- Browse button:
  - Click this button to view a File Create dialog box.
  - Browse to the needed location where to store the destination log file.

Data Logging stores acquired data into an external file. Each time the meter starts, a new log file needs to be created.

Several recovery alternatives are provided when the specified file name already exists, listed in Table 5-2.

Table 5-2. Destination Log File – Name Conflict Resolution

Option	Description
Overwrite existing file	The same file is overwritten each time the user presses Start. The previous data is overwritten, and only the most recent run is preserved.
Make update to destination file	The same file name is re-used each time the user presses Start, but the new data is added to the file's previous contents.
Create specific new name	A specific new Destination Filename is created each time the user presses Start. The specific name is created by adding different successive, numeric suffixes or by modifying the name until a file name does not conflict with previous names.

5.1.3.3.3 Log File Field Delimiter

The Destination log file is formatted exactly the same as regular Import/Export files. This option determines the extension used on the log file name; choose between the supported file formats listed in Table 5-3:

Table 5-3. Destination Log File — Supported File Types

Option	Description
Comma (.csv)	Data records are encoded using Comma-Separated fields (“,”), often used in applications in the U.S. and other countries.
Tab (.tsv)	Data records are encoded using Tab-Separated fields (“\t”), often used in applications in Europe and other countries.

5.1.3.3.4 Data Reduction

Data logging can create very large files, particularly when using high acquisition speeds.

Users typically do not want to save logs for every single sample. Each data record is approximately 50 bytes. Therefore, at an acquisition speed of 20 kHz, this translates to approximately 1 Mb per second (or 60 Mb per minute), so can quickly fill smaller hard drives.

To reduce or summarize the collected data, select one of the options listed in Table 5-4:

Table 5-4. Destination Logging — Data Reduction

Option	Description
Keep All Samples	Data reduction is set to off and the log file contains all the samples collected by the meter. Remember that, at high speeds, the log file can grow to an enormous size.
Keep One Sample Every … (By Elapsed Time)	This data reduction mode discards samples most of the time, and retains only a single sample at regular time intervals that you choose (for example, one sample per 30 seconds or one sample per minute or hour).
Keep One Sample Out of Every (By Sample Count)	This data reduction mode discards samples most of the time, retaining only every nth sample that you define (such as one sample out of every 1000 or 20000).

5.1.3.3.5 Skipped Samples

Skipped samples may be ignored, or they may be averaged together.

Table 5-5 shows the options for skipped samples:

Table 5-5. Destination Logging — Skipped Samples

Option	Description
Averaged Together	The various fields of Skipped Samples are averaged together. Each entry in the log file shows the arithmetic mean of all the samples in the Reduction interval, such as the Flags field the logical OR of all the Flags fields.
Discarded	Skipped samples are simply ignored, and have no effect on the log file contents.

5.1.4 Data Buffer

The meter collects data into a single Capture Buffer. This is a circular buffer, which means that data is added to the buffer and after a point, the oldest items are removed. When the meter stops, only the most recent samples are saved.

The Data Buffer section of the Home Tab includes the icons shown in Figure 5-13. This section displays the icons to manage the Data Buffer, whereas the Data Buffer tab on the toolbar defines the settings for the data files to be captured.

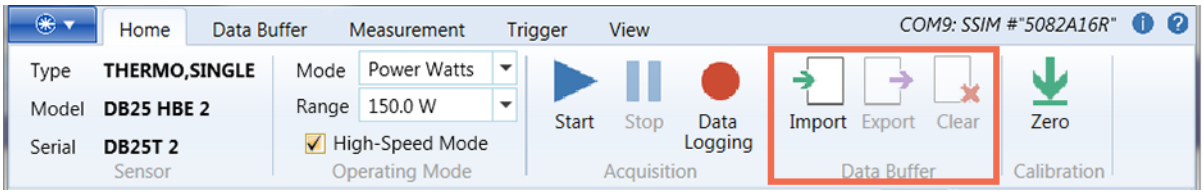

Figure 5-13. Home Tab — Data Buffer Section

Use the icons shown in Table 5-6 to manage the data buffer files.

Table 5-6. Data Buffer Icons

Option	Description
Import	When import data is imported to the Acquisition Buffer from an external file, you are prompted to specify a source file name. Loads the acquisition from an external file. Clicking the Import icon displays the standard desktop directory. Select the desired file format from the drop-down menu, and browse to the location for the file you want to import.
Export	When data is exported in the Acquisition Buffer to an external file, you are prompted to specify a destination file name. Saves all data in the acquisition to an external file. Clicking the Export icon displays the standard desktop directory. Select the desired file format from the drop-down menu, and browse to the location where you want to save the file.
Clear	Discards all captured data in the data acquisition buffer in preparation for acquiring new measurements. Selecting the Clear icon also clears the Trending window and removes any chart data, analysis markers, cursors, and other annotations, as well as resets the Statistics Panel. After Clear is selected, the icon is active in the toolbar. Click the Clear icon in the Quick Access tool bar for the same results.

5.1.5 Calibration

The Calibration section of the Home Tab displays the Zero icon, shown in Figure 5-14. Clicking the Zero icon in the Quick Access tool bar gives the same results.

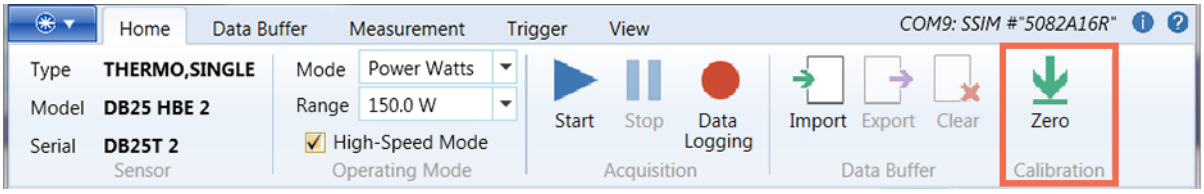

Figure 5-14. Home Tab — Calibration Section/Zero Icon

This command measures the zero baseline for the sensor in all possible ranges. This action does not affect any data, statistics, or analysis results. To make sure that calibration is valid, cover the sensor during this operation.

CAUTION!
Remember to block the laser beam before Zero is clicked.

Click the Zero icon to display the progress box shown in Figure 5-15:

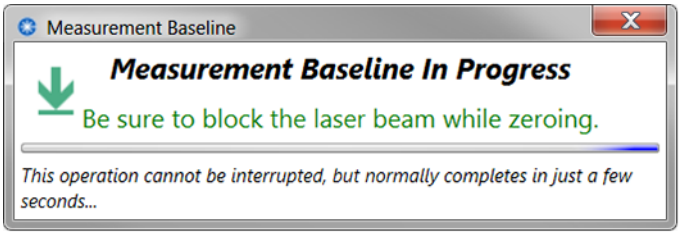

Figure 5-15. Zero Meter Drop-Down Menu

5.2 Data Buffer Tab

All acquisition sample data are ultimately collected in the Data Buffer, which is also the destination for data acquired by the meter. The buffer is also the destination or source, respectively, for data Imported from or Exported to an external data log file.

Selecting the Data Buffer tab displays the toolbar shown in Figure 5-16:

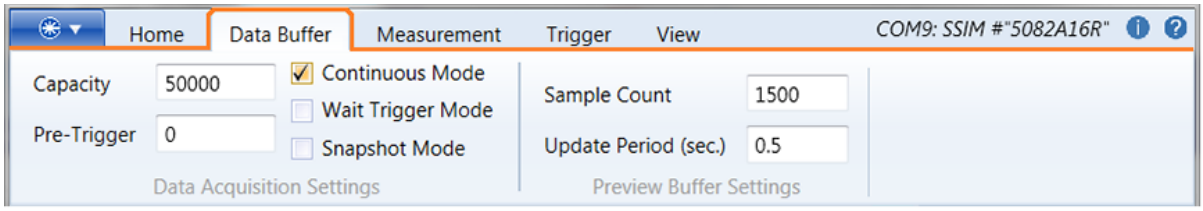

Figure 5-16. Data Buffer Tab

The Data Buffer is a circular buffer. That is, although it has a finite capacity, it can record data continuously. When the buffer reaches its capacity, older samples are discarded to make room for new ones. No matter how long data acquisition continues, the Data buffer always holds a fixed number of the most recent samples.

The Coherent Meter Connection software maintains a separate buffer to display progress of the data acquisition. The Data Buffer collects all the acquisition data, but a separate Preview buffer periodically refreshes the

user interface with just a subset of the most recent data. While data collection is in progress, only data captured inside the Preview buffer is displayed in the Trending chart.

After data collection ends (either by filling the Acquisition buffer or by hitting Stop while in Continuous Mode), the Trending chart displays the entire contents of the Capture buffer.

5.2.1 Data Acquisition Settings

In the section for Data Acquisition Settings, set options for Capacity and Pre-Trigger values, Mode, and a preview by Sample Count and Update Period (see Table 5-7):

Table 5-7. Data Acquisition Settings

Option	Description
Capacity	Controls the overall number of samples to collect in the Data Buffer.
Pre-Trigger	The number of samples to collect before the first trigger event.
Mode	Select the measurement mode (see more on p. 41): • Continuous • Wait Trigger • Snapshot

Durations are a convenient alternative to sample counts, though the underlying value is actually a sample count. As such, durations are rounded to the nearest multiple of 1 μSECS, the smallest sample period in Snapshot Mode.

Durations can have a range, for example from 0 to 384000 μS. There are further restrictions that capacity duration must be ≥ 1 μSECS Also, pre-trigger duration must be ≤ the capacity. Refer to the respective user manuals for the meter being used for specific duration limits.

For Snapshot Mode, Capacity and Pre-Trigger settings can be specified as durations in μSECS.

5.2.1.1 Buffer Capacity

Capacity controls the overall number of samples to collect (the size of the Capture Buffer). Only the specified number of the most recent data samples are saved during data acquisition, though you can stop acquisition before the entire buffer is filled.

Capacity may be specified by entering a sample count, a duration, or using a slider control. The maximum value is <Text>.

If you click the check box for Snapshot Mode, the Capacity setting determines the total number of samples to be collected in a single Snapshot. The limits are:

1 ≤ Capacity ≤ Snapshot maximum

5.2.1.2 Pre-Trigger Offset

Data Acquisition may be configured so that a portion of the data acquired before the first trigger event can be included in the capture buffer. Pre-Trigger is allowed only for power sensors using High-Speed Mode or Snapshot Mode.

The Pre-Trigger setting determines how many samples to collect before the first trigger event. Pre-Trigger size may be specified by entering a sample count, a duration, or using a slider control.

The data collected in Snapshot Mode may be partitioned into two sections: those samples that occurred before the trigger event, and those samples that came afterwards.

- If Pre-Trigger = 0, then the entire snapshot buffer will hold samples that came after the trigger event.
- If Pre-Trigger = Capacity, then the buffer holds samples that came before the trigger event.

  Limits: 0 ≤ Pre-Trigger ≤ Capacity ≤ Snapshot Maximum

If allowed, this setting determines how much pre-trigger data to include. The value must be less than or equal to (≤) the selected capacity.

- If a larger value is selected, an error message appears in the dialog and the Save button is disabled.
- The maximum value is <Text>.

5.2.1.3 Set Mode

Select the Mode or combination of Modes from the options in Table 5-8:

Table 5-8. Data Acquisition Modes

Mode	Description
Continuous Mode	Acquires data continuously until you press the Stop button.
Wait Trigger Mode	Discards sample data until first trigger event is detected. • Starting with that trigger, the meter continues to fill the buffer normally. • When the capture buffer is full, data acquisition stops.
Snapshot Mode	Enables or disables Snapshot Mode.

5.2.1.3.1 Continuous Mode Setting

If the check box for Continuous Mode is selected, the meter continues to fill the buffer (and discard the oldest samples) until you press the Stop button.

If Continuous Mode is NOT selected, the meter collects samples until the buffer is full and then automatically stops data collection. Press the Start button to again fill the buffer with new samples.

When running in non-Continuous Mode, press Stop to stop the buffer before it is full.

5.2.1.3.2 Wait Trigger Mode Setting

If the check box for Wait Trigger Mode is selected, the meter discards sample data until the first trigger event is detected.

Starting with the first trigger event, the meter continues to fill the buffer normally.

When the capture buffer is full, data acquisition stops or continues depending on the setting for Continuous Mode. If Continuous Mode is selected, the samples immediately that follow, the trigger may eventually be overwritten.

5.2.1.3.3 Snapshot Mode Setting

Snapshot Mode is a special high-speed data acquisition mode that stores data in the hardware SRAM of the instrument. Results must be uploaded to the PC after all the data has been acquired.

Snapshot Mode captures High-Speed events at, for example, 625 kHz or 1 µSec per sample (the capture rate to the internal buffer inside the meter). For specific values refer to the respective user manual for the meter being used.

Snapshot Mode is only allowed if the current sensor supports high-speed power mode.

Clicking the check box for Snapshot Mode launches a dialog box, shown in Figure 5-17. Highlights in the Snapshot Mode dialog box show edits needed to enable Snapshot Mode.

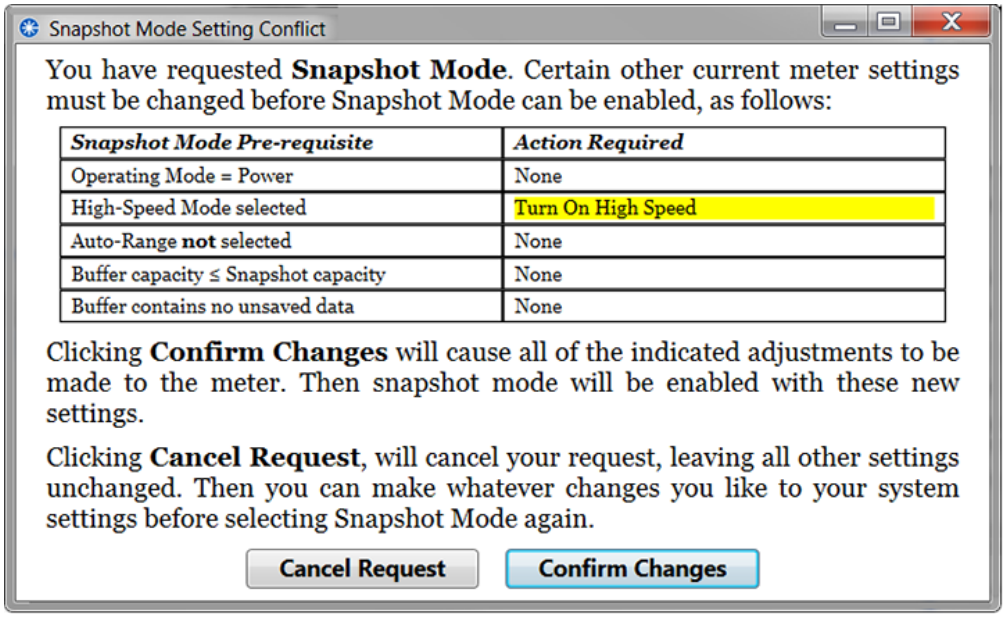

Figure 5-17. Data Buffer – Snapshot Mode Settings Conflict

5.2.2 Preview Buffer Settings

For more information about how to use this feature, see 'Take a Snapshot Measurement' (p. 153).

In the Preview Buffer Settings section of the Data Buffer tab, select the samples and refresh period, shown in Table 5-9:

Table 5-9. Preview Buffer Settings

Option	Description
Sample Count	Specifies the number of preview samples used by the Preview buffer. The maximum value is 3000.
Update Period	Specifies the refresh period, in seconds, that the Preview buffer uses to extract the most recent capacity samples. The fewer the seconds, the faster the update.

Enter either:

- An absolute number of samples.
- An equivalent duration in microseconds.

NOTICE

If the user interface becomes sluggish or unresponsive, either lower the Sample count or increase the Update period to reduce or eliminate the issue.

5.2.2.1 Sample Count

Sample Counts control how many samples are used to update the preview display. If you make this number too large, it can negatively affect the application's performance. The maximum value is 3000.

Capacity and Pre-Trigger settings in Snapshot Mode may be specified as sample counts. This is the whole number of data samples contained in the Snapshot buffer or in the Pre-Trigger portion thereof.

Sample counts may range from 0 to 240000, with the further restrictions that Snapshot Capacity cannot be zero, and that pre-trigger capacity must ≤ the overall capacity.

5.2.2.2 Update Period (Preview Buffer)

The application maintains a separate buffer for displaying data acquisition progress. The Data Buffer collects all the acquisition data.

However, for performance reasons, a separate Preview Buffer is used to refresh the user interface periodically with just a subset of the most recent data. The Preview Buffer is only used for High-Speed data acquisition.

The Update Period determines how often the Preview Buffer is updated for display during high-speed data collection. If you make the number too small, it can negatively impact system performance. The minimum value is 0.20.

5.3 Measurement Tab

The Measurement tab in the tool bar ribbon is shown in Figure 5-18:

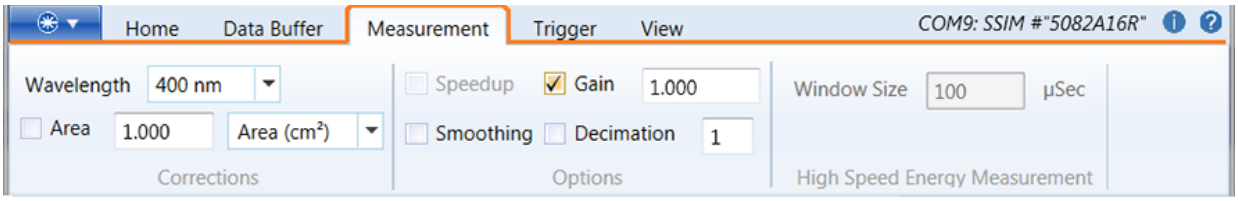

Figure 5-18. Measurement Tab

The Measurement toolbar includes areas to set:

- Corrections (Wavelength | Area)
- Options for measurement (Speed-up | Gain | Smoothing | Decimation)
- Window size (for high-speed energy measurement)

5.3.1 Measurement Corrections

In the Corrections area on the Measurement tab, you can set the Wavelength and Area to be measured, as shown in Table 5-10:

Table 5-10. Measurement Tab — Wavelength and Area

Option	Description
Wavelength	Displays the current wavelength.
Area	Specifies the area of the laser beam (either the beam area in cm^2 or the beam diameter in cm). The formula for calculating area from diameter is p * (diameter / 2)^2.

5.3.1.1 Edit Wavelength Table

To display available settings for the Wavelength, click the drop-down menu.

To edit the Wavelengths, right-click on the drop-down arrow of the Wavelength menu to display the dialog box shown in Figure 5-19:

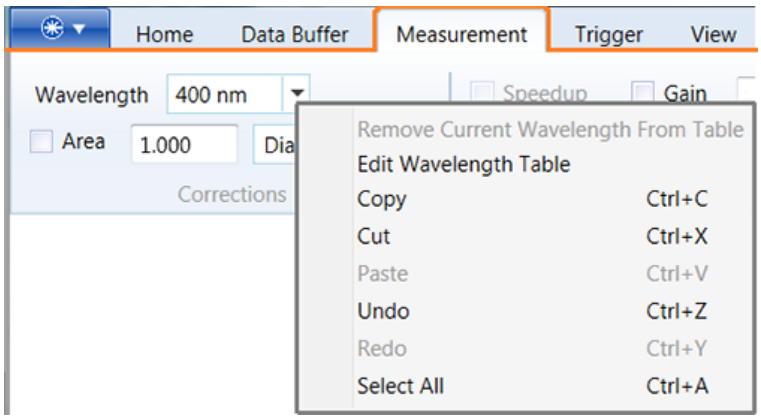

Figure 5-19. Measurement Tab –Wavelength Drop-Down Menu

Select Edit Wavelength Table to display a dialog box, shown in Figure 5-20, where you can add or remove a wavelength that you previously added.

Set or change a user-added wavelength as follows:

- Add a wavelength
- Remove a user-added wavelength
- Edit a wavelength
- Disable a wavelength

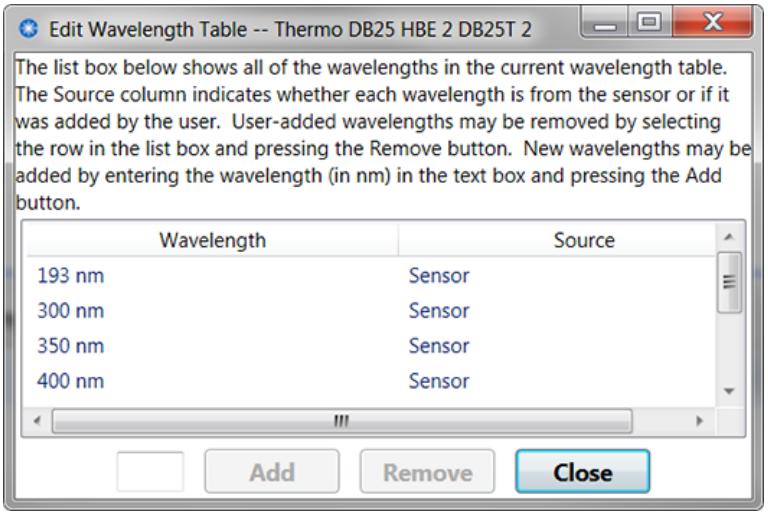

Figure 5-20. Edit Wavelength Table

Each of these are shown in the subsections that follow.

5.3.1.1.1 Add a Wavelength

To add a wavelength to the list, use one of the methods that follow:

- Directly type a new wavelength in the Wavelength field in the Measurements tab toolbar.
- Edit the Wavelength Table to add the new wavelength.

To add a new wavelength to the Wavelength Table:

1. Right-click the Wavelength drop-down menu in the Measurements tab toolbar.
2. From the pop-up menu, select Edit Wavelength From Table.
3. At the bottom of the Edit Wavelength Table dialog box, enter a new wavelength in the empty field to the left of the Add button.
4. Click Add. This saves the new wavelength to the table, and displays the wavelength in the Wavelength drop-down menu in the toolbar.
5. Click Close.

5.3.1.1.2 Remove a Wavelength

If the source of a wavelengths is identified by the sensor, that wavelength cannot be removed from the Wavelength drop-down menu or the Wavelength Table.

To remove a user-added wavelength from the drop-down list in the toolbar:

1. Select the wavelength from the Wavelength drop-down menu in the Measurements tab toolbar.
2. Right-click the down arrow next to the user-added wavelength.
3. From the pop-up menu, select Remove Current Wavelength From Table.

5.3.1.1.3 Edit a Wavelength

Editing the Wavelength Table removes a wavelength previously added by a user.

To edit the Wavelength Table:

1. Select the wavelength from the Wavelength drop-down menu in the Measurements tab toolbar.
2. Right-click the down arrow next to the user-added wavelength.
3. From the pop-up menu, select Edit Wavelength From Table.
4. In the Edit Wavelength Table dialog box, select the wavelength.
5. Click Remove.
6. Click Close.

5.3.1.1.4 Disable Wavelength Compensation

There is no way to disable wavelength compensation.

In the drop-down menu shown in Figure 5-21, **[Specify wavelength]** is displayed only when a meter encounters a new sensor for the first time. That simply means that a wavelength has never been selected for that meter.

Remember to set the appropriate wavelength. If you attempt to run the meter without doing so, a warning message is displayed as shown in Figure 5-22:

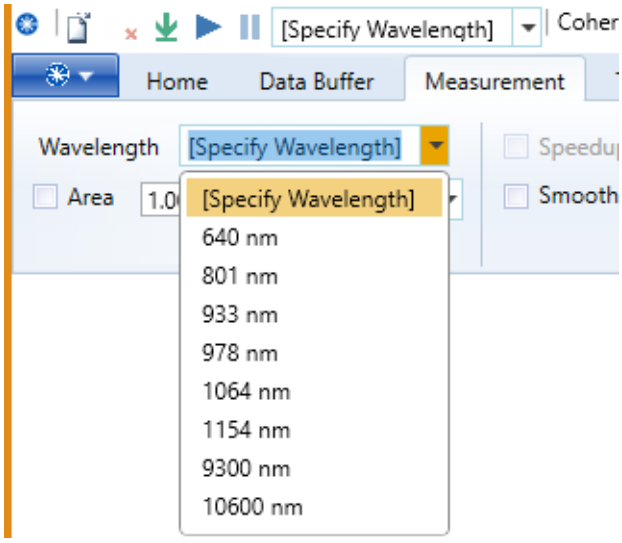

Figure 5-21. Disable Wavelength Compensation

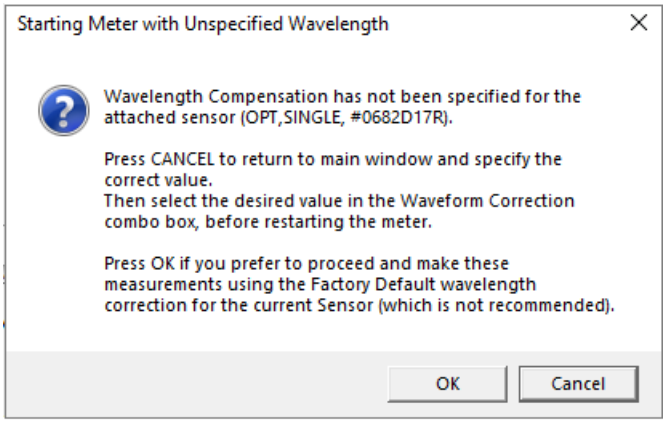

Figure 5-22. Warning to Set a Wavelength

After you set a wavelength, the setting is retained indefinitely and the warning messages are no longer displayed. Users can change the wavelength to other valid values but cannot disable it.

5.3.1.2 Area Correction

Area correction determines whether the Area Correction Value is specified in terms of its actual area (in cm^2) or the circular Diameter (in cm) of the beam. Changing the dimension affects the range of valid correction values.

To make a correction to the Area:

1. Under the Measurement tab, click the check box for Area to enable or disable Area Correction.
2. Enter a value to be applied for Area Correction.
3. From the drop-down menu, select either Area (cm^2) or Diameter (cm).

Either specification ultimately results in an underlying area value (in cm^2).

- The minimum value for the correction value is 0.01 cm^2 or around 0.113 cm.
- The maximum value is 500 cm^2or around 25.23 cm.

The resulting area value is divided into the power or energy measurements, resulting in Watts or Joules per cm^2, as shown in Figure 5-23:

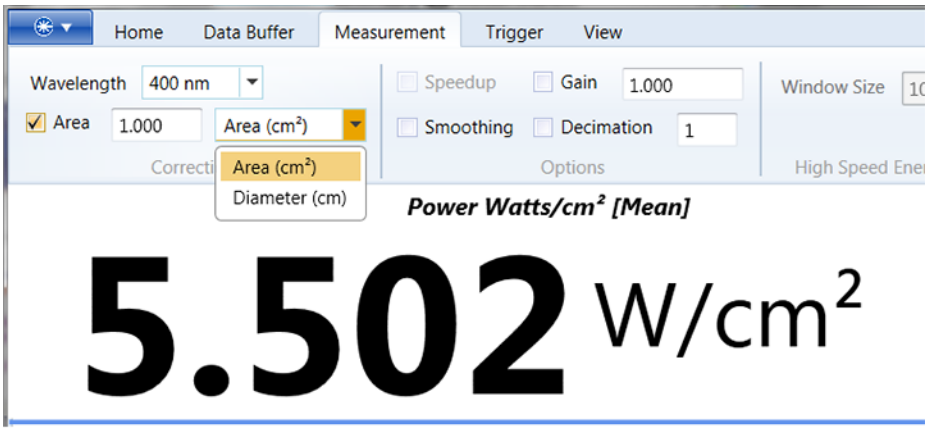

Figure 5-23. Measurement Tab – Area Correction

5.3.2 Measurement Options

The options listed in Table 5-11 are available under the Measurement tab:

Table 5-11. Measurement Options

Option	Description
Speed-up	Speeds up the rise time of a thermopile. NOTE: Use this function only with thermopile sensors.
Smoothing	Enables or disables Data Smoothing.

Table 5-11. Measurement Options (continued)

Option	Description
Gain	Enables or disables the Gain factor and applies a factor to a meter reading. Gain may be any value > 0. In particular, gain may make the measured result larger (value > 1) or smaller (1 > value > 0). This feature can be useful when measuring a source through a beam splitter or attenuator, or when applying a secondary calibration factor.
Decimation	Slows down the data captured by the meter. For example, a decimation value of 2 causes the meter to discard every other sample (which is a 50% reduction in the data rate).

5.3.2.1 Speed-up

When using thermopile sensors, some measurements rely on waiting for a laser pulse to reach a peak value, which can take a very long time.

Speed-up calculates where the peak occurs, based on an extrapolation of the first part of a measurement curve (based on an initial subset of samples). Speed-up uses this optimization to more quickly produce a measurement.

5.3.2.2 Smoothing

Smoothing applies a ‘noise-reducing’ filter to the data samples collected in the meter. This is a 32-sample bin average to reduce the “jitter” of the measurements.

5.3.2.3 Gain

Gain applies an arbitrary gain factor to all measurements. For example, if your sensor is downstream from a splitter or some other device that attenuates the actual laser beam, you can artificially inflate the measurements so that they reflect the actual output of the laser, rather than what the sensor measures.

- The gain factor must satisfy 0.001 ≤ gain factor ≤ 100000 (1e5).
- A gain factor of 1.0 is the same as disabling the option.

5.3.2.4 Decimation

Controls the rate of decimation. If enabled, Decimation lowers the data rate from the meter to the PC by discarding samples.

5.3.3 High-Speed Energy Measurement

The actual data transmission rate is the base sample rate divided by this Decimation Rate. For example, a decimation value of “2” tells the meter to discard every other sample (a 50% reduction in data rate). “3” means the meter sends only every third sample, and so on. A value of 1 is the same as disabling decimation.This setting applies only to energy measurements on the high-speed channel using a PowerMax-Pro sensors only.

The Window Size specifies the window size (in µSec) for High-Speed Joules energy measurements. The input value is expressed in microseconds. The Valid Range is from 100 to 1,000,000 µSec.

The window size determines which of two different algorithms are used for energy measurements, as follows:

- 10 µSec setting: Selects a peak detection algorithm. The energy calculation is based on the Peak Power of the pulse that is found in this (smallest possible) detection window. In this case, the energy calculation is independent of the actual pulse width.

- 100 through 1000000 µSec: Range of settings selects an integration algorithm.

The energy calculation is obtained by integrating the power values, starting with the trigger event, and that follow through for the full duration of the window. In this case, the energy calculation is entirely dependent on the window size.

For optimal energy measurements, size the window slightly smaller than the nominal pulse rate for the input signal.

- If the window is too small, energy measurements can be understated.

- A window that is too large can exaggerate the energy measurement.

5.4 Trigger Tab

The Trigger tab in the tool bar ribbon is shown in Figure 5-24:

The Trigger tab includes the sections that follow:

- Trigger Level (Watts | Percent)

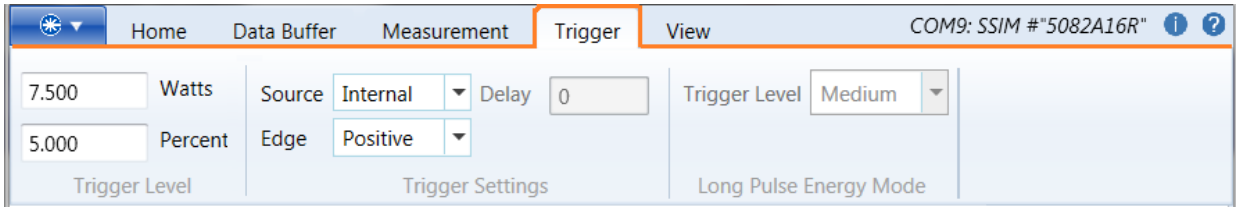

Figure 5-24. Trigger Tab

- Trigger Settings (Source | Edge | Delay)
- Long Pulse Energy Mode (Trigger Level)

Use settings on the Trigger tab to configure the meter to detect trigger events.

Trigger events are marked with a vertical **red** line in the Trending display.

For an example about how to use Triggers in Snapshot Mode, see 'Take a Snapshot Measurement' (p. 153).

5.4.1 Trigger Level

The Trigger Level specifies a way to calculate the energy of a pulse from a power measurement.

Any trigger setting between the data minimum and maximums causes a trigger. If you do not know the Peak Power, enter a Level setting between zero and the average power.

Table 5-12 shows the settings that you can specify:

Table 5-12. Set Trigger Levels

Option	Description
Watts or Joules	Specifies the trigger level as an absolute measurement in the current measurement unit (Watts or Joules).
Percent	Specifies the trigger level as a percentage of maximum Joules or Power rating of a probe.

5.4.1.1 Trigger Unit

Enter a setting in Watts that represents a level approximately 50% between zero and the Peak Power you expect each pulse to have. Valid Trigger Level Values range from Minimum to Maximum. Changing the Trigger Level Value setting automatically makes the appropriate adjustment to the Trigger Level Percent setting.

5.4.1.2 Notation

To select either a Scientific Notation or Fixed Notation format, right-click on the word Watts. In the pop-up dialog box, select the desired format, as shown in Figure 5-25. When selected, the Trigger Level value is displayed in Scientific notation; otherwise, the Trigger Level value is in Decimal notation.

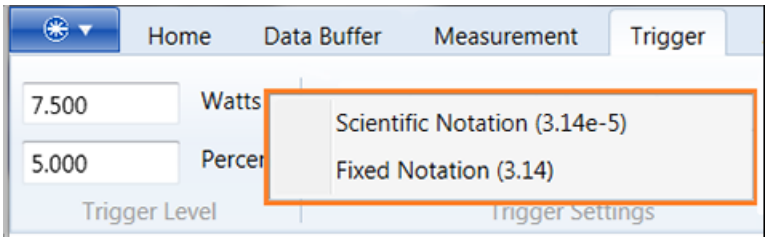

Figure 5-25. Trigger Tab – Notation (Scientific or Fixed)

5.4.1.3 Trigger Level Percent

Specifies the Trigger Level as a percentage of full range in the current measurement range. Changing the Trigger Level Percent setting automatically makes the appropriate adjustment to the Trigger Level Value setting.

Valid Trigger Level Percent values range from Minimum to Maximum. For Pyroelectric probes, the valid range is 0.0001 to 30%.

- When using a PowerMax-Pro probe in Watts mode, the valid range is 0 to 100%.
- When using a PowerMax-Pro probe in Joules mode, the valid range is 0.0001 to 100%.

5.4.2 Trigger Settings

Trigger events occur when the meter detects a series of measurements that cross a trigger level but do so only in a specific direction (either rising or falling), as shown in Table 5-13:

Table 5-13. Trigger Settings—Rise and Fall

Option	Description	
Source	Select the trigger source based on:	
	Internal	An internal analysis of the measurement data itself by the meter.
	External	An external electrical input through the trigger input connector.
Edge	Selects the trigger edge (external triggering only).	
	Positive	aka Rising Edge: Triggers when a sequence of measurements below the trigger level, are followed by a measurement that is above the trigger level.
	Negative	aka Falling Edge – Triggers when a sequence of measurements above the trigger level, are followed by a measurement that is below the trigger level.
Delay	Instructs the meter to delay data capture until after a certain amount of time (a specified number of microseconds) that follow a trigger event. Delay is meaningful only for External Triggers.	

5.4.3 Long Pulse Energy Mode

Long Pulse Energy Mode is a special measurement mode that looks for pulses and calculates the energy of pulses (measured in Joules).

This mode is used for legacy PowerMax USB/RS (“Meterless”) Sensors (that is, a sensor other than PowerMax-Pro USB/RS). The threshold setting is enabled only for those legacy products and is disabled in all others.

For information about how to take an Energy Measurement, see p. 160.

NOTICE

When Long Pulse Energy Mode is set, all other trigger controls are not used.

To start Long Pulse Energy Mode when using a legacy sensor:

1. In the Coherent Meter Connection software, go to the Home tab in the Operating Mode section. From the Mode drop-down menu, select **Energy** (Joules).
2. Under the Trigger tab in the Long Pulse Energy Mode section, select the Trigger Level (Low, Medium, High) from the drop-down menu.
3. In the Trending tab window, right-click and, from the Source pop-up menu, select 'Show Trigger Markers'.

   NOTE: The trigger level is computed dynamically from the actual sensor data, so the selections you choose are relative (Low, Medium, High) and not absolute. Experiment until you find the best setting for your particular needs.

5.5 View Tab

Figure 5-26 shows the View tab on the tool bar. The View tab controls the display of the user interface.

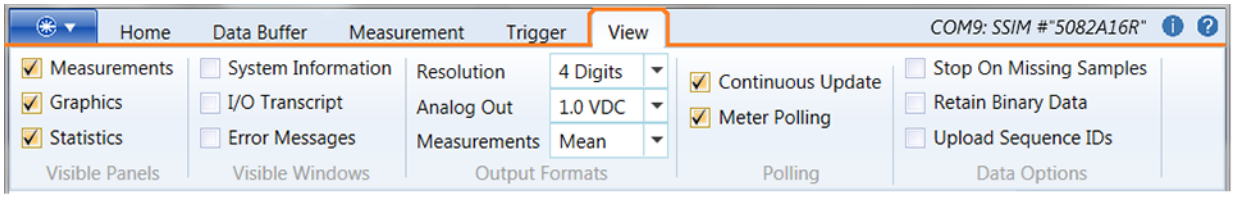

Figure 5-26. View Tab

The View tab includes the sections that follow:

- Visible Panels (Measurements | Graphics | Statistics)
- Visible Windows (System Information | I/O Transcript | Error Messages)
- Output Formats (Resolution | Analog Out | Measurements)
- Polling (Continuous Update | Meter Polling)
- Data Capture (Stop on Missing Samples | Retain Binary Data | Upload IDs)

5.5.1 Visible Panels

The items that follow, in the Visible Panels section control which panels that are displayed in the lower half of the user interface. These can also be selected in the drop-down menu.

- Measurements
- Graphics
- Statistics

All selections are enabled by default.

- At least one panel must be displayed.
- You can display one, two, or three panels at the same time.
- You can hide one or two panels at the same time.

If you do not want to display any of those panels, click the check box to deselect that panel.

5.5.2 Visible Windows

The Visible Windows section displays the options that follow, shown in Table 5-14:

Table 5-14. View Tab — Visible Windows

Option	Description
System Information	Displays a summary of meter and sensor settings.
I/O Transcript	Displays a transcript of communication between the user interface and the meter. This transcript does not include binary or High-Speed data.
Error Messages	Reports errors detected by the system.

5.5.2.1 System Information

When you click the check box for System Information under the View Tab, or select from the main drop-down menu select **View** > **Show System Info**, the dialog box shown in Figure 5-27 displays:

Use the scroll bars to display all information. Also click the down-arrow next to ‘Meter Properties’ to expand or contract information shown in Figure 5-28, for all categories included in this window:

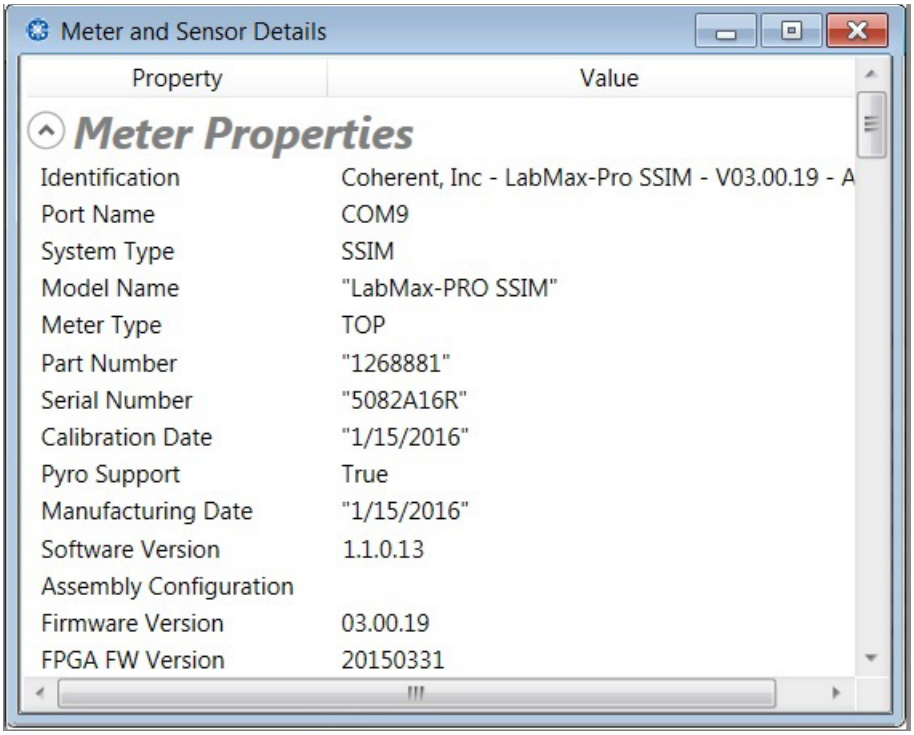

Figure 5-27. View Tab – System Information

- Meter Properties
- Sensor Properties
- Persistent Settings
- Other Settings — This includes the Installation Date for Licensed features, as well as a list of remaining days for the Free Trial.

To display a context menu, shown in Figure 5-28, right-click in the dialog box and save or copy details:

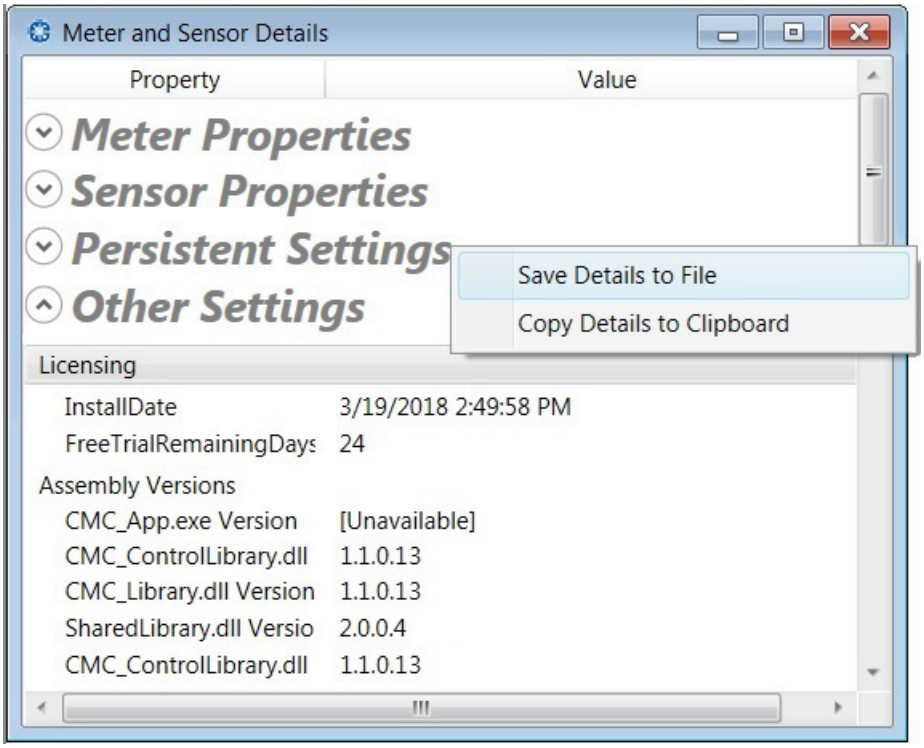

Figure 5-28. View Tab – System Information Context Menu

5.5.2.2 I/O Transcript

When you click the check box for I/O Transcript under the View Tab, or select from the main drop-down menu select View > Show IO Transcript, the dialog box shown in Figure 5-27 is displayed:

The I/O Transcript window displays a transcript of communication between the user interface and the Meter hardware.

This includes all communications from when the meter was first opened, regardless of when the Transcript window was opened. This transcript only includes text commands to and responses from the meter, and specifically excludes any binary or high-speed traffic.

Right click in the window to display a context Menu, shown in Figure 5-30. Select any of the options on the menu as desired.

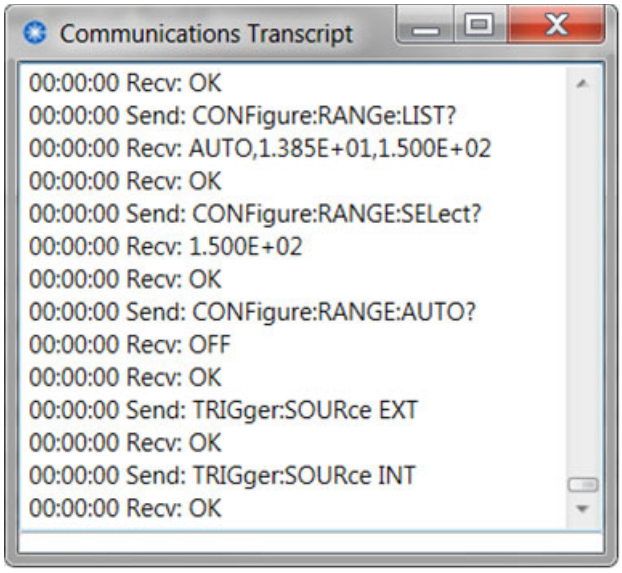

Figure 5-29. View Tab – I/O Transcript

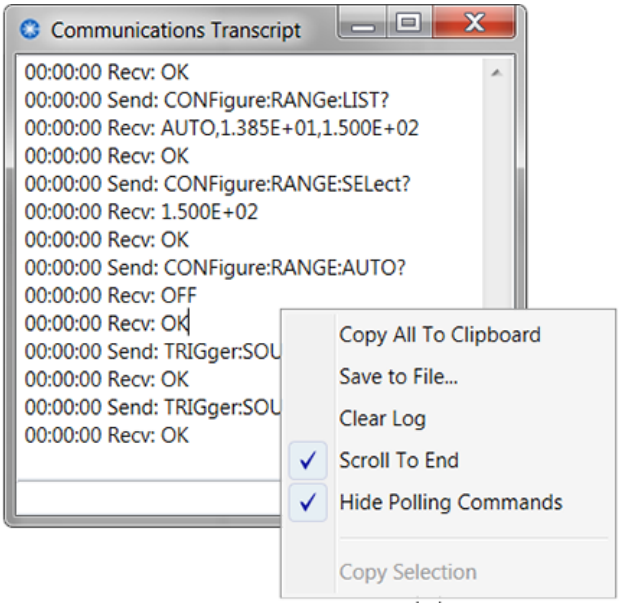

Figure 5-30. View Tab – I/O Transcript Context Menu

5.5.2.3 Error Messages

When you click the check box for Error Messages under the View Tab, or select from the main drop-down menu select View > Show Error Log, the dialog box shown in Figure 5-27 is displayed:

For more information, see the section ’Stop On Missing Samples’ (p. 75).

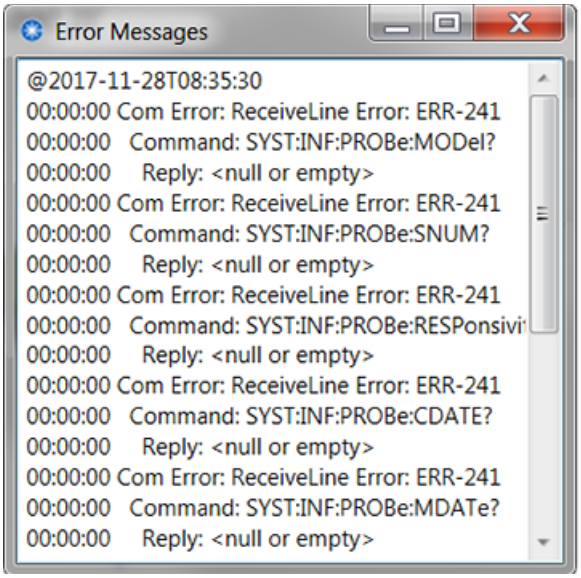

Figure 5-31. View Tab – Error Messages

5.5.3 Output Formats

Table 5-15 shows the options available for output formats:

Table 5-15. View Tab — Output Formats

Option	Description
Resolution	Selects the Resolution value. Number Resolution controls the formatting of all measurement values.
Analog Out	Selects the full-scale voltage (1, 2, or 4 volts).
Measurements	Selects the source of the data shown in the main Measurement Panel and includes measurement values in the data stream.

Each of these options are shown in the subs-sections that follow.

5.5.3.1 Resolution Value

The Resolution value determines the total number of real numbers displayed (3, 4, or 5 digits). This is NOT the number of digits to the right of the decimal point.

The display of measurement values is further affected by the current Range setting. For example, a 300 mW range with 4 digits selected shows numbers such as 102.4, 33.89, or 1.302.

5.5.3.2 Analog Out

The front panel of the LabMax-Pro SSIM meter has a connector labeled Analog Out. The hardware outputs an electrical voltage that is proportional to the measurements being read by the meter. Analog output is only active when the meter is running.

The signal is not available for Pyro sensors or PowerMax-Pro sensors in Snapshot mode.

NOTICE

The Combo Box is always enabled, and any changes take effect the next time Analog Out becomes active.

Select the output voltage (1, 2, or 4 volts) from the Analog Out drop-down menu that corresponds to a full-scale measurement, as shown in Figure 5-32:

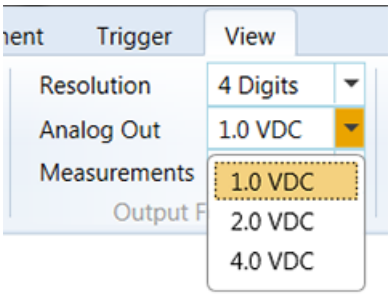

Figure 5-32. View Tab – Analog Out

5.5.3.3 Measurements

All choices are updated regularly when the meter is running; when the meter is stopped, only Live readings update.

The type of measurement is also displayed in square brackets that follow the selected operating mode. Table 5-16 shows the types, which include:

Table 5-16. Output Format Measurement Types

Option	Description
Mean	The arithmetic mean of all samples.
Minimum	The smallest sample.
Maximum	The largest sample. Maximum values are not enforced.
Live	The most recent sample from the instrument.
Filtered	A simple filter applied to the most recent 32 samples.

5.5.4 Polling

Table 5-17 shows the options available for polling:

Table 5-17. View Tab — Polling Options

Option	Description
Continuous Update	Enables or disables Continuous Update mode. This feature is only activate if Meter Polling is also enabled.
Meter Polling	Enable or Disable Meter Polling Mode. When enabled, the application periodically queries the meter for status.

5.5.4.1 Continuous Update

Continuous Update gives a continuous, general view of what the sensor sees when the meter is not running. Selecting this feature refreshes the main Measurement panel periodically whenever the meter is stopped.

This feature requests measurement readings and updates that follow:

- The upper Measurements panel, the Tuning tab, and Sensor temperature readings (if supported). Temperature is functional only when there is no active measurement.
- Certain error conditions also are tested for and reported.

The Acquisition Buffer, Trending tab, Histogram, Statistics, and other displays all are not updated.

Updating is automatically replaced by the Preview mechanism when you Start data acquisition.

5.5.4.2 Meter Polling

Meter Polling checks the meter status (sensor connects, sensor disconnects, and meter shutdowns).

- The primary purpose of polling is to detect sensors (and the meter itself) as they are connected or disconnected.
- Secondarily, polling is necessary to support Continuous Update mode.

5.5.5 Data Options

Table 5-18 shows the Data options available in the View Tab:

Table 5-18. View Tab — Data Options

Option	Description
Stop On Missing Samples	Controls how the software handles Missing Samples errors.
Retain Binary Data	Instructs the meter to save the binary bytes along with each data record.
Upload Sequence IDs	Includes Sequence ID values in the data stream.

5.5.5.1 Stop On Missing Samples

The check box to Stop On Missing Samples controls how the software handles Missing Samples errors.

- If checked, the meter stops data acquisition and displays an error dialog.
- If unchecked, the meter continues collecting data despite the errors.

In either case, the data buffer flags will mark the samples that follow the missing ones and the Measurements panel displays a **red** Missing indicator.

5.5.5.2 Retain Binary Data

The check box to Retain Binary Data instructs the meter to save the binary bytes along with each data record.

Selecting this feature takes more space, and also displays a hex version of the binary data in exported files. This feature is primarily used to debug Meter communications.

5.5.5.3 Upload Sequence IDs

The meter assigns timestamps to each data sample, based on an internal timer. Selecting this check box to Upload Sequence IDs causes the meter to upload timestamps so they are included in exported data files.

Using timestamps imposes additional overhead for data communications, and otherwise not used by the software. This feature is primarily used to debug Meter communications.

6 User Interface – Panels

This section shows the areas in which you can view data in various panels of the Coherent Meter Connection software:

- Measurements Panel in the middle of the window (p. 77)
- Graphical view panels in the lower half of the window, using these tabs:
  - 'When the sensor is inactive, sensor readings are not available.' (p. 81)
  - 'Trending Window' (p. 86)
  - 'Histogram Panel' (p. 118)
  - 'Beam Position Panel' (p. 121)
  - 'Diagnostics Panel' (p. 122)

Each of these viewing areas are shown in the sections that follow.

- For information about Statistics gathered that can be used for reference or data analysis, see 'Statistics and Pulse Analysis' (p. 125)
- For information about how to take Power or Energy measurements using the Coherent Meter Connection software, see 'Measurement Modes' (p. 141).

6.1 Measurements Graphics Panel

The Measurements Graphics Panel is the display area between the tool bar ribbon and the tabbed windows. This area displays data as it is being collected.

On start-up, the window does not contain any measurements but instead instructs users to open a meter, as shown in Figure 6-1:

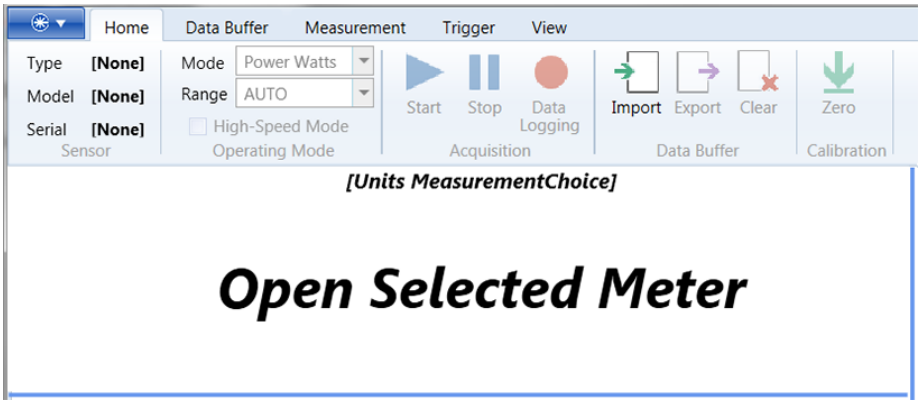

Figure 6-1. Measurements Panel On Start-Up

After you open a meter, the display changes to reflect the settings you selected. Figure 6-2 shows an example of numbers displayed in the panel if you selected measurements to be done in Power/Watts:

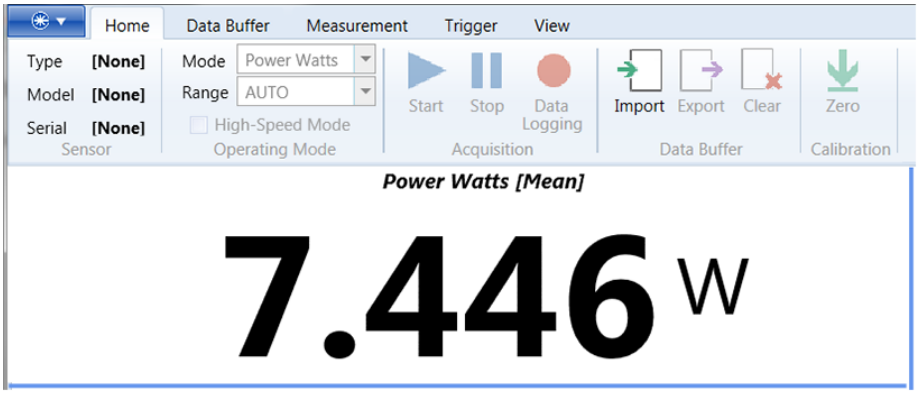

Figure 6-2. Measurements – Display in Power/Watts

Figure 6-3 shows an example of numbers displayed in the panel if you selected measurements to be done in Energy/Joules:

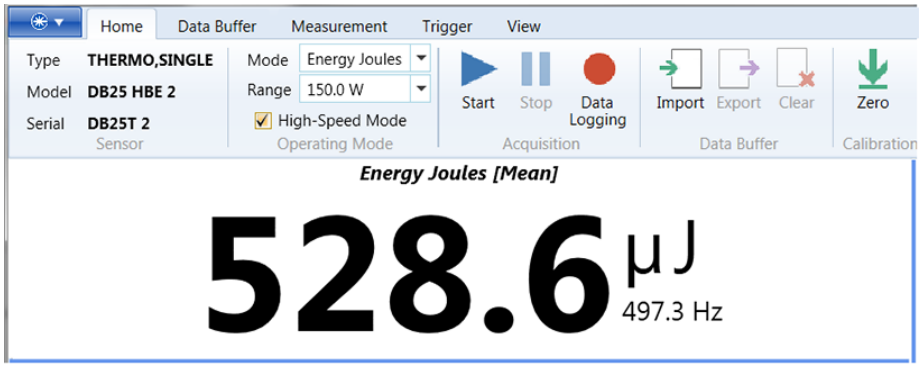

Figure 6-3. Measurements – Display in Energy/Joules

6.1.1 Exceptional Condition Indicators

Indicators in the top right corner of the Measurements Panel are displayed only when they are triggered by a specific condition, as shown in Figure 6-4:

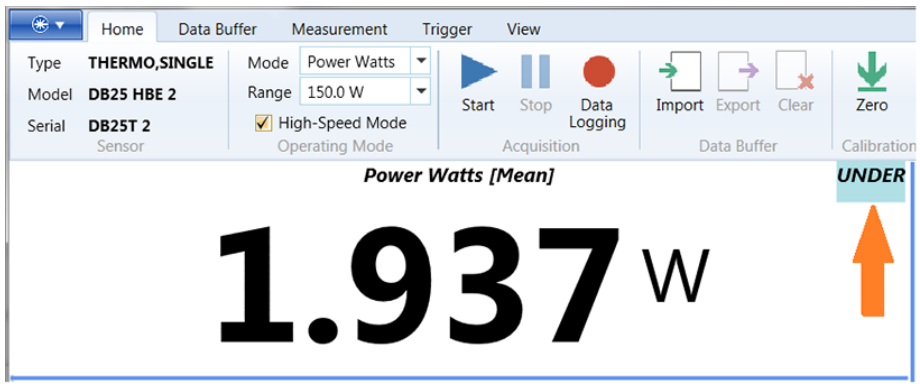

Figure 6-4. Measurements – Triggered Condition Indicator

These indicators are shown in Table 6-1:

Table 6-1. Condition Indicators in Measurements Panel

Icon	Description
HOT	The sensor indicates an over-temperature condition. Set the laser to and allow the sensor time to cool.
OVR	Displayed when the input signal is ≥ 90% of full scale. Any samples in excess of 100% full scale are truncated to the 100% level. • If in a fixed range, select a higher range. • If in AUTO or the highest range available, change the configuration to use a lower laser power level.
UNDER	To improve the measurement precision, set to a lower fixed range.
MISSING	Missing sample indicator. Displays when the meter reports that the workstation was unable to upload all the sample data before a buffer internal to the meter overflows. Depending on the option selected in the menu for Stop On Missing Samples, the meter either stops and displays a dialog or continues to collect data despite the error.

6.1.2 Temperature Conditions

The sensor temperature is updated about every 10 seconds. Temperature readings are not updated while data acquisition is in progress.

The temperature reading is at the bottom of the window (lower right corner), shown in Figure 6-5:

Figure 6-5. Measurements – Display Temperature

When the sensor is taking an active measurement, the temp field is gray and is not actively polling for information updates.

When the measurement or sensor is idle, then the temperature is actively being updated.

Displays for temperature conditions include:

- When the sensor displays no symbol, the temperature is normal.
    - When the sensor is taking an active measurement, the temperature field is gray and is not actively polling for information updates.
    - When the measurement or sensor is idle, then the temperature is actively being updated.
- When the sensor is enabled, the temperature is updated approximately every 10 seconds.
- When the sensor is disabled, readings are not updated while data acquisition is in progress.

6.2 Tuning Panel

When the sensor is inactive, sensor readings are not available.

The Tuning tab displays the current reading in either the Needle Dial view or the Bar Graph view, as shown in Figure 6-6. The recent minimum and maximum values are also displayed on either side of the window.

Capture the image in the Tuning panel and save it to a file on the workstation, as follows:

1. Right-click in the window and then select **Save Tuning Image** to a File...
2. In the standard Windows dialog box, browse to the directory needed to save the file.

Change the display in this panel using the controls shown in the subsections that follow.

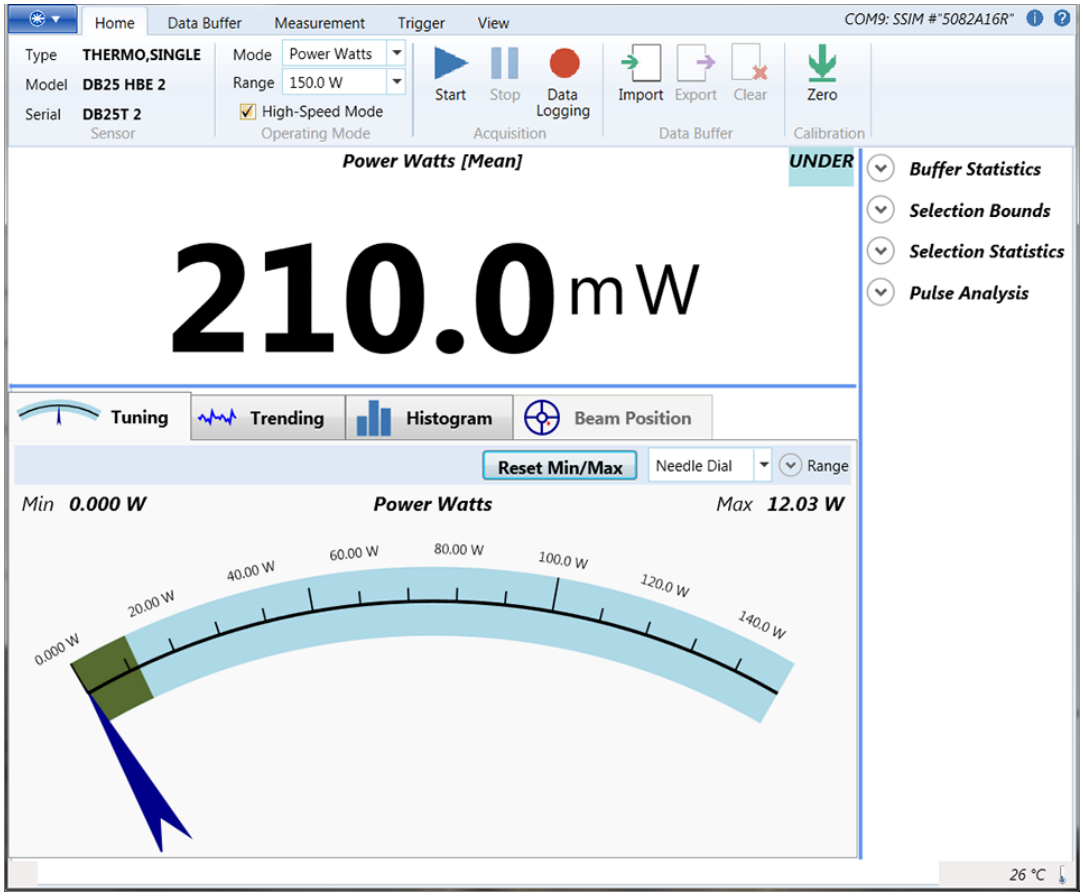

Figure 6-6. Tuning Panel

6.2.1 Reset Min/Max

To reset the Minimum and Maximum values, click the Reset Min/Max button, shown in Figure 6-7:

Figure 6-7. Tuning – Reset Minimum/Maximum Values

To clear the Minimum and Maximum values and again start tracking the values, beginning with the most recent value.

NOTICE

The Minimum and Maximum values are local to the tuning dials and have no correlation to the numbers displayed in the Statistics panel.

6.2.2 Display View

To change the style of the image in the Tuning panel:

1. From the drop-down menu next to Range in the Tuning window, select the style (either a Bar Graph or the Needle Dial), as shown in Figure 6-8. This changes the style in which you want measurements displayed in this panel.

Figure 6-8. Tuning – Change Display View

2. To change that, simply select the other option from the drop-down menu.

Selecting Bar Graph displays in view as shown in Figure 6-9:

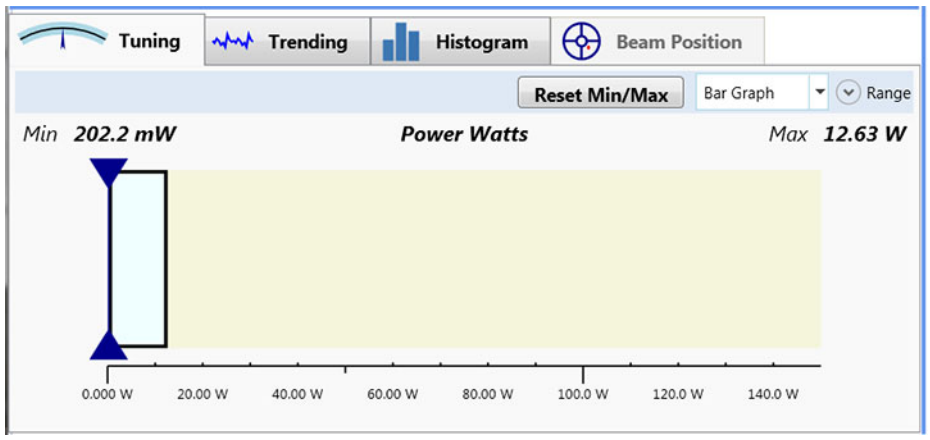

Figure 6-9. Tuning – Bar Graph Display

6.2.3 Tuning Range

Use the Tuning Range dialog box to scale measurement dimensions.

1. Open by clicking the down arrow next to Range in the Tining window. The Tuning Range dialog box is displayed, as shown in Figure 6-10:

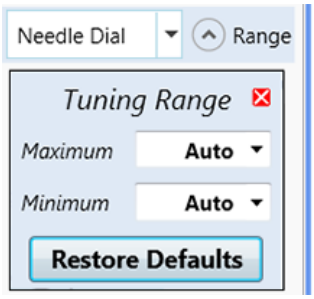

Figure 6-10. Tuning – Options for Tuning Range

2. To select the Maximum setting, click the drop-down menu.
3. To select the Minimum setting, click the drop-down menu.
4. To reset the dialog box, click Restore Defaults. This resets the dial to Auto for scaling. The range is set to a simple default, but then expands automatically to accommodate any values encountered.
5. Close the Tuning Range dialog box by clicking the x in the top-right corner of the Tuning Range menu.

6.2.4 Save Tuning Image

You can also save the image from the Tuning window to a file. To do so, do the following:

1. Right-click in the Tuning window. The command shown in Figure 6-11 is displayed:

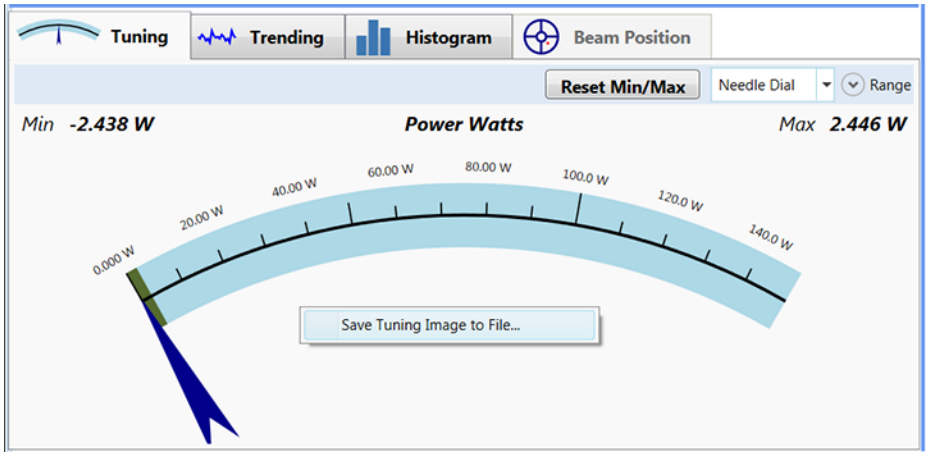

Figure 6-11. Tuning Tab—Save Tuning Image

2. The command opens the standard Windows browser. Select a directory where you want to store the image file, and click Save.

6.3 Trending Window

The display in the window for the Trending tab shows an X-Y chart of current data, as shown in Figure 6-12:

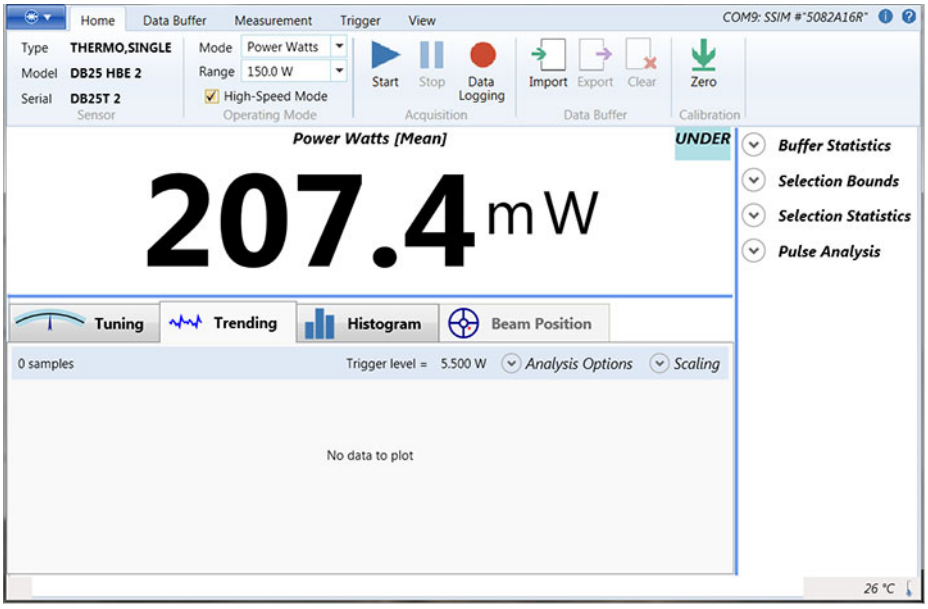

Figure 6-12. Trending Window

When taking a measurement with a pyroelectric sensor, the horizontal axis values at the bottom of the Trending window are displayed in terms of Pulse ID (rather than Elapsed Seconds).

Use these methods to navigate in the Trending window to view the entire data set:

- Drag either handle on the Navigation Bar to zoom in or out on the displayed data.
- Drag the Navigation Bar right or left to shift the display forward or backward in time.
- Double-click the Navigation Bar at the bottom of the Trending window to expand the display to 100% of available data.

A vertical Navigation Bar is shown whenever less than 100% of the height of the displayed data is visible. You can also zoom inside the window; see ’Zoom Mode’ (p. 95).

6.3.1 Trending Chart Context Menu

Right-click in the Trending window to display the context menu, shown in Figure 6-13:

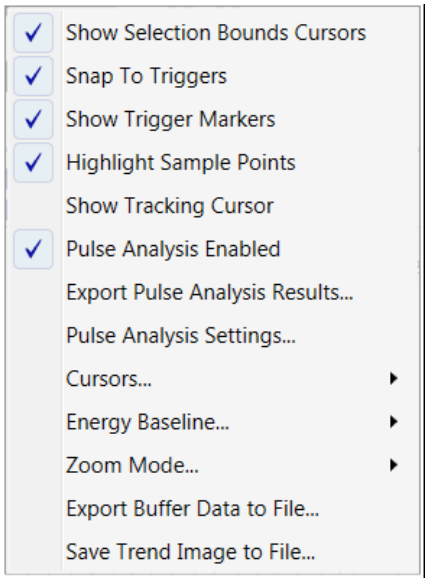

Figure 6-13. Trending – Context Menu

Selections in this pop-up menu are shown in Table 6-2. More information about each these commands are provided in the sections that follow.

Table 6-2. Trending Window – Context Menu Descriptions

Menu Option	Description
Show Selection Bounds Cursors	Displays cursors as vertical lines (sample time positions) and horizontal lines (measurement levels) in the Trending window. See p. 88 for details.
Snap to Triggers	Aligns the vertical cursors with existing trigger events on the horizontal axis in the Capture buffer (see p. 89).
Show Trigger Markers	When the Show Trigger Markers dialog box is checked, Trigger events become visible in the Trending display (see p. 90).
Highlight Sample Points	An annotation that shows a small circle for each sample (see p. 90).
Show Tracking Cursor	Displays a pair of vertical and horizontal dashed lines that represent time and measurement (see p. 91). Inspect captured data, a single sample at a time.

Table 6-2. Trending Window – Context Menu Descriptions (continued)

Menu Option	Description
Pulse Analysis Enabled	Toggle to enable or disable Pulse Analysis (see p. 92).
Export Pulse Analysis Results	Saves Pulse Analysis information to an external file (see p. 93).
Pulse Analysis Settings	Displays the Pulse Analysis dialog box where you select settings in a series of tabs (see p. 99).
Cursors…	Allows users to select a range of data in the Trending window (see p. 91).
Zoom Mode	View a portion of the available data (see p. 95 for Zoom options).
Export Buffer Data to File	Saves collected data to a file in the format specified (.csv, .tsv. or .txt); see p. 98.
Save Trend Image to File	Saves a graphic image to a file (see p. 98). Specify the format for the file as .bmp, .gif, .jpg, or .png.

NOTICE

When features are not enabled, they are shown in gray and have no operation. This is because the feature is not applicable to a particular sensor.

6.3.1.1 Show Selection Bounds Cursors

Selection Bounds Cursors set the area for measurement data, as follows:

- Vertical lines represent sample time positions.
- Horizontal lines represent measurement levels.

The Show Selection Bounds Cursors option displays Cursors on the Trending chart, as shown in the example in Figure 6-14.

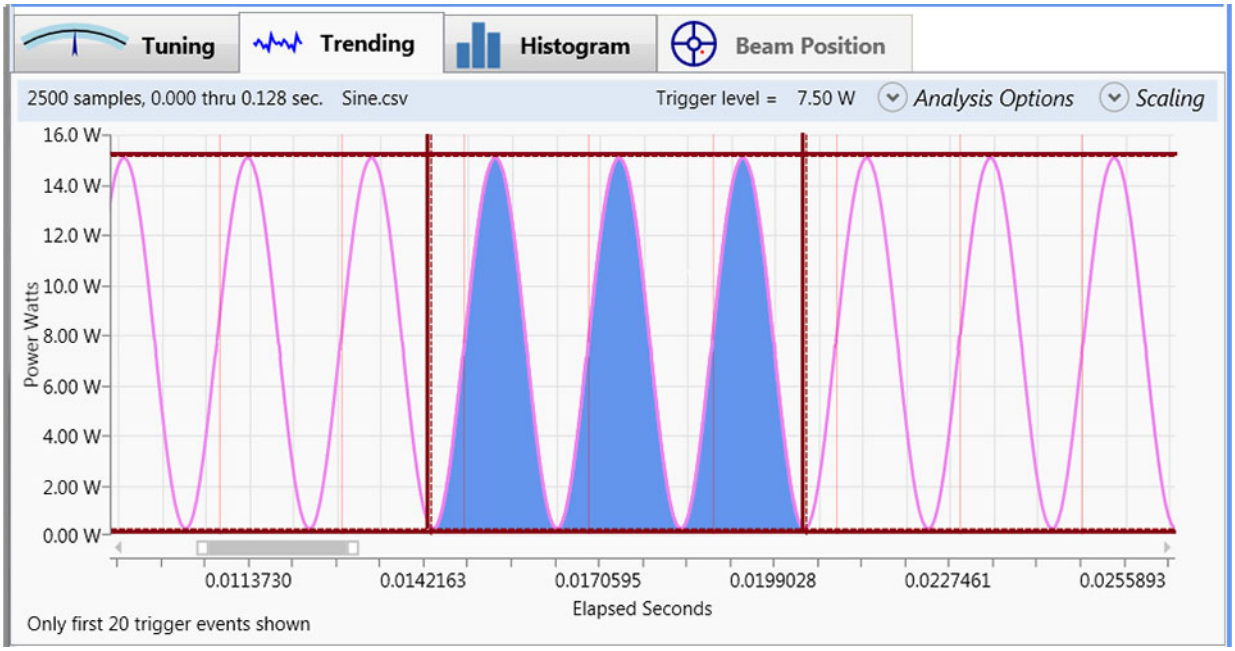

Figure 6-14. Show Selection Bounds Cursors

Selection Bounds Cursors are displayed as red dashed lines. There are four selection boundaries: left, right, upper, and lower.

The area ‘under the curve’ is highlighted in blue. This corresponds to the calculation of energy of the range of samples between the left and right cursor.

Move these cursors using the mouse in the same way you move the edge of a window to resize it.

In the Statistics Panel to the right of the Trending window, the Selection Bounds statistics are updated to reflect the values for the Selection Bounds.

6.3.1.2 Snap To Triggers

Aligns Vertical cursors with existing trigger events on the horizontal axis in the Capture buffer.

- When enabled, Snap To Triggers mode constrains Vertical cursors to align with the closest existing trigger event on the horizontal axis in the capture buffer. Only Vertical cursors are affected. When moving Vertical cursors, they ‘jump’ to each successive trigger location.

- When disabled, cursors may be moved freely to any location. Cursors remain wherever they happen to be at the time.

6.3.1.3 Show Trigger Markers

Trigger events become visible in the Trending display when the Show Trigger Markers selection is checked.

- Vertical **red** lines indicate the location of trigger events.
- A horizontal **green** line indicates the trigger threshold level.

To most system performance, the number of trigger events shown are limited to the first 20 while measurements are being taken (Preview mode) or the first 2000 trigger events after measurements have been taken.

The visual trigger markers are important to confirm that good triggers are occurring before entering and gathering data in Snapshot mode.

After confirmation that triggering is good for a particular set-up, system performance can be increased by set check box for trigger markers to off.

6.3.1.4 Highlight Sample Points

A Sample Point is an annotation that simply shows a small circle for each sample. Because a small point would be difficult to see on a normal chart in the Trending window, the software instead draws a small circle at each sample's location. This enhances visibility for the data displayed.

To show or hide this feature, right-click the context menu in the Trending panel and toggle the feature on or off. Selecting the Highlight Sample Points option displays the circles in the Trending chart, as shown in the example in Figure 6-15.

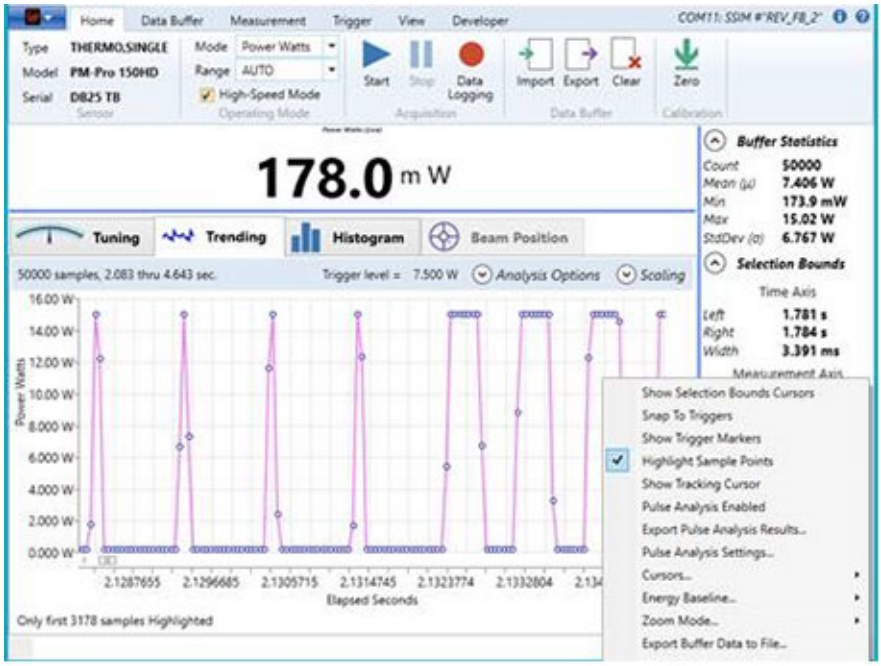

Figure 6-15. Trending – Highlight Sample Points

NOTICE

When using High-Speed data, it is recommended that to set the Highlight Sample Points feature to OFF.

After Start is pressed, wait for the first energy sample. The application processes the samples in the background for approximately one second of CPU time before displaying the annotated region of the buffer on the left side of the Trending window. The chart displays only after several samples are taken.

6.3.1.5 Show Tracking Cursor

The Tracking Cursor is used to examine the precise position of individual measurement samples. The window shows the current position (time) and value of the measurement.

Select different samples by dragging the **vertical line** to the left or to the right.

Enable or disable the Tracking Cursor in the context menu by right-clicking in the Trending window, and then selecting (or deselecting) Show Tracking Cursor.

When you select Show Tracking Cursor, both a vertical line as well as an information box is displayed in the Trending window, as shown in Figure 6-16:

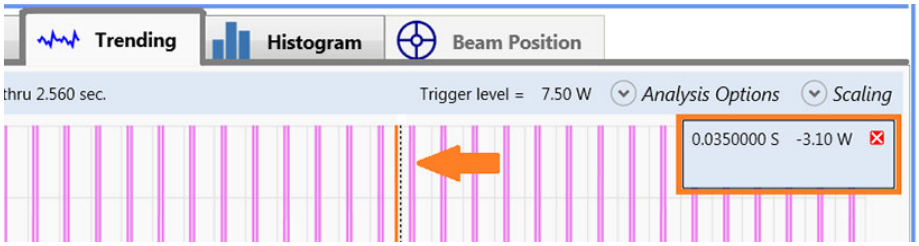

Figure 6-16. Trending – Show Tracking Cursor

The positions of the Tracking Cursors determine the Selection Bounds, which in turn affects the calculation of Selection Statistics.

When enabled, the Trending window displays a pair each of vertical and horizontal dashed lines, called Cursors.

- Vertical lines represent Time Cursors that mark sample time positions on the horizontal axis of the Trend chart.
- Horizontal lines represent Measurement Cursors that mark measurement levels on the vertical axis of the Trend chart.

Move Cursors by dragging the vertical drag line with the mouse. This allows you to inspect captured data a single sample at a time.

Also see ’Cursors…’ (p. 94) for information and examples about managing cursors.

6.3.1.6 Pulse Analysis Enabled

The menu option enables or disables Pulse Analysis. This feature must be enabled before you can view any analysis results. At the bottom of any tab, click check box to enable or disable Pulse Analysis.

Pulse Analysis may only be performed on Power measurements and is disabled for Energy data, for Pyro sensors, and whenever the capture buffer contains no data.

Visibility of annotations in the Trend window depends on other settings in the Display Options tab. Enabling Pulse Analysis also requires Enabling the Selection Cursors, which is done automatically when you turn on Pulse Analysis. Pulse Analysis is confined to the region of the buffer delineated by the Selection Bounds.

6.3.1.7 Export Pulse Analysis Results...

Use the menu option to Export Pulse Analysis Results… to extract and save all data in the Acquisition Buffer to an external file. Selecting this commands prompts users to specify a destination file name.

If no pulses are detected, the message shown in Figure 6-17 is displayed.

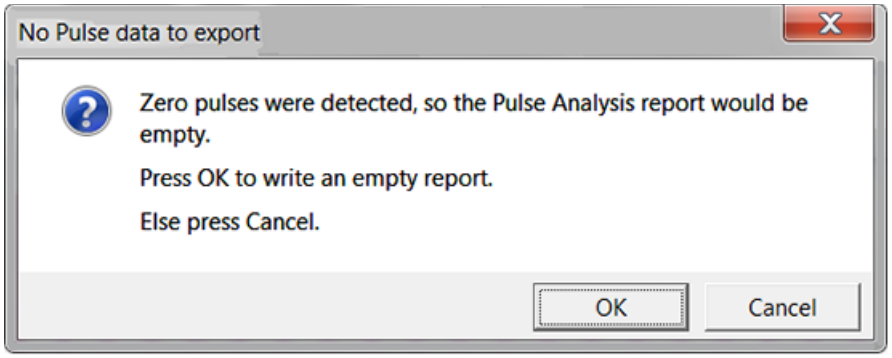

Figure 6-17. Trending – No Pulse Data to Export

6.3.1.8 Pulse Analysis Settings...

The menu option for Pulse Analysis Settings… displays the Analysis Options dialog box with four tabs. For details about the dialog box, see ’Analysis Options’ (p. 99).

Selections in this dialog box affect how Pulse Analysis inputs and outputs are presented in the Trending window. At the bottom of any tab, click check box to enable or disable Pulse Analysis.

6.3.1.9 Cursors...

The menu option for Cursors… applies to the Selection Bounds Cursors. Selecting **Cursors**… displays these options, shown in Figure 6-18:

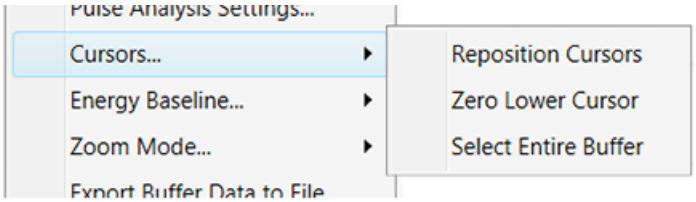

Figure 6-18. Trending – Options for Cursors

To enable or disable cursors:

1. Right-click in the Trending window.
2. From the pop-up menu, select Cursors.

   Options include:

   - Reposition cursor
   - Zero lower cursor
   - Select entire buffer
3. Double-click the Navigation Bar to expand the display to 100% of available data.

Cursors do not move when you zoom in or out.

Cursor positions are saved after each measurement.

6.3.1.9.1 Reposition Cursors

The Reposition Cursors command generally makes all cursors visible.

Selecting the **Reposition Cursors** command moves the upper and lower cursors to the maximum and minimum values in the buffer. This command also sets the left and right cursors at the 1/3 and 2/3 positions in the window respectively.

When you exit and restart the software, cursors remain wherever you left them. Because of this, some cursors are restored to positions that are not visible on the screen. Use the Reposition Cursors command to view cursors.

Some annotations (particularly Trigger markers and Sample Point Highlights) are too expansive to render for all of large capture buffers. The software draws only the left-most cursor and does not show other markers.

Therefore, if you turn on trigger markers and scrolled off to the right, you may not see any cursors until you zoom out or scroll back to the left. Use the Reposition Cursors command to again view cursors.

6.3.1.9.2 Zero Lower Cursor

The lower cursor is the moved to the 0W line.

6.3.1.9.3 Select Entire Buffer

This option lets users select the entire buffer, which is useful when samples may be outside of the display area.

6.3.1.10 Energy Baseline

The energy baseline tracks the lower bounds of the Selection Cursor. This setting enables Energy calculations to be performed relative to a baseline measurement, representing the lowest possible energy. For more information about the Energy Baseline, see ’Energy Options’ (p. 107).

6.3.1.11 Zoom Mode

Zoom Mode allows you to change the magnification level of data displayed in the window to view a portion of the available data. Options include:

- Zoom Show All
- Zoom None
- Zoom Horizontal
- Zoom Vertical
- Zoom Both

To zoom:

1. Go to the Trending window and right-click to display the context menu.
2. From the menu, select Zoom Mode…

3. Choose one of the options shown in the pop-up menu, shown in Figure 6-19.

Figure 6-19. Trending – Zoom Mode Menu Options

The examples that follow describe how to zoom in or out when viewing measurements in the Trending chart.

Click and drag the mouse, then release to define a portion of the display. The chart zooms in to display the selected section, as shown in Figure 6-20.

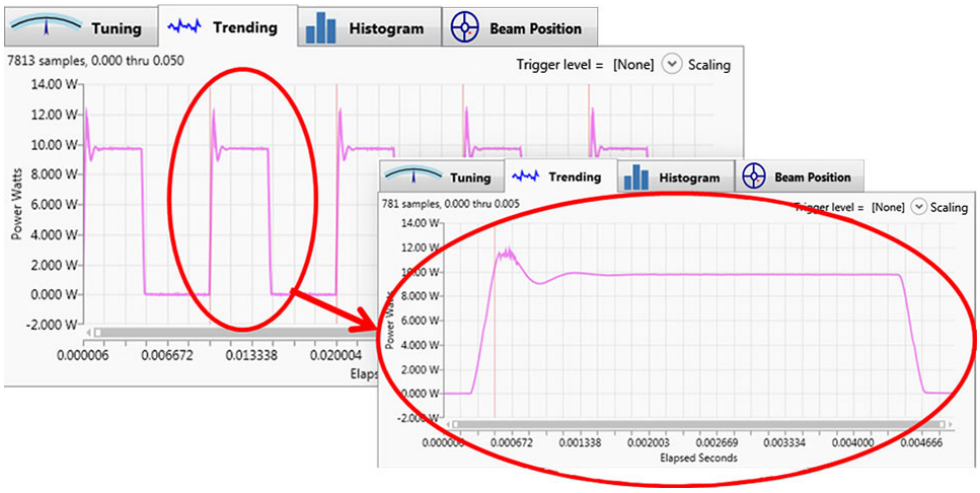

Figure 6-20. Trending – Zoom Example 1

Use the mouse wheel to zoom in or out, as shown in Figure 6-21.

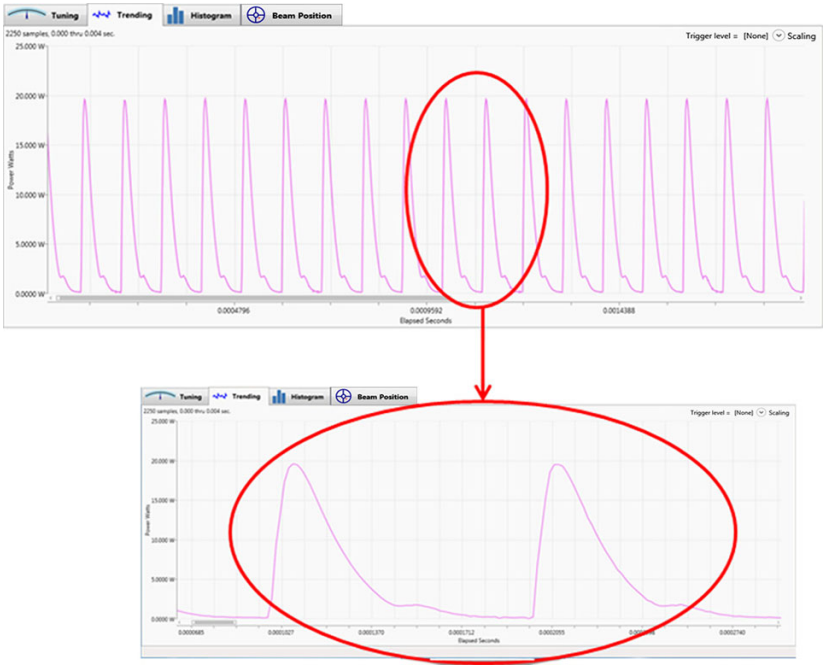

Figure 6-21. Trending – Zoom Example 2

Use the scroll bar to define a portion of the display (drag either the left or right handle in the scroll bar) or scroll the display (drag the scroll bar to the left or right), as shown in Figure 6-22.

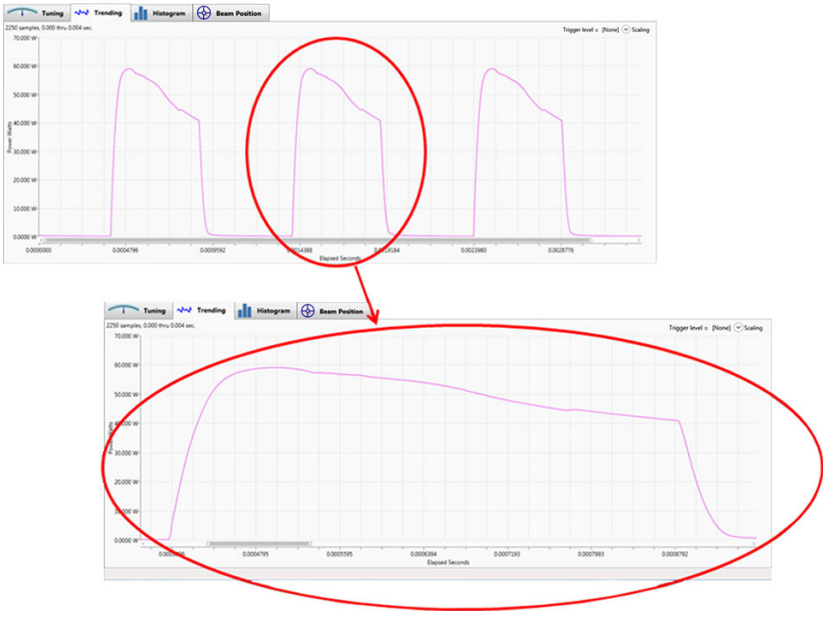

Figure 6-22. Trending – Zoom Example 3

6.3.1.12 Export Buffer Data to File

The menu option to **Export Buffer Data to File…** is available only if the Selection Cursors are active.

This command includes an option to export only that portion of the buffer marked by the left and right Cursors. This is useful for extracting interesting subsets of data from a capture buffer.

When you select **Export Buffer Data to File…**, the dialog box shown in Figure 6-23 is displayed:

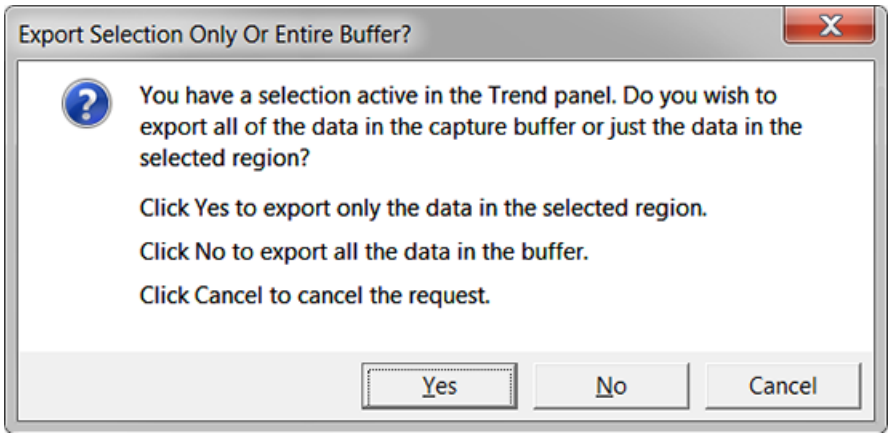

Figure 6-23. Trending – Export Data to File

6.3.1.13 Save Trend Image to File

The menu option to Save Trend Image to File… displays a standard Windows dialog box, where users can browse to the location to save the trend image.

6.3.2 Trending Options

Directly under the Trending tab is a bar, shown in Figure 6-24, that provides information about measurements, as well as selections to display dialog boxes for Pulse Analysis and Scaling.

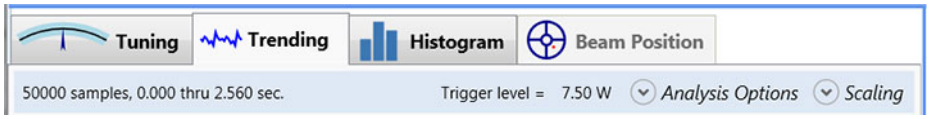

Figure 6-24. Trending – Information and Options Bar

Click the drop-down menu for Analysis Options or Scaling to select settings for those topics.

- Selecting Pulse Analysis Options from the drop-down menu in the Trending window is different than selecting Pulse Analysis Statistics to be displayed in the Statistics panel. Pulse Analysis can be done only on captured data (in the buffer) when the meter is not running.

- Scaling

6.3.3 Analysis Options

Pulse Analysis is a feature that analyzes captured data from high-speed PowerMax Pro sensors, detects pulse waveforms, and summarizes statistics about each one.

> **NOTE:** Pulse analysis is disabled for Energy data, for Pyroelectric sensors, and whenever the capture buffer contains no data.

Pulse Analysis includes:

- Examining individual data samples in order

- Determining when pulses start and stop

- Calculating and recording the resulting statistics

The analysis applies to the data between selection Cursor positions. Users can select individual pulses, multiple pulses, or the entire buffer for analysis.

When Pulse Analysis is enabled, the analysis computation is performed automatically each time any setting is changed in the user interface and each time data acquisition stops. The display in the Trending window is automatically updated and reflects the current results.

The overall shape is in the form of a “rectangle”, formed by a rather rapid “rise time” followed by a period where the signal stays more or less level, and then a “fall time” period where it returns to the baseline. The signal is “noisy” (displayed as jagged lines) before, during, and after the pulse.

Display and analysis options available in the Trending Chart window for Pulse analysis settings are shown in more detail in the sections that follow.

Pulse Analysis with PowerMax Pro sensors is not available when a standard LabMax Touch meter is used.

These functions require a LabMax Touch Pro meter:

- The drop-down menu for Analysis Options (shown in Figure 6-25):

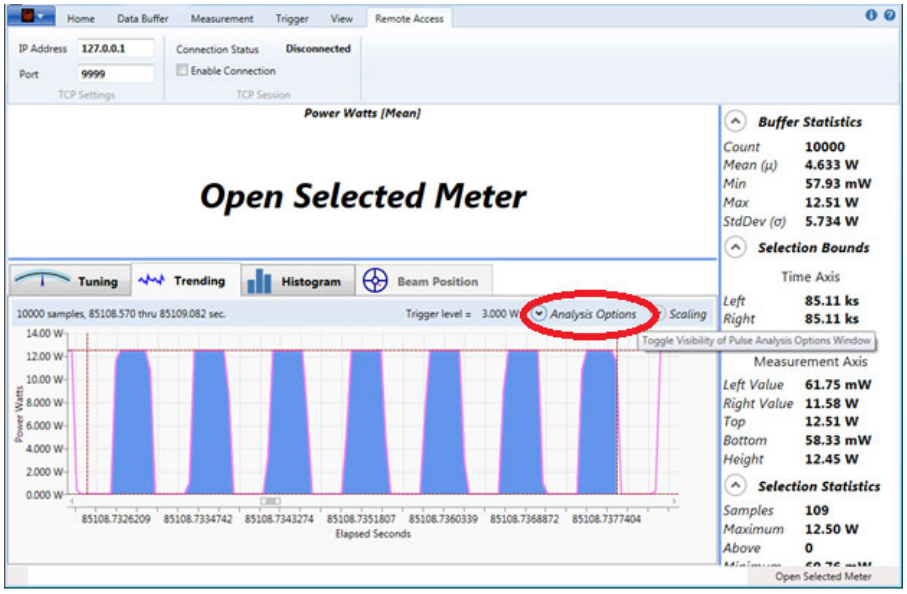

Figure 6-25. License Manager – Analysis Options

- The Pulse Analysis options in the window pop-up menu (shown in Figure 6-26):

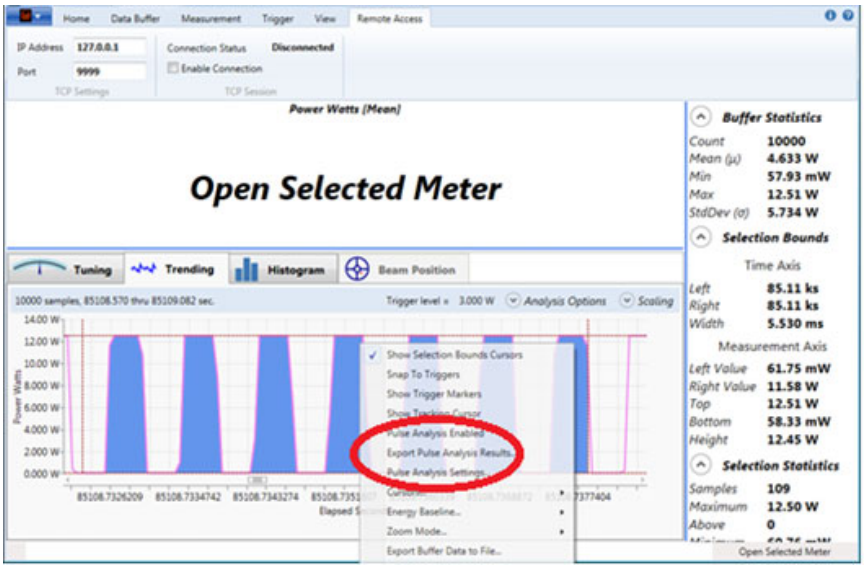

Figure 6-26. Pulse Analysis Context Menu Options

6.3.3.1 Enable Pulse Analysis

At the bottom of each tab in the Pulse Analysis Settings dialog box is the area shown in Figure 6-27:

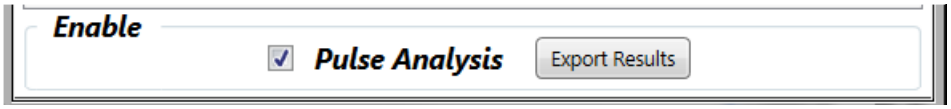

Figure 6-27. Trending – Enable Pulse Analysis

This check box enables or disables Energy calculations. You must enable Pulse Analysis to view any energy measurements or analysis results. Enabling Energy Analysis is only meaningful if Pulse Analysis is enabled.

Pulse Analysis may only be performed on Power measurements and is disabled for Energy data, for Pyroelectric sensors, and when the capture buffer contains no data.

Visibility of annotations in the Trending window depend on the other settings in the Display Options tab. Enabling Pulse Analysis necessitates also Enabling the Selection Cursors, which is done automatically when you turn on analysis.

The Export Results button allows you to export the Pulse Analysis results to an external file.

6.3.3.2 Threshold Level

The Threshold Levels tab is shown in Figure 6-28. Use this tab to view and change various threshold levels that affect pulse detection, as well as Rise Time and Fall Time calculations.

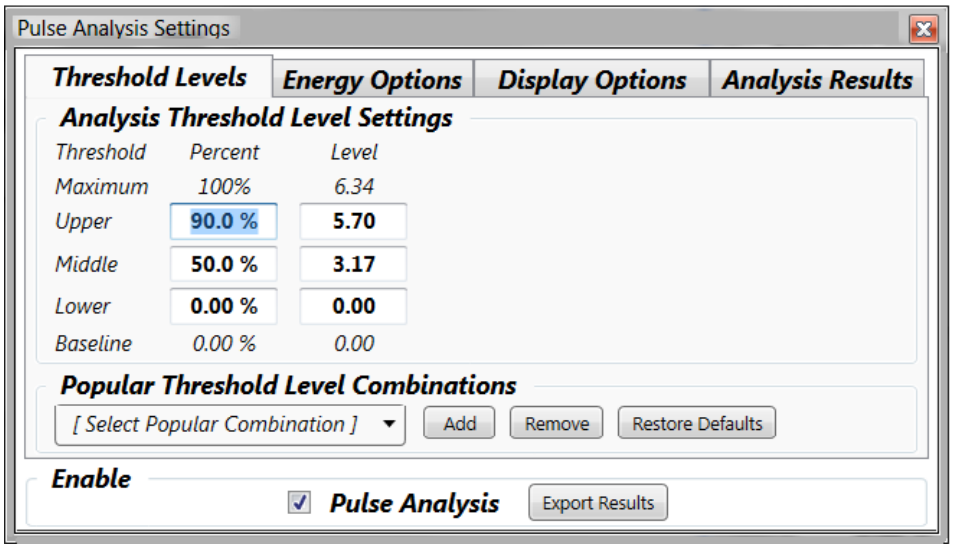

Figure 6-28. Trending – Pulse Analysis – Threshold Levels Tab

You can choose settings either by Percent value or Level value:

- Percent Value: Settings for this threshold level as percentage of the Maximum.
- Level Value: Settings for this threshold level as an absolute Measurement value.

Troubleshooting tips:

- If you find that you are not capturing pulses, restore the default settings. Settings can be changed using the menu above.
- Settings can also be changed by moving the trigger lines in the trending window. Sometimes these lines are moved when that was not intended.

6.3.3.3 Analysis Threshold Level Settings

Analysis depends on threshold values, listed in Table 6-3. To enable Pulse Analysis, click the check box at the bottom of the dialog box for Threshold Levels.

Table 6-3. Pulse Analysis Threshold Levels

Option	Description
Threshold	The maximum value inside the selected field.
• Upper Threshold	Used for Rise Time and Fall Time calculations.
• Middle Threshold	Used to display the middle crossing location.
• Lower Threshold	Used for rise time and fall time calculations.
• Energy Baseline	Used for energy calculations.
Percent	Threshold level as percentage of the Maximum.
Level	Threshold level as an absolute measurement value.

Thresholds are specified by the user either as an absolute power value or as a percentage of the maximum. For a given maximum, the figures are interchangeable.

The percentages define the levels relative to the baseline and the overall maximum of the pulse. By default, thresholds are set at 10%, 50% and 90%. Percentages are more useful overall because they automatically adjust to different power levels. Changing power level changes the height of the pulse, but the overall shape often remains much the same.

Thresholds may be easily changed—either drag the corresponding level markers on the chart or, in the Analysis Options dialog box, define settings on the Threshold Levels tab.

- The Upper Threshold must be as high as possible, but must be low enough to include all pulses.
- The Lower Threshold must be set above zero, high enough to exclude noise but low enough to capture the starting and ending points of all pulses.
- There is an additional setting for Middle Threshold. The setting does not play a direct role in analysis and is hidden by default in the Display Options dialog box. The Middle Threshold is provided if you want to measure Pulse Width in terms of the time between crossing the 50% levels.

If the waveform is noisy, the Upper Threshold must be low enough and the Lower Threshold must be high enough so that the noise does not detect extraneous pulses.

If you have an issues capturing pulse information, it is recommended that you reset the application to the factory default settings.

6.3.3.3.1 Thresholds Set Properly

The example in Figure 6-29 shows the Thresholds set properly. The Pulse Analysis chart zooms in on the last of the four pulses.

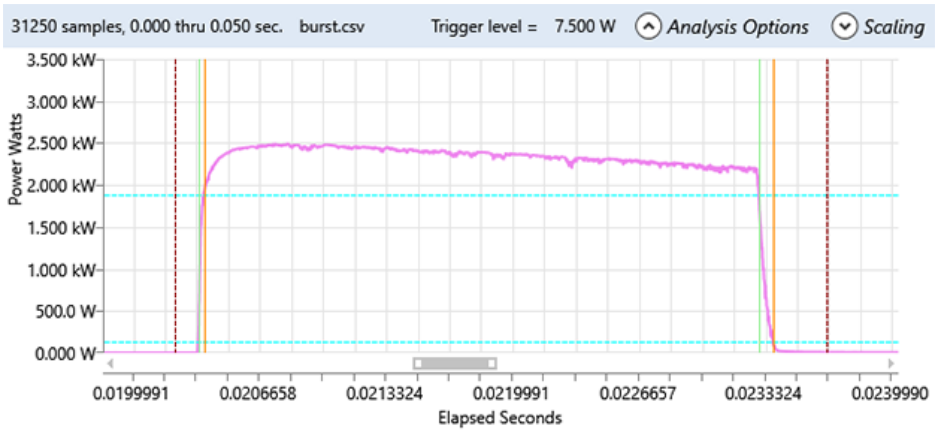

Figure 6-29. Threshold Levels Set Properly

- The Start times are green lines, the Stop times are red lines.
- The left pair is the Rise time, the right pair is the Fall time.
- Start and Stop times show the width of the Rise and Fall times for the pulse.

Note that the Start and Stop times for each of the rising and falling edges are close together. In this example, Statistics show 27.20 µSec and 75.20 µSec respectively.

6.3.3.3.2 Upper Threshold Too High

If the Upper Threshold level is set too high, the Fall time is grossly distorted. As shown in the example in Figure 6-30, the Fall time is distorted to almost half of the original pulse width (not desirable).

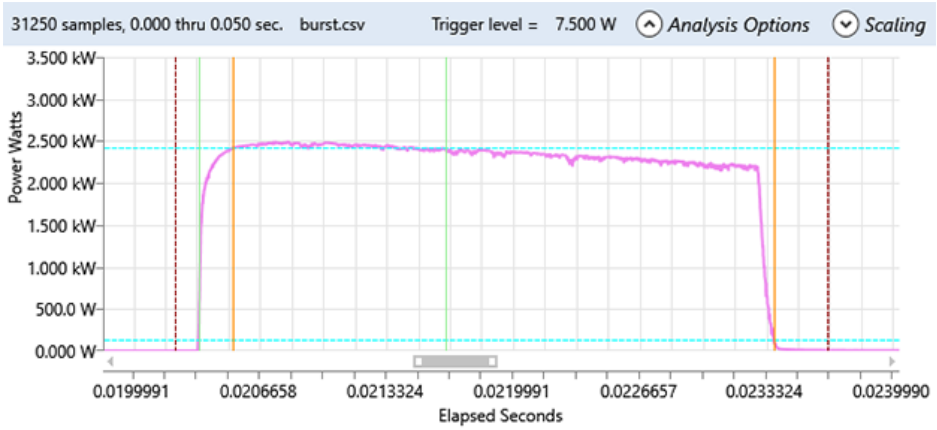

Figure 6-30. Upper Threshold Too High – Fall Time Distorted

If the Upper Threshold level is set way too high, the pulse is ignored, as in Figure 6-31.

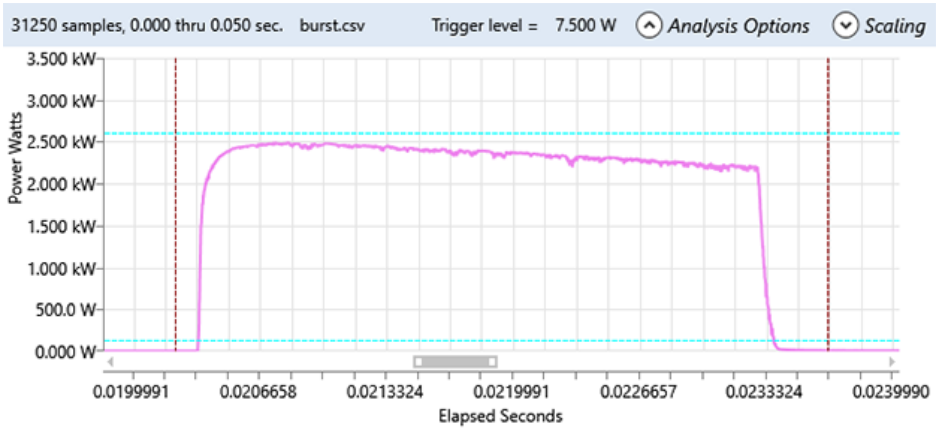

Figure 6-31. Upper Threshold Way Too High – Pulse Ignored

6.3.3.3.3 Lower Threshold Too Low

Similarly, if the lower level is too low, the pulse is not detected, as shown in Figure 6-32.

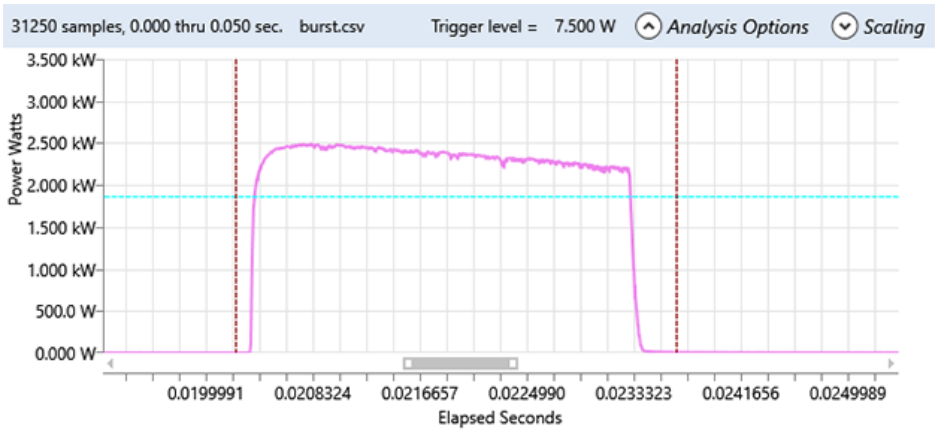

Figure 6-32. Lower Threshold Too Low — Pulse Not Detected

6.3.3.3.4 Popular Threshold Levels Combinations

The section in the lower half of the Threshold Levels dialog box allows you to set all percentages according to a previously saved configuration. Table 6-4 lists the options:

Table 6-4. Threshold Level Configurations

Option	Description
[Select Popular Combination]	Set all percentages according to a previously saved combination.
Add	Add current settings to the list of popular combinations. Settings are saved when you close the window for this tab.
Remove	Remove the current selection from the list of popular combinations. Settings are saved when you close the window for this tab.
Restore Defaults	Restore percentages to initial defaults.

6.3.3.4 Energy Options

Energy calculations are performed relative to a baseline measurements, which represents the lowest possible energy.

In integrating the power readings, this baseline is subtracted from each sample. The options to define the Energy Baseline, are listed in Table 6-5:

Table 6-5. Energy Baseline

Option	Description
Fixed Zero (0 mW)	The Energy Baseline is fixed at literal zero (0 mW) for all samples. This is the most common setting for energy calculations taken from power measurements.
Lower Cursor Level	The Energy Baseline value is determined by the lower Horizontal cursor measurement level.
Custom Setting	Define a custom value for the Energy Baseline.

The Energy Options tab is shown in Figure 6-33. These options affect Pulse Analysis energy calculations.

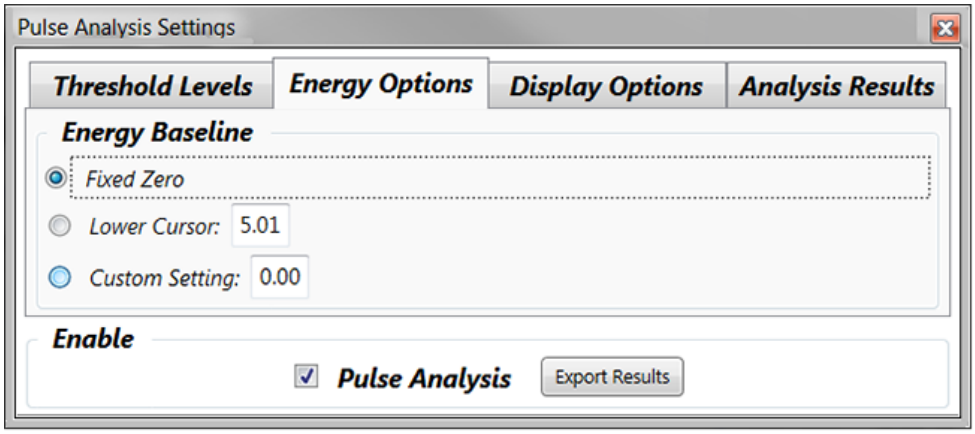

Figure 6-33. Trending – Pulse Analysis – Energy Options Tab

Energy is calculated from the sum of the power samples inside the pulse: the samples from Rise Start Time through Fall Stop Time.

The Energy Baseline is subtracted from measurements for each power sample when calculating energy, and measurements below this threshold are ignored. The purpose of this setting is that sometimes the power levels may be artificially elevated, and a non-zero baseline corrects for that

error. The Energy Baseline usually is zero, but may be overridden with an explicit value or by making it track the lower bounds of the Selection Cursor.

6.3.3.5 Display Options

Settings in the Display Options dialog box determine how Pulse Analysis inputs and outputs are displayed in the Trending chart. The default settings are shown in Figure 6-34.

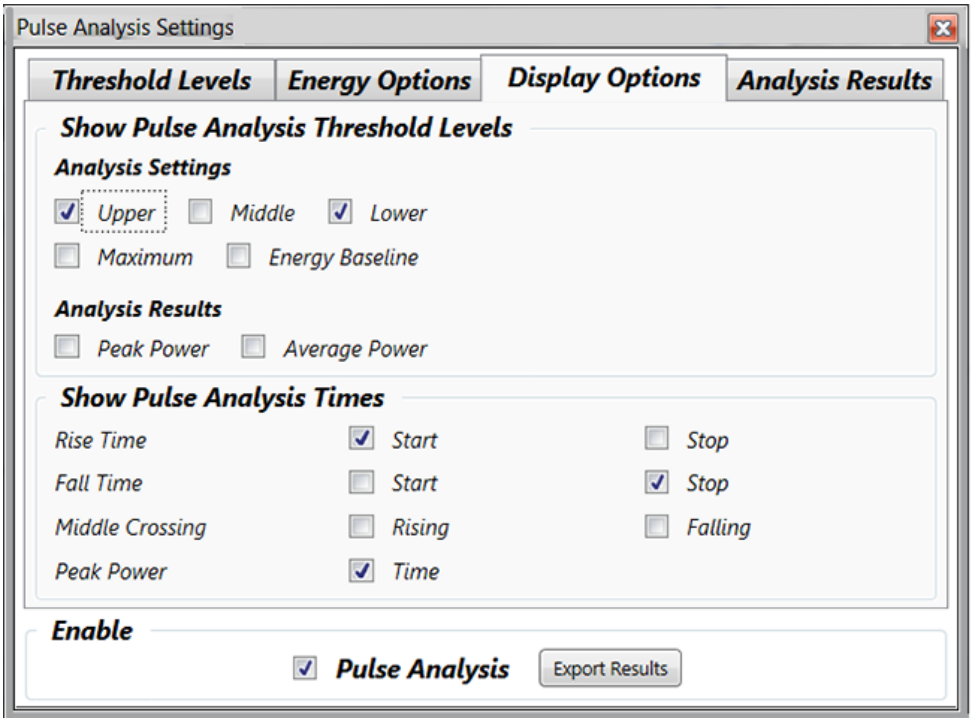

Figure 6-34. Trending – Pulse Analysis – Display Options Tab

Any changes are saved on exit and restored at start-up, and are persistent until settings are again changed.

6.3.3.5.1 Show Pulse Analysis Threshold Levels

There are two categories of annotations in the top half of the dialog box.

- Analysis Settings: Horizontal lines showing input levels to the analysis process
- Analysis Results: Horizontal lines showing the results of the analysis

These settings control the visibility of horizontal line annotations in the Trending window, which show the current Threshold Level Settings relevant to analysis.

Two additional levels affect Pulse Analysis. These are two dashed solid dark red horizontal lines, showing the calculated maximum and minimum levels inside the capture buffer. They correspond to the 0% and 100% levels (although this default maximum may be manually overridden).

Table 6-6 shows the settings for Analysis Settings, which control the visibility of horizontal line annotations in the trend window showing the current input levels to the analysis process.

Table 6-6. Display Options — Threshold Analysis Settings

Setting	Description
Upper	Controls visibility of annotations in the Trending window that show the current Upper level setting used for analysis.
Middle	Controls visibility of annotations in the Trending window that show the current Middle level setting used for analysis.
Lower	Controls visibility of annotations in the Trending window that show the current Lower level setting used for analysis.
Maximum	Controls visibility of annotations in the Trending window that show the current Maximum Settings used for analysis. This setting controls the level values for the other three thresholds, which are based on a percentage of this level.
Energy Baseline	Calculated energy of the pulse. In Energy calculations, power measurements below this baseline value are ignored. Normally this baseline is zero, and thus does not affect energy calculations. This setting is included for the rare case where power measurements are known to be uniformly artificially high. In such a case, the baseline may be used to correct the measurements in order to accurately compute energy.

Table 6-7 shows the settings for Analysis Settings. These settings control the visibility of horizontal line annotations in the trend window showing the current results levels from the analysis process.

Table 6-7. Display Options — Threshold Analysis Results

Setting	Description
Peak Power	Peak Power is the largest power measurement inside the body of the pulse, with the Peak Power reading recorded for each pulse in Energy calculations. This is the maximum measurement value found above the upper threshold, regardless of the baseline. • If checked, a horizontal line is drawn in the Trending window that shows the Mean value of the Peak Power levels of all the pulses in the analysis region. • If only a single pulse is selected, then this line shows the Peak Power level for that one pulse.
Average Power	In Energy calculations, an average is computed of all the power measurements included in an energy calculation. This excludes the power readings prior to the Energy Start time, and trailing after the Energy Stop time. • If this is checked, a horizontal line is drawn in the Trending window that shows the Mean value of the Average Power levels of all the pulses in the analysis region. • If only a single pulse is selected, then this line shows the mean power level for that one pulse.

6.3.3.5.2 Show Pulse Analysis Times

Pulse Analysis Times controls the visibility of vertical line annotations in the Trending window. The vertical lines show the current times of various events resulting from Pulse Analysis, one for each possible transition in the analysis process.

Table 6-8 shows the settings for the bottom half of the Display Options dialog box:

Table 6-8. Display Options — Pulse Analysis Times

Value	Description	
Rise Time	Before the analyzer can begin analyzing a pulse, it needs to see one or more samples that are below the Lower threshold. Samples prior to that point are ignored. If analysis starts or ends in the middle of a pulse, those partial pulses are discounted from the analysis.	
	Start	As soon as a sample is seen that is Above the Lower threshold, that marks the start of rise time.
	Stop	As soon as a sample is seen that is above the High threshold, rise time calculation stops.

Table 6-8. Display Options — Pulse Analysis Times (continued)

Value	Description	
Fall Time	The time between these two events is the pulse's Fall Time. Following fall time stop, the pulse is in back the Searching State.	
	Start	As soon as a sample is seen that is Below the Upper threshold while running, Fall Time Start marks the possible start of fall time.
	Stop	Once falling, as soon as a sample is seen that is below the Lower threshold, Fall Time Stop marks the end of fall time.
Middle Crossing	Checking this option causes a vertical line to be drawn where the Rising and Falling crossings occur.	
Peak Power	Time	Time stamp for the Peak Power Level sample. (Peak Power and Height are the same in the common case where the baseline is zero.) This check box displays a vertical line through the corresponding sample for each pulse in the analysis region. The line consists of alternating long and short sections, similar to a center line in drafting.

6.3.3.5.3 Rise Time

The time between these two events is the pulse's Rise Time. Following the rise time, the pulse is in the Running State. Rise time calculations may encounter zero or more samples between the lower and upper thresholds. For very fast rise times (that is, one sample below the lower threshold, followed by a second sample above the upper threshold), the rise time may appear to be instantaneous. Such fast rise times necessarily are reported as zero, which means too fast to measure.

On the other extreme, there may be false starts to rise time (that is, if the signal rises above the lower threshold, but then falls below it again without ever crossing the upper threshold)—that is a **false start**. The analyzer ignores this partial pulse, and resumes searching for the start of another pulse.

6.3.3.5.4 Fall Time

The actual fall time is a transition below the upper threshold, which eventually falls below the lower threshold without ever rising again above the upper threshold. The pulse is accepted, and added to the accumulate pulse analysis statistics.

The time difference between the crossing of the upper threshold and the crossing of the lower threshold is reported as the Fall Time for the pulse. As with Rise time, the Fall Time calculations may encounter zero or more samples between the upper and lower thresholds. Such fast fall times necessarily are reported as zero, which means too fast to measure.

Similarly, there may be false starts to fall time (that is, if the signal drops below the upper threshold but then returns above it -- that is a false start. The analyzer ignores the false start and waits for another candidate start of fall time.

6.3.3.5.5 Middle Crossing Time

Separately from—and completely independent of Rise and Fall times—analysis tracks the times that the middle threshold is crossed. It is crossed initially sometime during the rise time transition, and finally sometime during the fall time transition.

Checking this option causes a vertical line to be drawn where these crossings occur.

These transitions are recorded for whatever use people may have for them. That is, some consider pulse width to be the time between the two middle crossings, rather than Rise Start and Fall Stop.

6.3.3.5.6 Peak Power

Peak Power Time, Peak Power level, and overall pulse Height are also computed by the Energy Calculator. The Height is the Peak Power level minus the Energy Baseline. (Peak Power and Height are the same in the common case where the baseline is zero.)

The charts that follow illustrate Peak Power Times and Levels:

- Red dashed lines show the left and right bounds of the analysis. (The dashed lines also show the upper and lower bounds, too, which are irrelevant for this example.)
- Peak Power Times are displayed as vertical red annotations with long and short dashes.
- The Average Peak Power Level is shown by a solid, orange line.

Figure 6-35 shows how the chart for the Peak Power Level and Peak Power Time are displayed in the Trending window:

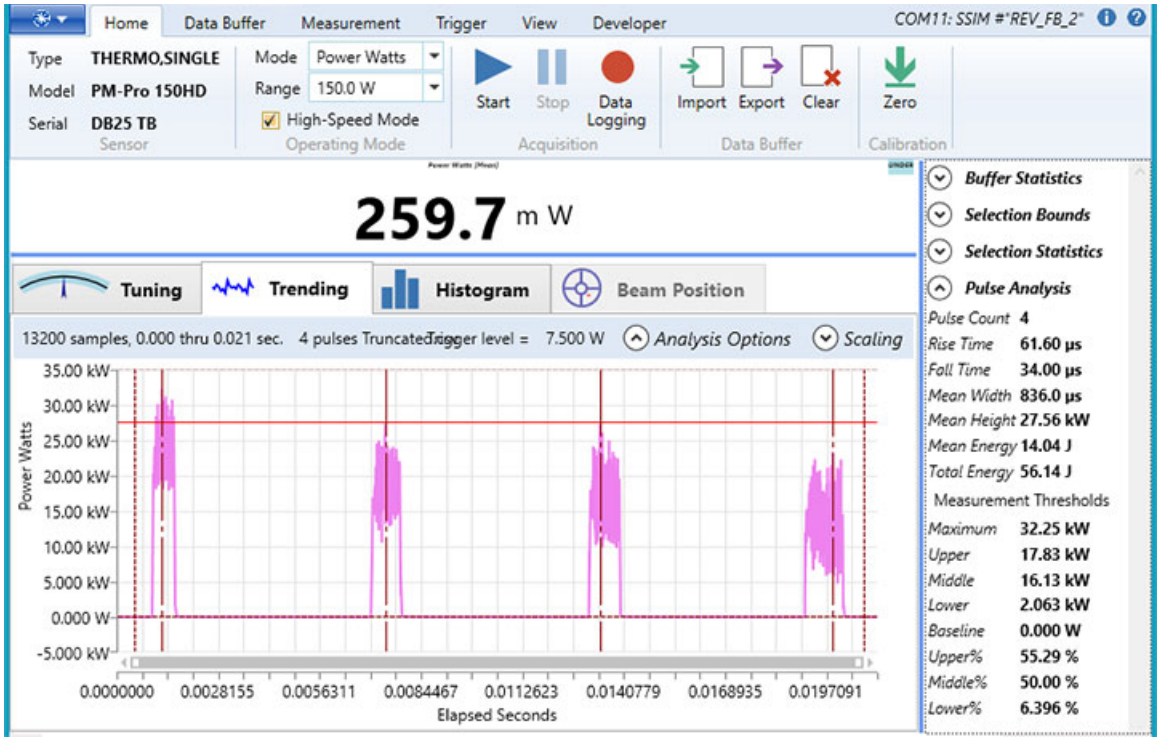

Figure 6-35. Peak Power — Levels and Time

If you move the left and right bounds, the annotations and statistics all change accordingly, as shown in Figure 6-36:

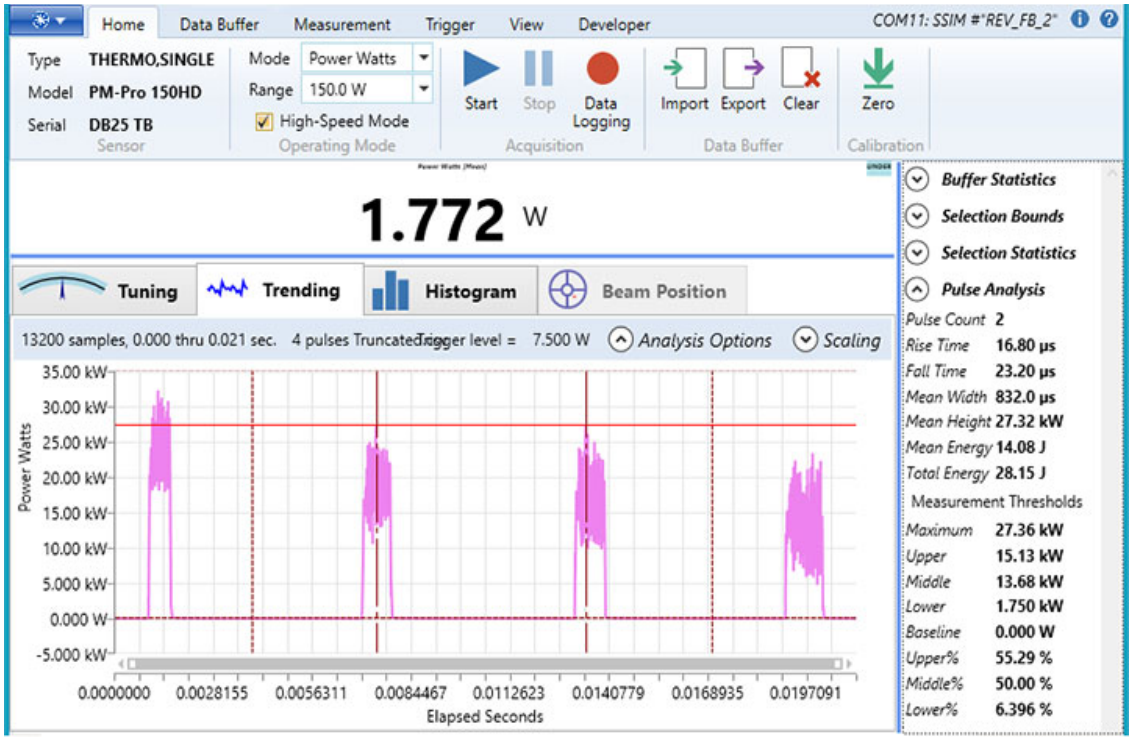

Figure 6-36. Peak Power — Shift Bounds

6.3.3.6 Analysis Results

An example of the Analysis Results tab is shown in Figure 6-37:

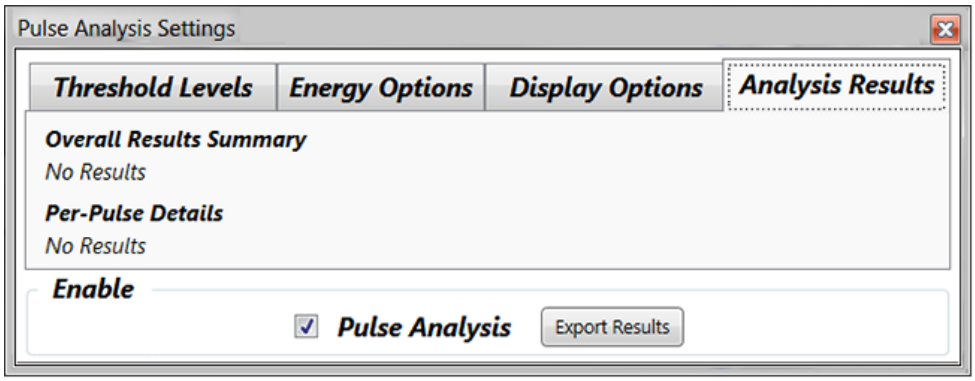

Figure 6-37. Trending – Pulse Analysis – The Analysis Results Tab

After a measurement is run, the tab displays more information, as shown in 'Trending – Analysis Results After Measurement' (p. 115):

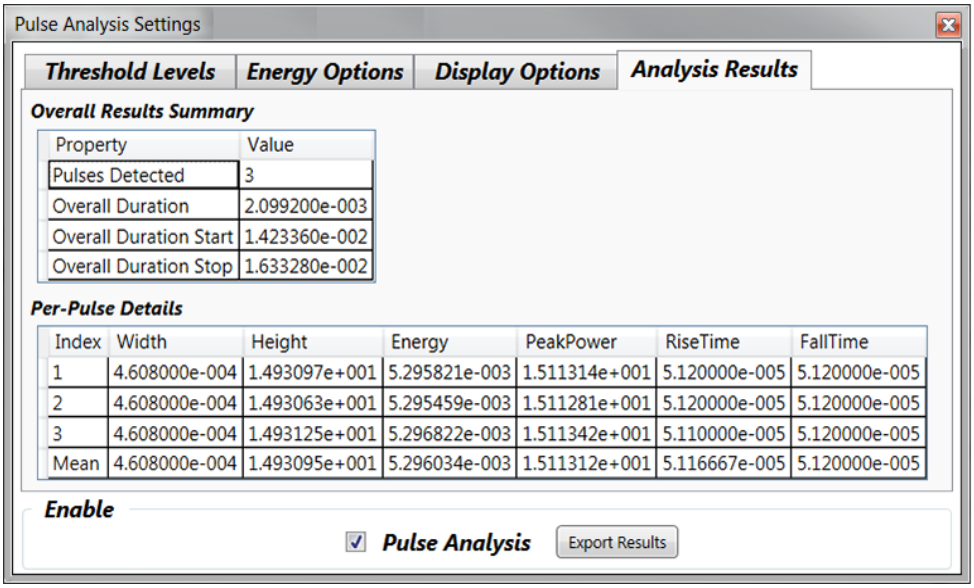

Figure 6-38. Trending – Analysis Results After Measurement

6.3.3.6.1 Overall Results Summary

This tab lists a summary of the overall results as well as per-pulse details, shown in Table 6-9:

Table 6-9. Overall Analysis Results

Option	Description
Pulses Detected	A count of the number of pulses found.
Overall Duration	The overall duration of the sequence of pulses analyzed from to Overall Duration Start to Overall Duration Stop.
Overall Duration Start	The starting time of the first pulse.
Overall Duration Stop	The ending time of the last pulse.

6.3.3.6.2 Pre-Pulse Details

There is one row for each pulse detected, and one additional row for the Mean values of all rows in each column. Per-Pulse details are shown in Table 6-10:

Table 6-10. Per-Pulse Analysis Results

Option	Description
Index	Index of the pulse (1. Count), or “Mean” for the Means row.
Width	The width of the pulse, measured as' FallStopTime' minus 'RiseStartTime'.
Height	Equals Peak Power – Baseline.
Energy	Energy calculation for this pulse.
Peak Power	The maximum power reading of a pulse (without subtracting baseline).
Rise Time	The time it takes for the signal to transition from below the Lower Threshold until above the Upper Threshold, measured as 'RiseStopTime' minus 'RiseStartTime'.
Fall Time	The time it takes for the signal to transition from above the Upper Threshold until below the Lower Threshold, measured as 'RiseStopTime' minus 'RiseStartTime'.

6.3.4 Scaling Dialog Box

The Scaling option defines the maximum and minimum values for both measurement and time. Use this option to adjust vertical and horizontal axes for measurement and time, and define the maximum and minimum values for each.

To select this option, click the down arrow next to Scaling in the information and options bar directly under the Trending tab. The Trend Chart Scaling dialog box shown in Figure 6-39 is displayed:

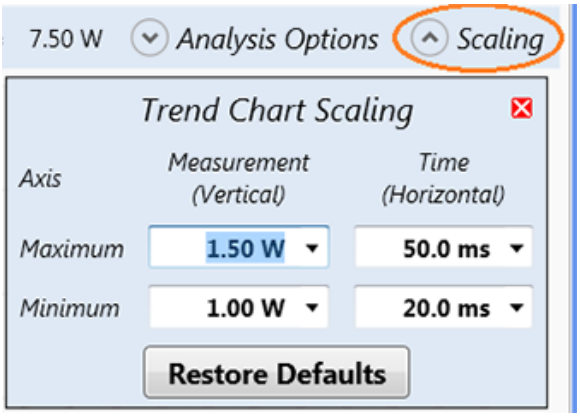

Figure 6-39. Trending – Scaling Dialog Box

After a meter is opened, each setting is populated with a selection of values. Use the drop-down menu shown in the example in Figure 6-40 to choose the values needed to use for the measurement.

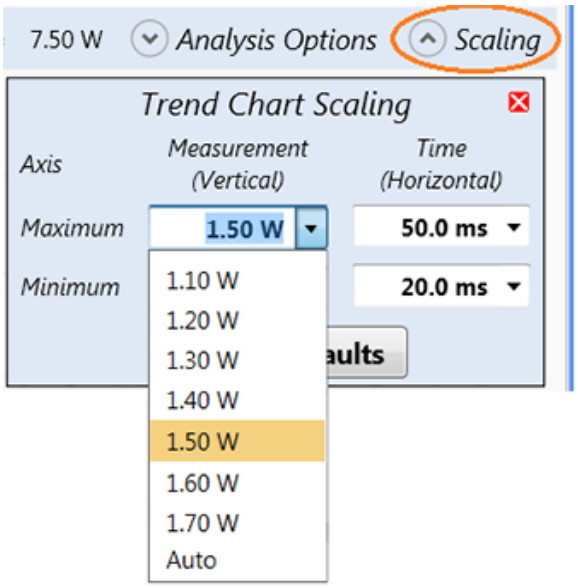

Figure 6-40. Trending – Scaling Settings Drop-Down Menus

Close the window by clicking the red ‘x’ in the top-right corner of the dialog box.

6.4 Histogram Panel

The Histogram panel is shown in Figure 6-41:

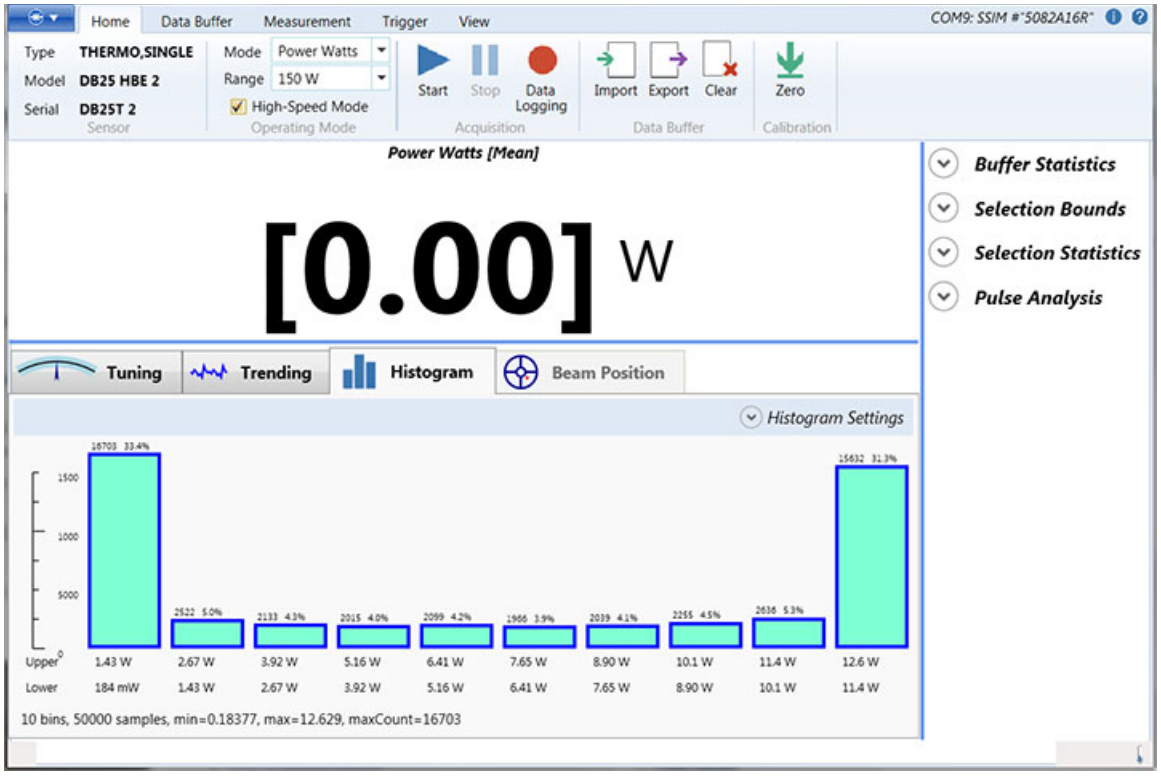

Figure 6-41. Histogram Panel

Displays in the Histogram panel vary, depending on the shape of the signal (sine wave, square wave, or spikes). A quick view of the Histogram panel can be used to differentiate or verify the type of signal.

To determine which options are displayed in the Histogram window, select the drop-down menu for Histogram Settings in the bar above the panel. The dialog box shown in Figure 6-42 is displayed. Scroll to view all options:

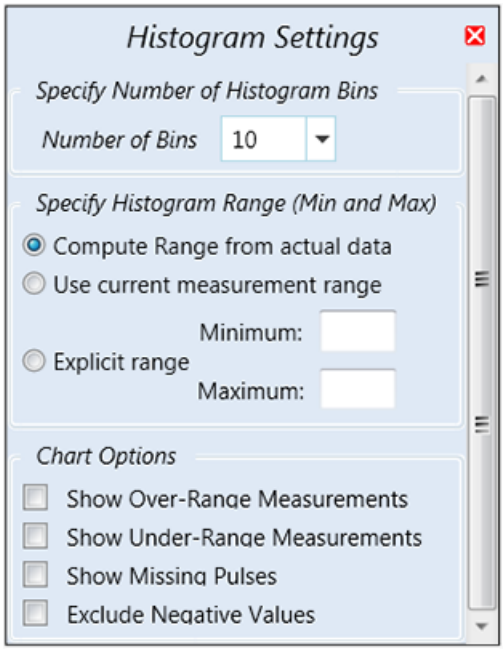

Figure 6-42. Histogram – Settings Dialog Box

There are three areas in which you can change settings in the Histogram window:

- Specify Number of Histogram Bins
- Specify Histogram Range (Minimum and Maximum)
- Chart Options

6.4.1 Specify Number of Histogram Bins

In this section, select the number of histogram bins to be used for the analysis. You can choose a value for the number of bins from 2 to 24 from the drop-down menu.

6.4.2 Specify Histogram Range

A Histogram confines its analysis to a specific range of values. Values inside that range are tallied into equal width ‘bins’.

- Values above that range are tallied as Over Range.
- Values below that range are tallied as Under Range.

There are several different ways to specify those ranges. Hover over the individual controls in this section for more detail.

Use the settings listed in Table 6-11 to specify ranges.

Table 6-11. Histogram Range

Option	Description
Compute range from actual data	A Histogram is confined to data between the minimum and maximum actual values contained in the current buffer. • Data below the minimum is classified as Under Range. • Data above the maximum is classified as Over Range.
Use current measurement range	A Histogram is confined to data between 0 (the minimum value) and the maximum value in the currently selected operating range. • Data below 0 is classified as Under Range. • Data above the maximum range is classified as Over Range.
Explicit range	A Histogram is confined to data between the two explicit values that you enter. • Data below the minimum is classified as Under Range. • Data above the maximum is classified as Over Range.

6.4.3 Chart Options

Several options affect the number of columns in the chart. Click a check box to display columns in the chart, listed in Table 6-12:

Table 6-12. Chart Options

Option	Description
Show Over-Range Measurements	Displays a column summarizing the number of Over Range samples.
Show Under-Range Measurements	Displays a column summarizing the number of Under Range samples.

Table 6-12. Chart Options (continued)

Option	Description
Show Missing Pulses	Displays a column summarizing the number of Missing Pulses found in the Histogram data.
Exclude Negative Values	Chart displays a column summarizing the number of negative samples in the Histogram data. Power and Energy measurements theoretically cannot be negative. However, samples may occur in practice due to electrical noise, calibration, and other errors. Use this option to exclude negative values from analysis; otherwise, negative values are included and affect the results.

6.4.4 Save/Export Histogram Data

After you take measurements, right-click in the Histogram window to display a pop-up menu. This allows users to:

- Export Histogram Data to File, or
- Save Histogram Image to File

These commands display a standard Windows dialog box, where you can browse to the location to save the exported file or Histogram image.

Specify a unique destination file name so files are not over-written with later actions to Export or Save.

6.5 Beam Position Panel

The Beam Position window is shown in Figure 6-43:

The Beam Position window shows the current beam position in real time, and charts the x and y offsets as a function of time. This window is available only when used with position-sensing thermopile sensors.

Use the Zoom feature in this window using the drop-down menu near the top of the Beam Position tab window.

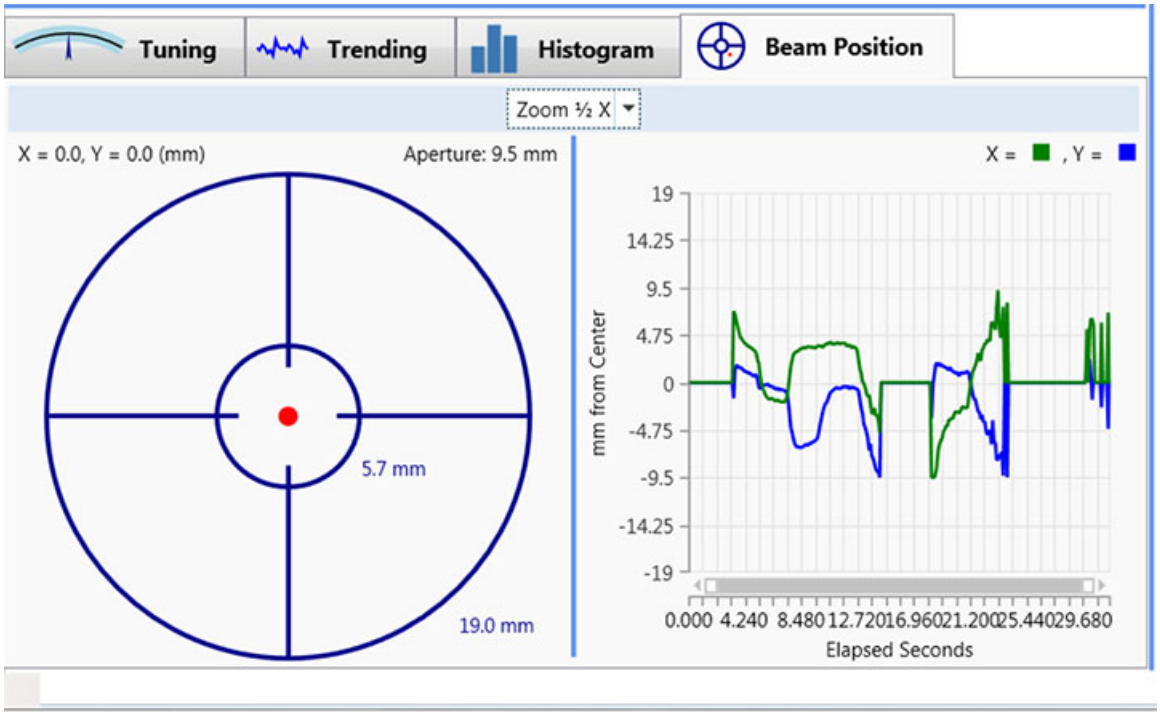

Figure 6-43. Beam Position Panel

6.6 Diagnostics Panel

NOTICE

This panel is only visible when a sensor device that supports these features is used.

This tab shows water flow rates and temperatures for supported sensors such as the PowerMax 10kW/15kW Sensors. Refer to the example in Figure 6-44.

For more details about flow rate and temperature plots, refer to the user manual for the sensor being used.

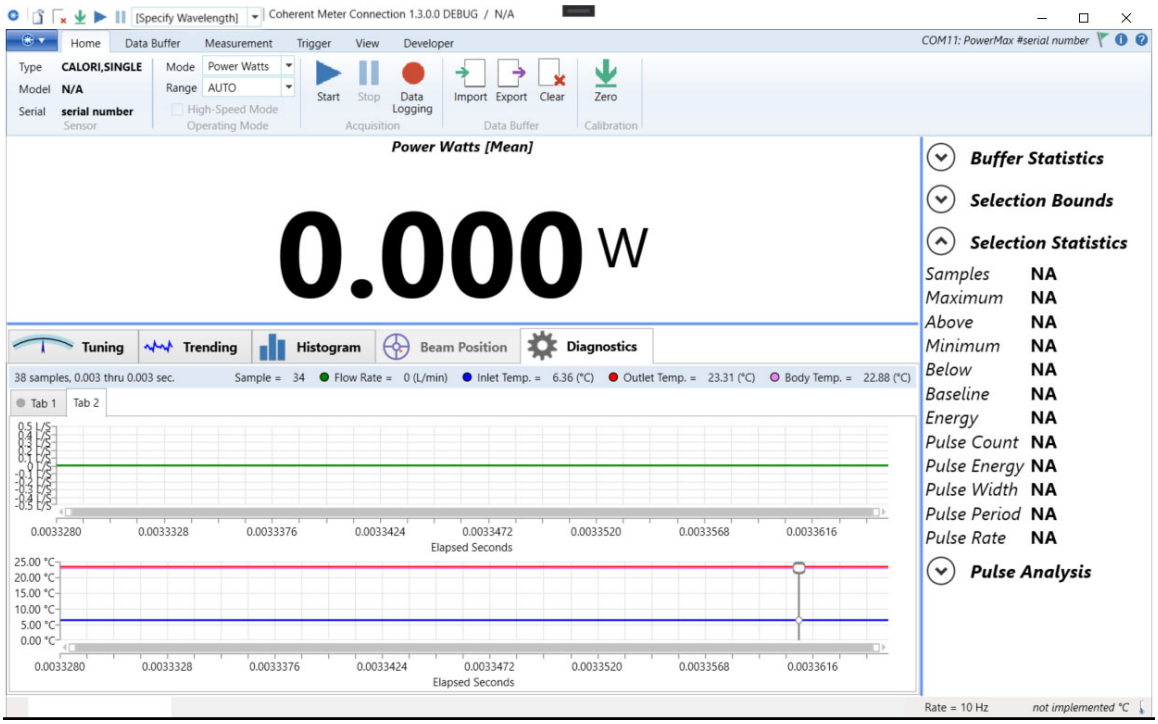

Figure 6-44. Diagnostics Panel

7 Statistics and Pulse Analysis

This section describes the Statistics panel in the Coherent Meter Connection software.

The Statistics panel always shows the actual number of trigger events present in the buffer at the time the display updates. The Statistics panel provides data for:

- 'Buffer Statistics' (p. 126)
- 'Selection Bounds' (p. 129)
- 'Selection Statistics' (p. 132)
- 'Pulse Analysis' (p. 135)

For information about how to take measurements using the Coherent Meter Connection software, see 'Measurement Modes' (p. 141).

7.1 Buffer Statistics

Figure 7-1 shows the Buffer Statistics section of the Statistics panel. These statistics are computed for the entire contents of the Capture buffer.

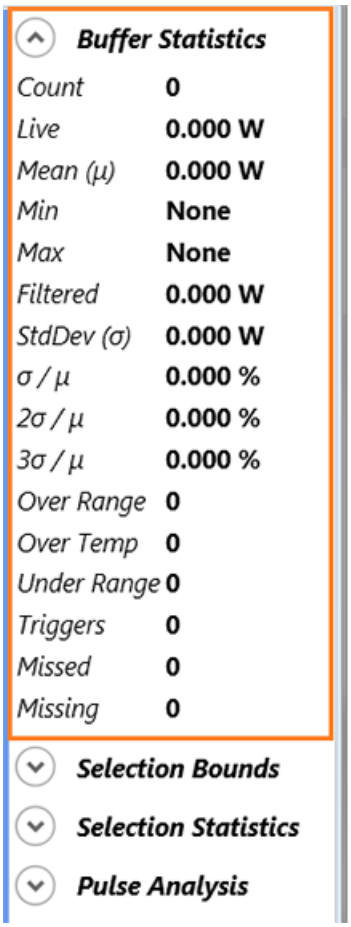

Figure 7-1. Statistics – Buffer Statistics Panel

Table 7-1 describes the Buffer Statistics section:

Table 7-1. Description of Buffer Statistics

Statistic	Description
Count	The total number of samples used to calculate these statistics.
Live	The most recent sample in this collection of samples.

Table 7-1. Description of Buffer Statistics (continued)

Statistic	Description
Mean (μ)	The arithmetic mean -- the sum of all measurements divided by total number of samples (Count).
Min	Minimum – The numerically smallest of all measurements.
Max	Maximum – The numerically largest of all measurements.
Filtered	A simple filter applied to the most recent 32 samples.
StdDev (σ)	Standard Deviation, represented by the Greek letter sigma (σ), is a measure of how much sample data varies from its mean. • A low standard deviation indicates that most of the data tend to be very close to the mean. • A high standard deviation indicates that the data are dispersed much more widely around the mean. It is common to consider a normalized version of standard deviation (σ) by dividing it by the mean of the sample data (μ). Some intervals are two or three standard deviations wide.
σ/μ	
2σ/μ (Stability)	
3σ/μ	
Over Range	A count of how many samples were marked Over Range by the meter. Samples are so-marked if they come within 90% of the maximum possible value that can be represented by the measurement electronics. Over Range indicates that measurement precision can be improved when a higher fixed range is set. If the meter is already in the highest range, then it indicates that the measurement capacity of the instrument has been exceeded.
Over Temp	A count of how many samples were marked Over Temperature by the meter. Samples are so-marked if their reported temperature exceeds a maximum threshold that is appropriate for that sensor. Over Temperature indicates that the sensor is overheating, and that it must be cooled down before continued use. **CAUTION!** Failure to do so can damage the sensor.
Under Range	Meter flags samples that are too small for the current fixed range. Under Range indicates that measurement precision can be improved when a lower fixed range is set.
Triggers	A count of all the samples in the capture buffer that match the trigger criteria, as specified in the Trigger tab.

Table 7-1. Description of Buffer Statistics (continued)

Statistic	Description
Missed	Missed Pulses — In High-Speed Energy Mode, the measurement hardware expects a pulse to be displayed inside each Measurement Window. If an expected pulse is not detected, then the corresponding sample is marked as having a missing pulse. The measurement hardware is reset and begins searching for the next pulse. A typical remedy for Missed Pulses is to increase the Window Size on the Measurement tab.
Missing	Missing Samples – Sometimes the PC software cannot keep up with the data stream from the instrument, and a buffer internal to the instrument overflows. When this happens, the meter firmware flags some of the subsequent samples as “Missing” to indicate where in the data stream this omission happened. The missing data is lost forever and cannot be recovered. One remedy to prevent missing samples is to increase the Decimation setting on the Measurement tab. (A setting of 2 or 3 is usually sufficient.) Also make sure that no other applications are running and that computer resources are devoted to this application.

Figure 7-2 shows the context menu available when you right-click in the Buffer Statistics section of the panel. All statistics are enabled (displayed) by default. Toggle the check box next to selected statistics to show or hide that option.

Figure 7-2. Statistics – Buffer Statistics Context Menu

7.2 Selection Bounds

NOTICE
For standalone meter use, this section only applies with the use of the LabMax Pro SSIM and LabMax Touch Pro meters combined with a PowerMax Pro sensor.
It also applies to the USB/RS PowerMax Pro sensors.

Selection Bounds are only available when cursors are enabled and the meter is not running. These are properties of the boundaries for the selected region, as determined by the position of the cursors.

NOTE: When taking a measurement with a pyroelectric sensor, the Selection Bounds panel displays Pulse ID Axis values (rather than Time Axis values).

Cursors are enabled or disabled on the Trending window. Vertical lines represent sample time positions and horizontal lines represent measurement levels.

To enable or disable Selection Bounds Cursors:

1. Right-click in the Trending window to display the context menu.
2. Verify that the check box is selected to show the Show Selection Bounds Cursors.

Figure 7-3 shows the options in the Selection Bounds section of the Statistics panel:

Figure 7-3. Statistics – Selection Bounds Panel

Table 7-2 describes the statistics in the Selection Bounds section:

Figure 7-4 shows the context menu available when you right-click in the Selection Bounds section of the Statistics panel. All statistics are enabled (displayed) by default. Toggle the check box next to selected statistics to show or hide that option.

Table 7-2. Statistics for Selection Bounds

Axis	Statistic	Description
Time	Left	Left cursors are Vertical line that mark the leftmost/smallest Time-Axis value for the selected region.
	Right	Right cursors are Vertical line that mark the rightmost/largest Time-Axis value for the selected region.
	Width	Displays the time interval between the left and right cursors.
Measurement	Left Value	Displays the measurement value of the leftmost/first value in the selected region.
	Right Value	Displays the measurement value of the rightmost/last value in the selected region.
	Top	The Top cursor position is a Horizontal line that indicates the topmost/largest Measurement-Axis value for the selected region.
	Bottom	The Bottom cursor position is a Horizontal line that indicates the lowest/smallest Measurement-Axis value for the selected region.
	Height	The Cursor Height displays the difference in amplitude between the Top and Bottom cursors.

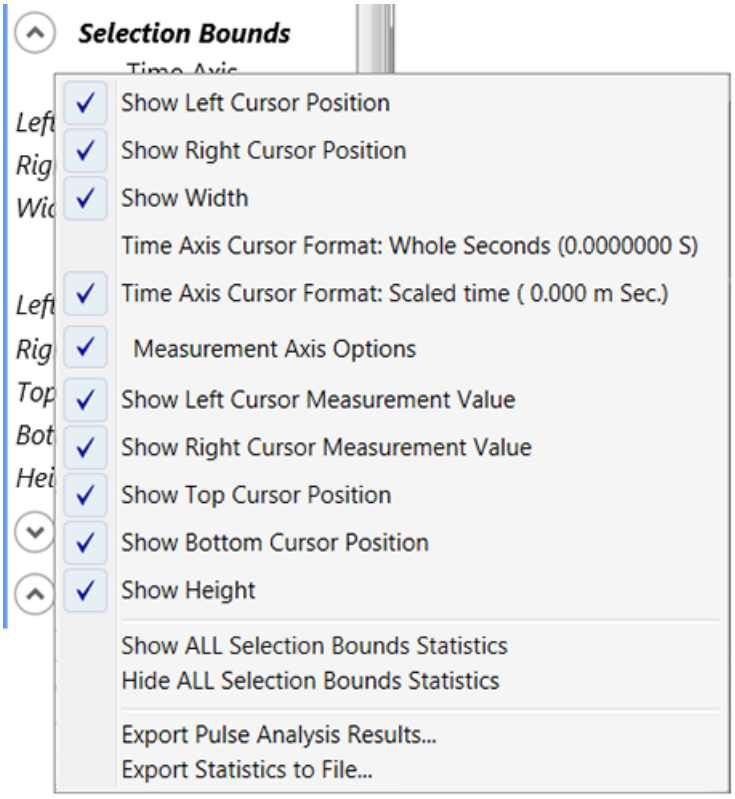

Figure 7-4. Statistics – Selection Bounds Context Menu

7.3 Selection Statistics

NOTICE
For standalone meter use, this section only applies with the use of the LabMax Pro SSIM and LabMax Touch Pro meters combined with a PowerMax Pro sensor.
It also applies to the USB/RS PowerMax Pro sensors.

These statistics are computed for the buffer contents in the selected region, as determined by the position of the Cursors.

Selection Statistics are only available when cursors are enabled and the meter is not running. Cursors are enabled or disabled on the context menu in the Trending window.

Figure 7-5 shows the Selection Statistics section of the Statistics panel.

Table 7-3 describes the Selection Statistics section:

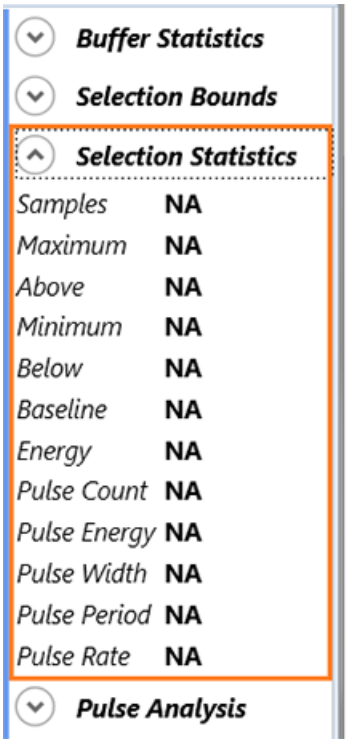

Figure 7-5. Statistics – Selection Statistics Panel

Table 7-3. Description of Selection Statistics

Statistic	Description
Samples	Total number of samples in the selected region.
Maximum	Maximum amplitude of the samples in the selected region.
Above	Total number of samples in the selected region with amplitude higher than the top Cursor.
Minimum	Minimum amplitude of the samples in the selected region.
Below	Total number of samples in the selected region with amplitude lower than the bottom Cursor.
Baseline	Displays the amplitude being used as the minimum level for energy computations. The baseline can either be fixed at 0.0 or assigned the amplitude of the bottom Cursor.
Energy	Displays the calculated energy of the waveform in the selected region. The calculation is an integration of the power readings over the time interval inside the selection. The calculation yields NaN if the selected region does not contain power measurements.

Table 7-3. Description of Selection Statistics (continued)

Statistic	Description
Pulse Count	Pulses displays the number of pulses (trigger events) contained in the selected region. [For all of these 'pulse' entries we will specify applicability for LM Touch Pro vs non-Pro models - coming from Peter]
Pulse Energy	Displays the average energy of the pulses in the selected region. This is calculated from the total energy in the region divided by the number of pulses (trigger events). This calculation is more realistic if the Snap To Triggers setting is selected in the context menu for the Trending window.
Pulse Width	Displays the average width of the pulses in the selected region. It is calculated from the total width (time) of the region divided by the number of pulses (trigger events). This calculation does not depend on Snap To Triggers setting.
Pulse Period	Displays the average period of the pulses in the selected region. It is calculated from the width (total time) of the region divided by the number of pulses (trigger events). This calculation is more realistic if the Snap To Triggers setting is selected in the context menu for the Trending window.
Pulse Rate	Displays the average frequency of the pulses in the selected region, calculated from the inverse of the Pulse Period. This calculation is more realistic if the Snap To Triggers setting is selected in the context menu for the Trending window.

Figure 7-6 shows the context menu available when you right-click in the Selection Statistics section of the panel. All statistics are enabled (displayed) by default. Toggle the check box next to selected statistics to show or hide that option.

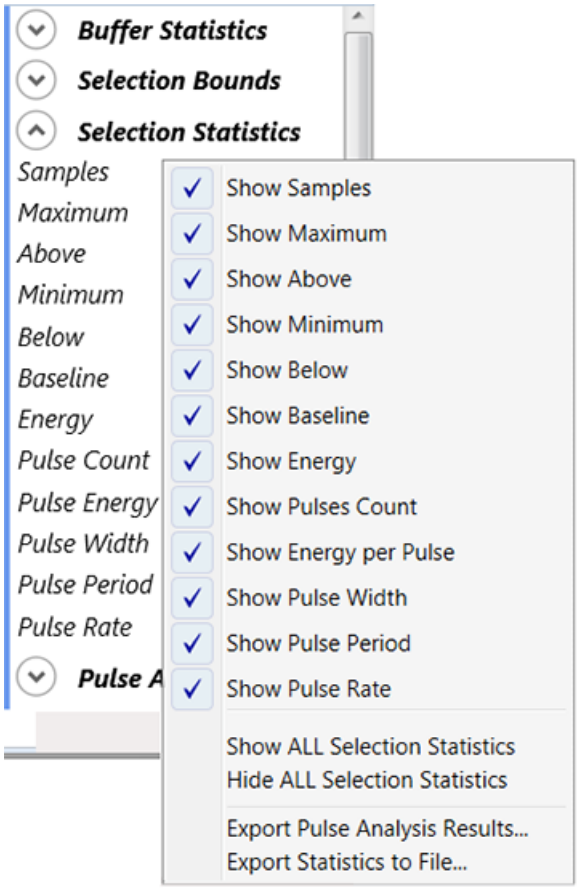

Figure 7-6. Statistics – Selection Statistics Context Menu

7.4 Pulse Analysis

NOTICE
For standalone meter use, this section only applies with the use of the LabMax Pro SSIM and LabMax Touch Pro meters combined with a PowerMax Pro sensor.
It also applies to the USB/RS PowerMax Pro sensors.

A Pulse is defined as a sequence of measurements that start below the lower threshold, rise above the upper threshold, and eventually fall down again below the lower one.

Pulse Analysis is the detection of pulses and computing various statistics about their shape and timing. The statistics in this section are valid only if Pulse Analysis is enabled in the context menu in the Trending window. For details about Pulse Analysis options, see ’Analysis Options’ (p. 99).

To enable or disable Pulse Analysis:

- Right-click in the Trending window to display the Trending window context menu, and select the “Pulse Analysis Enabled” option.
  (or)

- Click the check box at the bottom of each tab inside the Analysis Options Settings dialog box.

Figure 7-7 shows the Pulse Analysis section of the Statistics panel:

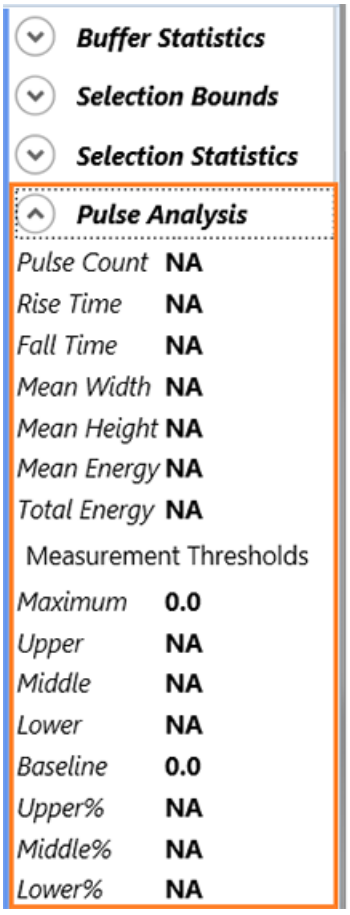

Figure 7-7. Statistics – Pulse Analysis Panel

Table 7-4 shows the statistics in the top half of the Pulse Analysis section:

Measurement Thresholds are used to detect pulses and calculate these statistics. The upper and lower thresholds are used to detect individual pulses and to calculate their Rise Time and Fall Time statistics.

Table 7-4. Statistics for Pulse Analysis

Statistic	Description
Pulse Count	The total number of pulses detected in the current selection.
Rise Time	Rise Time is the time the signal takes from the lower threshold to the upper. The statistic represents the average rise time of the pulses found in the current selection.
Fall Time	Fall Time is the time signal takes from the upper threshold to the lower. The statistic represents the average fall time of the pulses found in the current selection.
Mean Width	Pulse Width is measured between the upward and downward crossings of the Middle Threshold. The Mean Width represents the average pulse width of the pulses found in the current selection.
Mean Height	Height is Peak Power minus the Baseline. The Baseline defaults to zero, in which case Height is the same as Peak Power. A user sets the Baseline to some other value (for example, to compensate for such things as excess ambient light). Pulse analysis detects multiple pulses (0 or more) in a single analysis. For many of the statistics, CMC reports the averages of all the pulses (hence “Mean Height” instead of Height), which means the mean (numerical average) of all the pulses in the selected region. The Results Table tab shows the corresponding statistics for each individual pulse.
Mean Energy	The average energy of the pulses found in the current selection.
Total Energy	The total energy of the pulses found in the current sample.

The lower half of the Pulse Analysis Statistics panel includes Measurement Thresholds, shown in Table 7-5:

Table 7-5. Statistics for Measurement Thresholds in Pulse Analysis

Statistic	Description
Maximum	The maximum threshold used to translate threshold percentages to measurement level values. It defaults to the maximum actual value found in the selected range.
Upper	The upper threshold level is used to detect pulses and calculate Rise- and Fall-time statistics.
Middle	The middle threshold level is used to detect pulses and calculate pulse width statistics.
Lower	The lower threshold level is used to detect pulses and calculate Rise- and Fall-time statistics.
Baseline	The Energy Baseline is used to exclude power measurements that are smaller than this given threshold level. Normally it is zero, but may be used in unusual circumstances to exclude power measurements below a given level.
Upper%	The upper threshold, expressed as a percentage between the minimum and maximum values found in the capture buffer.
Middle%	The Middle threshold, expressed as a percentage between the minimum and maximum values found in the capture buffer.
Lower%	The Lower threshold, expressed as a percentage between the minimum and maximum values found in the capture buffer.

On occasion, data transmission or other errors corrupt the measurement data, resulting in measurement values which are patently not legitimate. When this happens, the samples in question are marked by the software.

Figure 7-8 shows the context menu available when you right-click in the Pulse Analysis section of the Statistics panel. All statistics are enabled (displayed) by default. Toggle the check box next to selected statistics to show or hide that option.

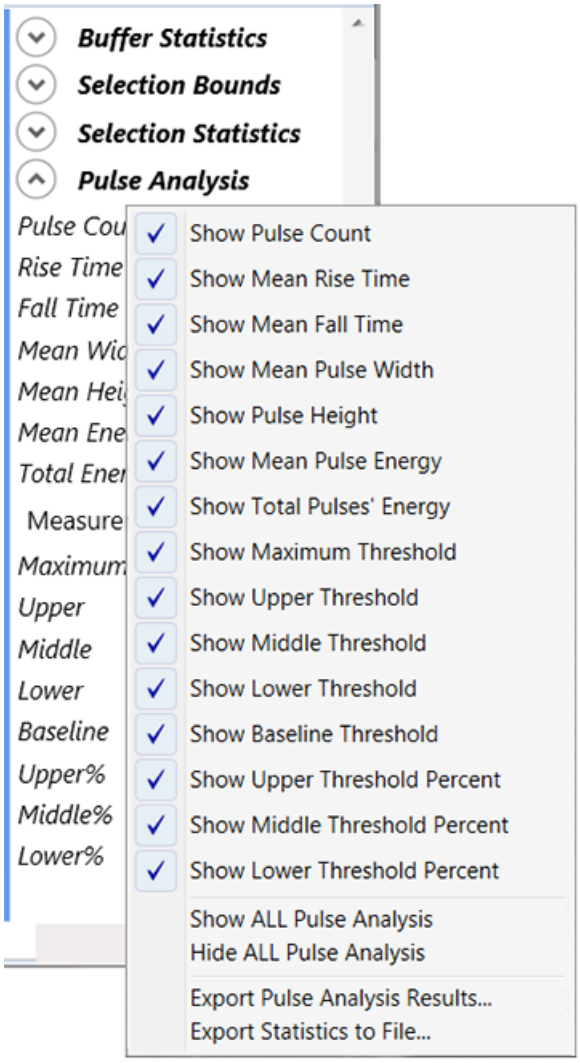

Figure 7-8. Statistics – Pulse Analysis Context Menu

7.5 Export Statistics for Analysis

Users can export statistics and computations to a separate file for later viewing/analysis. This applies to each section of the Statistics panel:

- Right-click in the Statistics panel and, from the context menu, select the needed option
  (or)

From the Main Menu drop-down menu, select Import/Export and then select the needed option.

8 Measurement Modes

This section shows how to use the Coherent Meter Connection software to take measurements at different speeds and with different equipment.

For more information about the features of the software, as well as devices supported, see 'User Interface – Main Controls' (p. 21).

8.1 Overview of Measurement Modes

The Coherent Meter Connection software offers the following Power measurement modes:

- Basic Mode (p. 145), also referred to as Standard Mode, a nearly instant average power reading at a 10 Hz sampling rate
- High-Speed Mode (p. 150), a high-speed power reading streaming at 20 kHz
- Snapshot Mode (p. 153), a burst of high-resolution power data sampled at 625 kHz or 1.6 microseconds per sample

Each of these are shown in the next sub-sections, with step-by-step instructions following the overview.

For information about taking an Energy measurement, see p. 160.

8.1.1 Basic Measurement Mode Overview

The Basic power measurement mode for the LabMax-Pro SSIM uses a typical 10 Hz sampling rate.

This mode is best used to measure the average power of either Continuous Wave (CW) lasers or the average power of high-repetition rate (pulsed) lasers.

- In10 Hz sampling mode, PowerMax-Pro sensors supply an almost instantaneous power reading, similar to a photodiode, while also taking advantage of the sensor's ability to directly read very high powers.

  However, because data is sampled every 100 milliseconds, temporal pulse information is not displayed. To view temporal information, use High-Speed Mode instead.

- When measuring the average power of high repetition rate, short-pulsed lasers such as picosecond, femtosecond, and nano-second lasers, it is best to operate in Basic mode because:
  - Ultrafast and q-switched laser pulses are too fast for PowerMax-Pro to resolve temporal pulse information.
  - High-Speed Mode sampling rates tend to alias with the high kHz pulse repetition rates.

8.1.2 High-Speed Measurement Mode Overview

NOTICE
For standalone meter use, this mode only applies with the use of the LabMax Pro SSIM and LabMax Touch Pro meters combined with a PowerMax Pro sensor.
It also applies to the USB/RS PowerMax Pro sensors.

High-speed mode operates at a continuous data sampling rate of 20 kHz, permitting pulse shape analysis of modulated lasers with repetition rates up to 2.5 kHz.

These types of pulse trains are common in many laser-based material processing applications, such as micro welding. This mode can also be useful to view the settling times of Continuous Wave lasers after the laser is fired.

- A data point is sampled every 50 microseconds, making this mode very useful for real-time visualization of temporal shape of modulated lasers with pulse lengths hundreds of microseconds or longer. This mode also provides fast feedback about changes in power output from Continuous Wave sources.

- To prevent aliasing effects between the meter sampling rate and the laser pulses, High-Speed Mode cannot be used with lasers modulated at over 2.5 kHz pulse repetition frequency.

- High-Speed Mode is also used to determine the appropriate trigger level in or for Snapshot Mode. High-Speed Mode can be used to confirm that the LabMax-Pro SSIM meter is accurately triggering on the laser pulses before moving into Snapshot Mode.

Figure 8-1 shows data collected using a CO2 laser to illustrate the type of detail using High-Speed Mode.

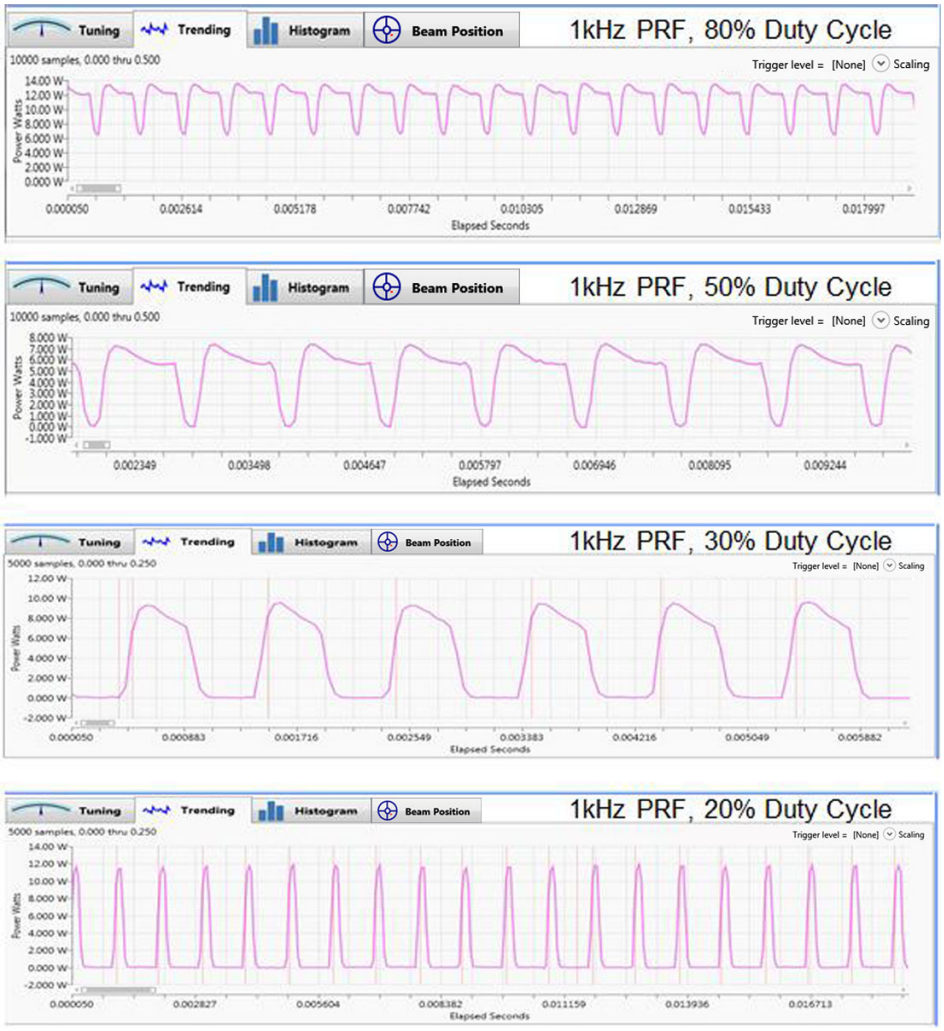

Figure 8-1. Examples Using High-Speed Mode

8.1.3 Snapshot Measurement Mode Overview

NOTICE

For standalone meter use, this mode only applies with the use of the LabMax Pro SSIM and LabMax Touch Pro meters combined with a PowerMax Pro sensor.
It also applies to the USB/RS PowerMax Pro sensors.

A faster high-speed sampling mode, called Snapshot Mode, provides burst sampling at a rate of 625 kHz for a maximum of 384 milliseconds.

This mode lets you see the temporal characteristics of modulated pulses used in commercial cutting, engraving and drilling applications, as well as long pulses and pulse trains used in aesthetic medical applications.

The temporal detail in Snapshot Mode illustrates the true performance of the laser—previously masked by slow thermopiles— thereby providing more information to help set up process recipes and monitor system performance in manufacturing.

Figure 8-2 shows the data quality and high pulse shape fidelity that is achievable. This example is a snapshot based on:

- Modulated 10.6 µm CO2 Laser
- 50 µSec PW
- 8 kHz PRF
- 40% Duty Cycle

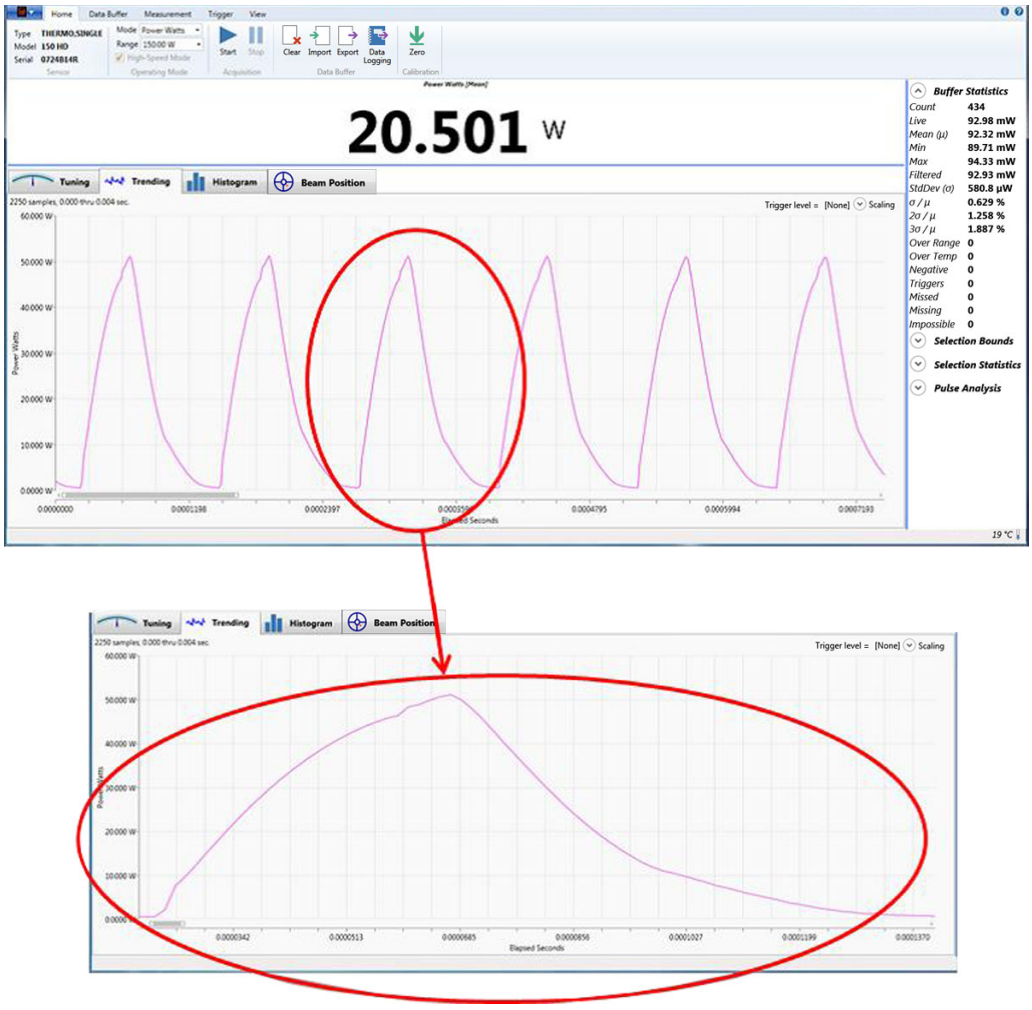

Figure 8-2. Example Using Snapshot Mode

For more information about the Snapshot process, sample size, and so on, see 'Take a Snapshot Measurement' (p. 153).

8.2 Before You Begin

This section assumes that you have already:

- Set up applicable laser safety control measures
- Installed and connected all hardware and components
- Installed the Coherent Meter Connection software and are familiar with the user interface

There are no user adjustments in the sensor itself.

The sensor can only be calibrated by returning the sensor to Coherent; see 'Maintenance and Support' (p. 197).

The Coherent Meter Connection software includes a gain adjustment feature; this does not affect the calibration. This feature is intended to allow for a bias "offset" to be created by the user to allow for things such as compensating for optical losses in the beam path leading up to the point of measurement, or to align two different measuring systems.

8.3 Take a Basic Power Measurement

This section shows the steps to take a basic power measurement at a 10 Hz sampling rate. This procedure can be sued with a LabMax Pro SIMM meter, a LabMax Touch/Touch Pro meter, or with a meterless USB/RS sensor.

To take a basic measurement:

1. Set up the meter or meterless sensor and then set the power to On.
2. Double-click the shortcut icon to start the Coherent Meter Connection software.

WARNING!
Follow all laser safety procedures. Use of controls or adjustments or performance of procedures other than those specified may result in exposure to hazardous radiation.

Make sure to either set the laser to OFF or block the beam until you are ready to take a power measurement.

3. [**Home tab**] To take a basic power measurement, make sure that the check box for **High-Speed Mode** is ***not*** checked in the Home tab, as shown in Figure 8-3:

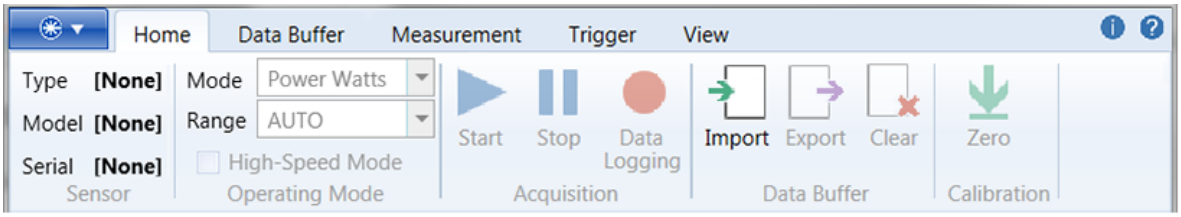

Figure 8-3. Home Tab

4. [**Data Buffer tab**] For a basic power measurement, select or change the following settings in the Data Buffer tab, as shown in Figure 8-4:

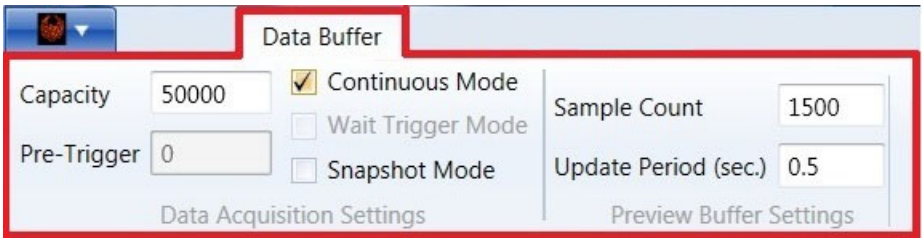

Figure 8-4. Data Buffer Tab

a.) [**Data Buffer tab**] In the **Capacity** field, enter a value that represents the sample size you want to collect. This value is also the sample size used to calculate Statistics.

b.) [**Data Buffer tab**] For the **Continuous Mode** check box:

- Click the check box if you want data collection to continue until you manually stop it.
- Deselect the check box to have data collection end after the Data buffer is full (when it reaches the value in the Capacity field).

5. [**Measurement tab**] For a basic power measurement, select or change settings in the Measurement Tab, as shown in the example in Figure 8-5:

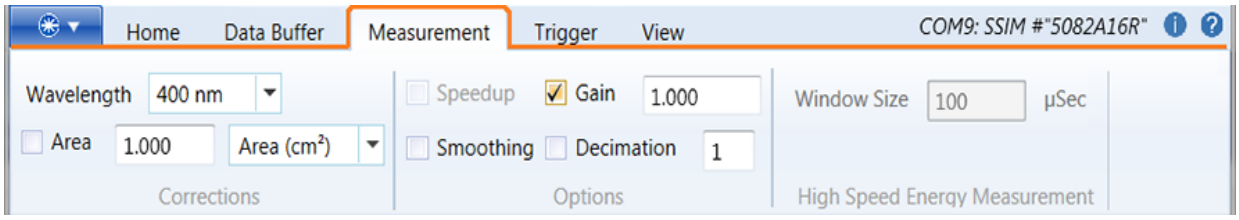

Figure 8-5. Measurement Tab

- Select the laser **Wavelength** from the drop-down menu. If the laser wavelength is not available, choose the setting that is closest to it.
- Alternatively, edit the Wavelength table to add the new setting to the drop-down menu, shown in Figure 8-6.

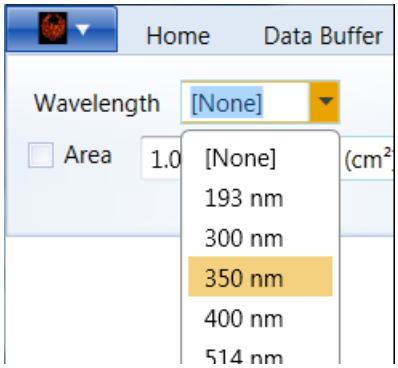

Figure 8-6. Select Wavelength

6. [**Trending tab**] Click the Trending tab in the lower half of the window to display the Graphics viewing panel, shown in Figure 8-7.
7. Turn on the laser and expose the sensor to the laser beam.

WARNING!
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser WILL cause serious eye injury and possible blindness. Follow all safety precautions; see 'Safety and Compliance' (p. 173).

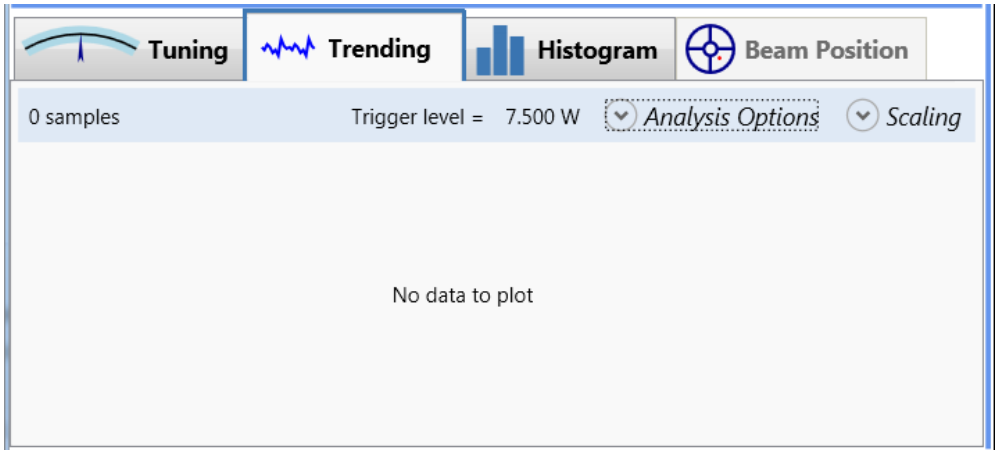

Figure 8-7. Trending Tab

8. [**Quick Access toolbar** or **Home tab**]:

   a.) To begins data collection, press the **Start** icon in the toolbar or the Home tab, shown in Figure 8-8.

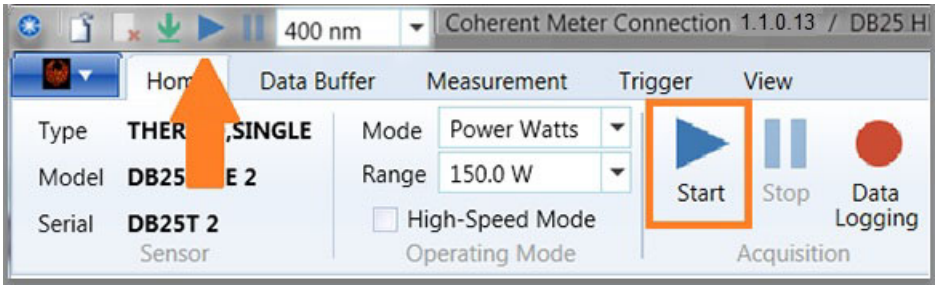

Figure 8-8. Start Data Collection

   b.) To end data collection, click the **Stop** icon in the toolbar or the Home tab, shown in Figure 8-9.

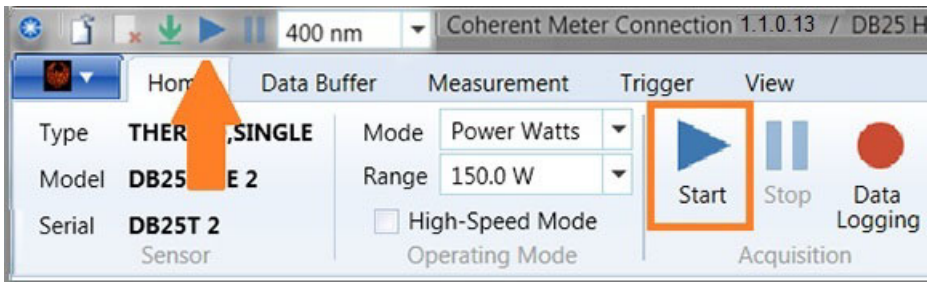

Figure 8-9. Stop Data Collection

The example in Figure 8-10 shows how and where information is displayed during data collection:

- Data is visible in the Trending chart.
- The panel displays a live reading.
- Statistics in the sidebar on the right are updated in real time (based upon data entering the buffer).

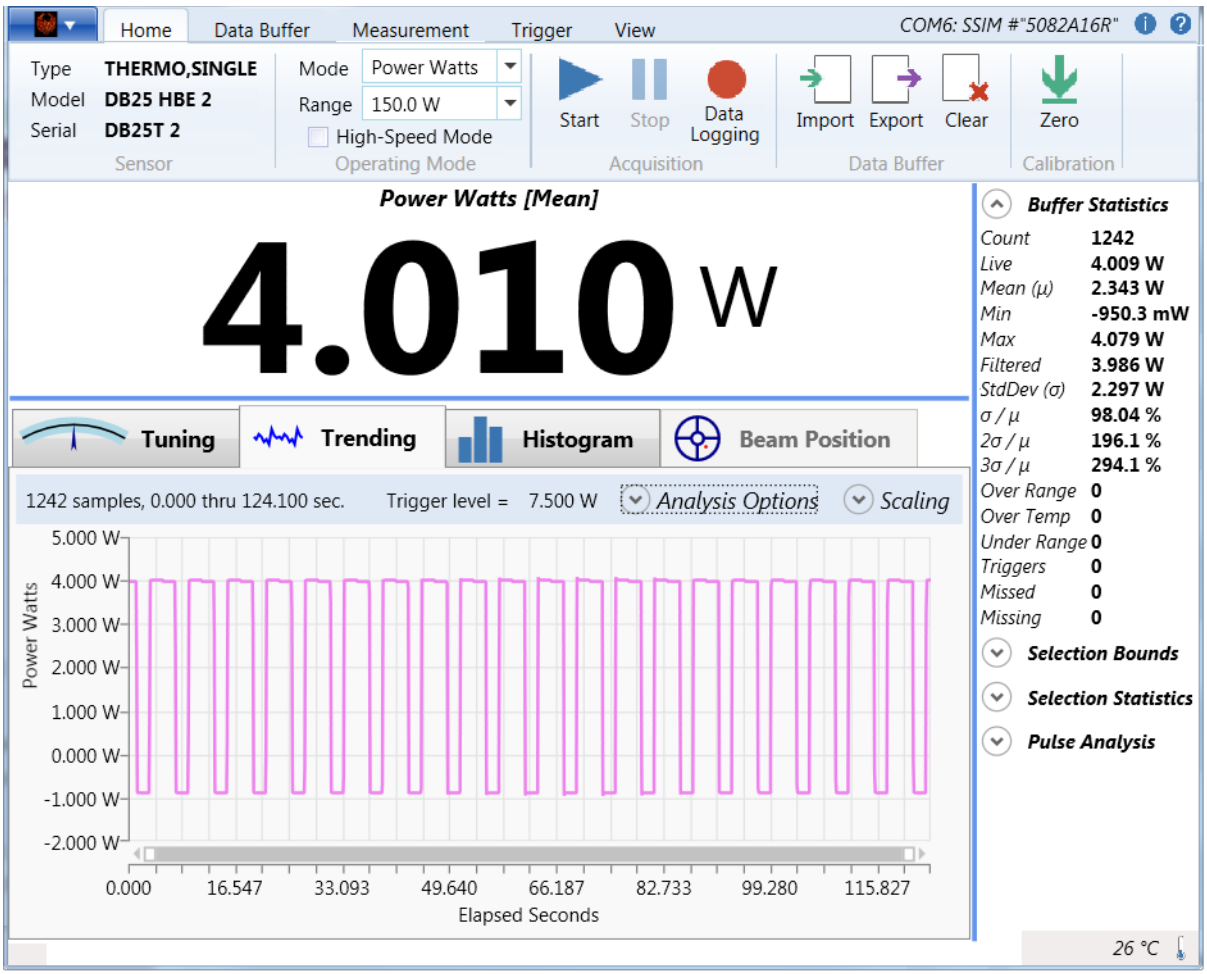

Figure 8-10. Main Window

You can view the Trending chart and Statistics to see the overall minimum and maximums for the data.

9. In the **[Home tab]**, click an icon to export or clear the capture. You can also click the Clear icon in the Quick Access toolbar, shown in Figure 8-11.

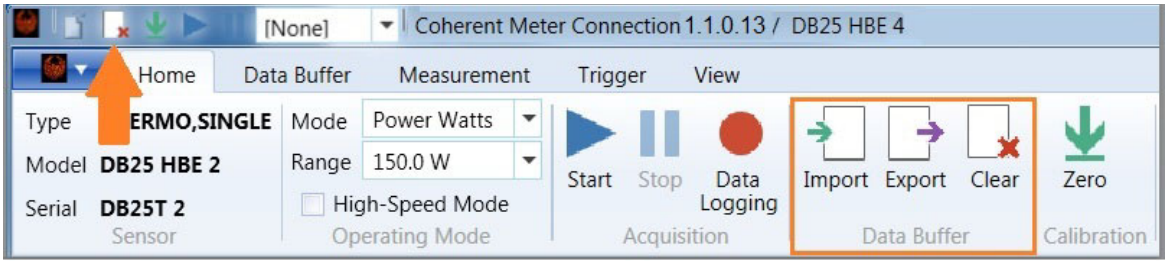

Figure 8-11. Export or Clear Data

8.4 Take a High-Speed Measurement

This section shows how to take a high-speed power measurement at a 20 kHz sampling rate.

To take a high-speed measurement:

1. Double-click the shortcut icon to run Coherent Meter Connection software.

WARNING
Make sure either the laser is OFF or the beam is blocked until ready to take a power measurement.

2. [**Home tab**] To take a high-speed measurement, select or change the following settings in the Home tab. Make sure that the check box for High-Speed Mode ***is*** checked.
3. **[Home tab]** Click the **Range** drop-down menu shown in Figure 8-12, and select one option from the list:

- AUTO (for auto-range)
- A fixed range for Low power limits
- A fixed range for High power limits

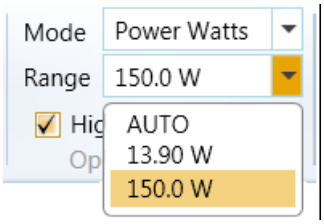

Figure 8-12. Settings for High-Speed Mode

The number of ranges listed depends on the sensor used; some sensors offer more than two ranges.

- AUTO is generally used only for a single range in slow speed.

- AUTO is not allowed in Snapshot or non High-Speed Mode operations.

4. [**Home tab**] Press the **Zero** button to measure the baseline value of the sensor. A dialog box displays the process to reset to zero; this takes only a few seconds. To set the meter to zero, the laser must be turned OFF (or the beam blocked).
5. [**Data Buffer tab**] For a high-speed measurement, select or change the following settings in the Data Buffer tab:
6. [**Data Buffer tab**] In the **Capacity** field, enter a value that represents the sample size you want to collect. This value is the sample size used to calculate Statistics.
7. [**Data Buffer tab**] For the **Continuous Mode** check box:
   - Click the check box if you want data collection to continue until you manually stop it.
   - Deselect the check box to have data collection end after the Data buffer is full (when it reaches the value in the Capacity field).
8. [**Data Buffer tab**] Make sure that the check box for **Snapshot Mode** is ***not*** checked.
9. [**Measurement tab**] Select the laser wavelength from the drop-down menu.
   - Select the laser **Wavelength** from the drop-down menu. If the laser wavelength is not available, choose the setting that is closest to it.
   - Alternatively, edit the Wavelength table to add the new setting to the drop-down menu.
10. [**Trending tab**] Click the Trending tab in the lower half of the window to display the Graphics viewing panel.
11. Set the laser to ON and then expose the sensor to the laser beam.

WARNING!

Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser WILL cause serious eye injury and possible blindness. Follow all safety precautions; see 'Safety and Compliance' (p. 173).

12. [**Quick Access toolbar** or **Home tab**] To begin data collection, press the **Start** icon in either the toolbar or the Home tab.

    Information is displayed as follows during data collection:
    - Data is visible in the Trending chart.
    - The panel displays a live reading.

- Statistics in the sidebar on the right are updated in real time (based upon data entering the buffer).

13. **[Trending tab]** The loading indicator at the bottom of the Graphics viewing panel displays in **green** while data is loading, as shown in Figure 8-13.

Figure 8-13. Loading Trending Data

TIP: If the application displays a 'Missing' warning during data collection, it means data was lost while transferring the data in real time from the meter's buffer to the PC.

This usually occurs because the computer is not able to keep up with the high rate of data continuously streaming from the meter. To prevent this:

- Make sure that the USB connection is a USB 2.0 High-Speed port, and then close other open applications.
- Reduce the Capacity buffer size.
- Export the data file to examine the error indicators to determine where and how much data was lost.

14. [**Quick Access toolbar** or **Home tab**] To end data collection, click the **Stop** icon in either the toolbar or the Home tab.
15. Zoom in or out to view measurements in the Trending chart.
16. In the [**Home tab**], click the icons to either export or clear the measurement.

8.5 Take a Snapshot Measurement

This section shows how to take a Snapshot power measurement.

Snapshot Mode is a special acquisition mode that captures high-speed data at (example: 625 kHz or 1.6 microseconds per sample - capture rate to the internal buffer inside the meter). Refer to the user manual for the respective meter being used for measurement for sample rate values.

NOTICE

To prevent aliasing effects between the meter sampling rate and the laser pulses, do not use this mode with lasers modulated at over 80 kHz pulse repetition frequency.

Due to the high rate of data acquisition in this mode, it is necessary to temporarily store the data in the instrument's hardware buffer, as it is not possible to upload it in real-time through the USB connector.

After data acquisition is complete, the instrument uploads the data to the PC, where it is placed in the Capture buffer and displayed in the software.

8.5.1 Snapshot Sample Size

Depending on the meter being used, there is a maximum size of the Snapshot, for example: 240,000 samples - 384 milliseconds of data collection). Refer to the respective user manual for the meter being used for maximum sample values.

Users can request a snapshot of any number of samples up to a specified sample rate. This is done by adjusting the buffer Capacity setting in the Data Buffer tab. This field does not allow an entry greater than the limit associated with the meter being used, when Snapshot Mode is enabled

A smaller number of samples reduces the time to collect and upload them, and speeds up the response that displays on the user interface. A sample size that is set too small may not result in a collection window that is not long enough to view your entire pulse.

The 240,000 samples can be divided between pre-trigger samples and regular (post-trigger) samples as follows: $0 \leq$ pre-trigger $\leq$ capacity ≤ 60000 and $1 \leq$ capacity.

The Snapshot mode sample rate is 1.6 µSec/sample.

Coherent Meter Connection software allows users to specify the pre-trigger size and the total size, either in number of samples or microseconds (rounded to the nearest 1.6).

Preview mode is disabled when Snapshot mode is enabled. The user interface is updated at the completion of each Snapshot buffer upload.

It takes approximately a third of a second for the meter to acquire 240,000 samples and another 12 seconds to upload the data. That is, it takes approximately 12.3 seconds before users can view the data. A smaller number of samples require proportionally less time to display the data.

Also see information about 'Show Trigger Markers' (p. 90).

8.5.2 Overview of the Snapshot Process

During Snapshot Mode, the hardware waits for a trigger event before acquiring data. There is no preview of the data when waiting for a trigger. The recommended sequence is as follows:

1. Configure the laser and sensor for measurement.
2. Configure data acquisition settings on the LabMax-Pro SSIM or LabMax Touch Pro meter initially only in High-Speed Mode. This shows the presence of triggers, or data even in the absence of triggers.
3. Fine-tune trigger levels in High-Speed Mode, then change settings on the meter to Snapshot Mode.
4. Start the meter.
5. Start the laser, which triggers data acquisition. When a trigger is found, the meter starts filling the Capture buffer.
6. If a trigger event is not automatically detected, press the Force Trigger button at the bottom of the panel to manually acquire a Snapshot.
7. When the buffer is full, data is sent to the user interface and displayed in the Graphics viewing panel on the Trending tab.

In practice, it can take some experimentation to determine the various settings and appropriate trigger levels.

- If you check the Continuous mode check box, the meter automatically loops.
- If Continuous mode is not selected, the meter stops and awaits further instructions.

The duration of a Snapshot depends on the laser pulse length and the number of pulses you want to capture.

8.5.3 Procedure: Define Settings

The first part of the procedure is done in High-Speed Mode to define the data acquisition settings, including trigger settings.

1. Double-click the shortcut icon to run Coherent Meter Connection software.

WARNING!
Make sure that either the laser is turned OFF or the beam is blocked until you are ready to take a power measurement.

2. [**Home tab**] For a Snapshot measurement, first configure only High-Speed Mode in the Home tab to take trial measurements:
   a.) [**Home tab**] Make sure that the check box for **High-Speed Mode *is*** checked.
   b.) [**Home tab**] Click the **Range** drop-down menu and select either of the ***fixed*** ranges. (This signifies the maximum power limits for each range.) Snapshot does not support Auto ranging.
   c.) [**Home tab**] Click the **Zero** button to measure a baseline value for the sensor. A dialog box displays the process to set to zero; this takes only few seconds.

WARNING!
Before you the meter is set to zero, make sure either the laser is turned OFF or the beam is blocked.

[**Data Buffer tab**] To take initial trial measurements in High-Speed Mode, select or change the following settings in the Data Buffer tab:

3. [**Data Buffer tab**] Enter a value in the **Capacity** field that represents the sample size you want to collect.

   NOTE: A setting of 20,000 represents one second of data collection, which is adequate to set up Snapshot Mode.

   This value is also the sample size used to calculate Statistics. The purpose of this step is to confirm good data collection and correct pulse triggering.

   - If this setting is 0 (zero), Snapshot begins at the time of the trigger event, which occurs after the first pulse begins.
   - If you want to capture the portion of the first pulse before the trigger event, add in some pre-trigger samples.

4. [**Data Buffer tab**] Make sure that the check box for **Continuous Mode *is*** checked.

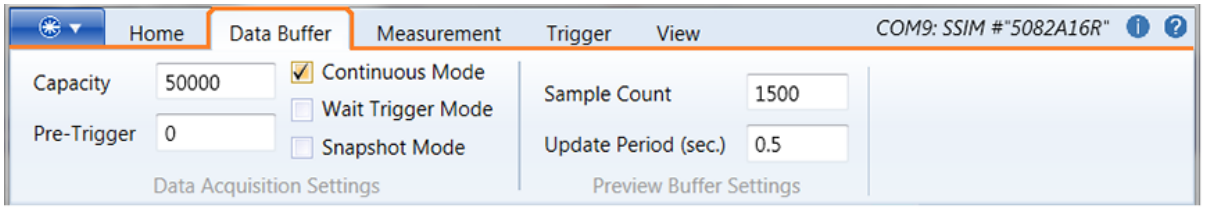

Figure 8-14. Data Buffer Tab

5. [**Data Buffer tab**] Make sure that the check box for **Snapshot Mode** is ***not*** yet checked.
6. [**Measurement tab**] Select the laser **Wavelength** from the drop-down menu.
   - Select the laser **Wavelength** from the drop-down menu. If the laser wavelength is not available, select the setting that is closest to it.
   - Alternatively, edit the Wavelength table to add the new setting to the drop-down menu.

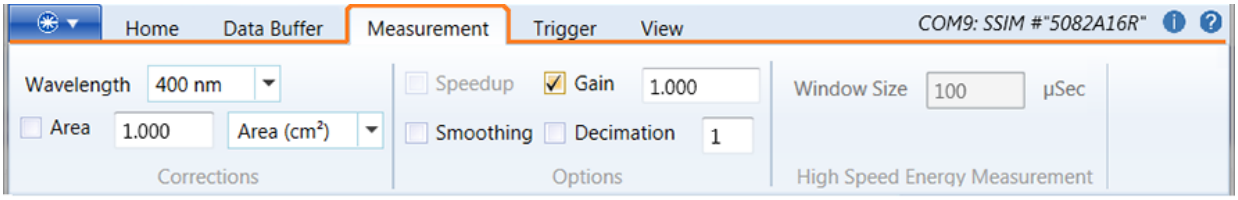

Figure 8-15. Measurement Tab

7. [**Trigger tab**] Enter a Level setting in **Watts** that represents a level approximately 50% between zero and the Peak Power you expect each pulse to have.

   Any trigger setting between the data minimum and maximums causes a trigger. The Trigger Tab is shown in Figure 8-16.

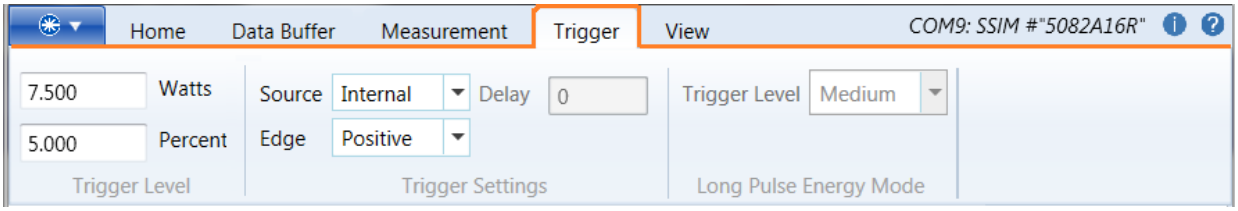

Figure 8-16. Set Trigger Levels

If the Peak Power is not known, enter a Level setting between zero and the average power.

8. Make sure that Trigger settings are correct:

- Source is set to **Internal**.
- Edge is set to **Positive**.
- Delay is set to **0** (zero).

9. [**Trending tab**] Right-click inside the Graphics viewing panel to display a pop-up menu, shown in Figure 8-17. Select **Show Trigger Markers**. This setting confirms that the meter is auto triggering on the pulses.

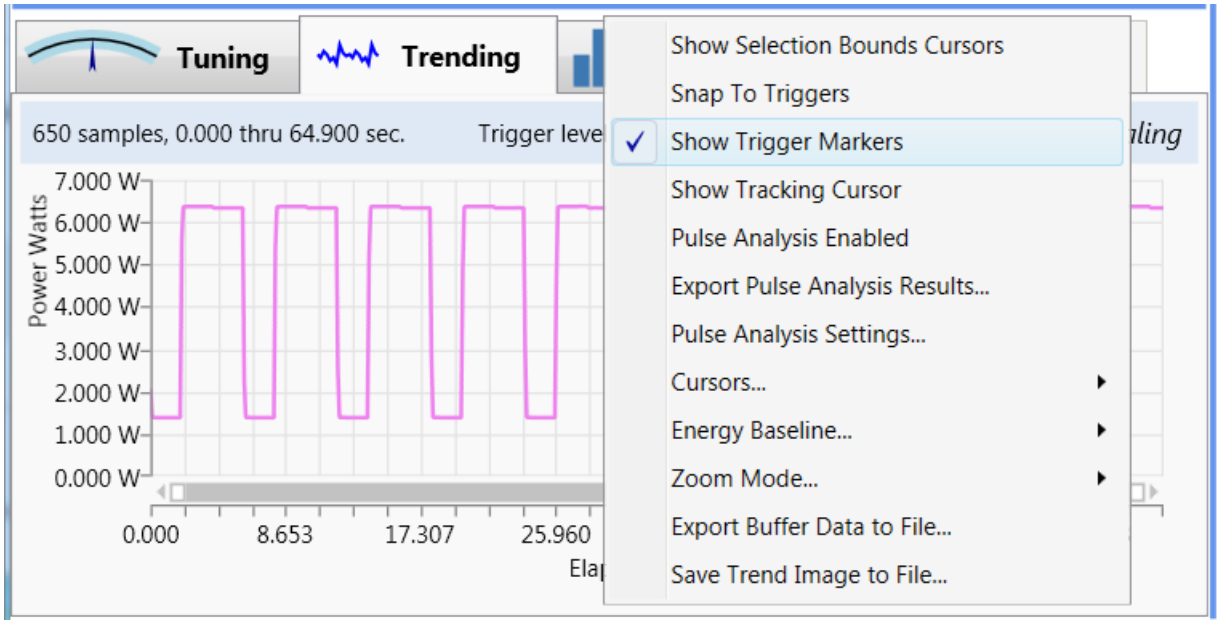

Figure 8-17. Show Trigger Markers

This setting is available only if there is data in the buffer, and remains in effect until you change it. If there is no data, first run a trial measurement, then select **Show Trigger Markers**.

10. Turn on the laser and expose the sensor to the laser beam.

WARNING!
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser WILL cause serious eye injury and possible blindness. Follow all safety precautions; see 'Safety and Compliance' (p. 173).

8.5.4 Procedure: Trial Measurement

To start a trial measurement:

1. [**Quick Access toolbar** or **Home tab**] Press the **Start** icon in the toolbar or the Home tab.
2. [**Quick Access toolbar** or **Home tab**] To end the measurement, press the **Stop** icon in the toolbar or the Home tab.
3. [**Trending tab**] After the data is loaded, the result for the trial measurement is plotted in the Trending chart.
4. Confirm that each pulse has a trigger marker. This is represented by a **magenta** vertical line plotted at each trigger event, as shown in Figure 8-18.

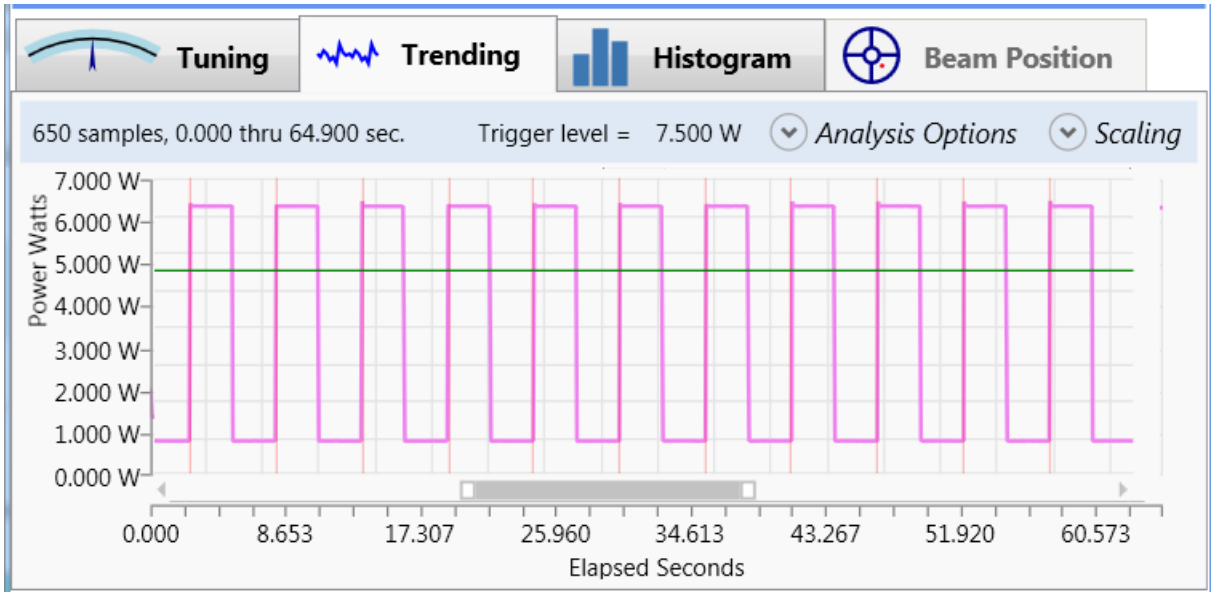

Figure 8-18. Display Trigger Markers

- If the **magenta** trigger markers are not visible, or are not consistently triggering on each pulse event, adjust the Trigger Level setting in that tab.
- The **green** line in the Trending chart represents the trigger threshold level.

5. Continue to do trial measurements again until trigger events are occurring as expected.

8.5.5 Procedure: Take a Snapshot

After trigger events are occurring and pulses are displaying properly, move into Snapshot Mode.

To take a Snapshot measurement:

1. [**Data Buffer tab**] Click the check box for **Snapshot Mode**.

   If settings (such as Range and Data Buffer) are not configured correctly and Snapshot Mode is selected, the dialog box shown in Figure 8-19 is displayed that indicates any errors:

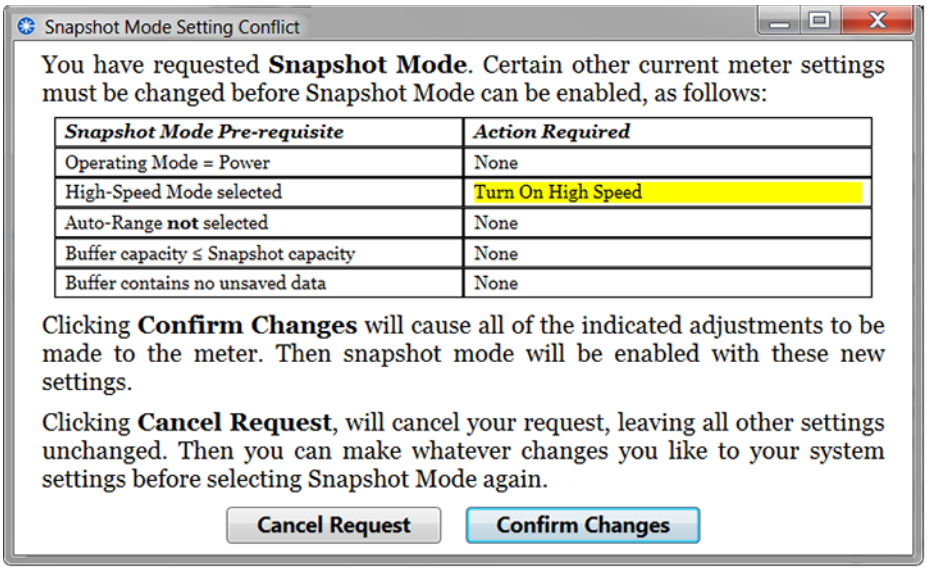

Figure 8-19. Snapshot Mode Setting Conflicts

   To resolve, click the **Confirm Changes** button, and Coherent Meter Connection software automatically adjusts the settings.

2. Set the laser to On and then expose the sensor to the laser beam.

WARNING
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser WILL cause serious eye injury and possible blindness. Follow all safety precautions; see 'Safety and Compliance' (p. 173).

3. [**Quick Access toolbar** or **Home tab**] To begin a measurement in Snapshot Mode, press the **Start** icon in the toolbar or the Home tab.

   A Snapshot Mode icon is displayed in the Status bar at the bottom of the Trending window. The Status bar is blank when the buffer is loaded in Non-Continuous mode or if Stop is pressed.

   - As shown in Figure 8-20, a **red** oscillating bar displays until the laser fires and a trigger event is detected.

Figure 8-20. Snapshot Mode — Waiting for Trigger

- When a trigger event is detected, the Snapshot Mode bar turns **green**, as shown in Figure 8-21.

  This bar actively displays the progress of loading the data from the internal Snapshot buffer in the meter to the PC application. Loading can take several seconds, depending upon the size of the Snapshot Capacity setting.

Figure 8-21. Snapshot Mode — Loading Data

If a trigger event does not occur, the system stays in the waiting state (the Snapshot icon displays the **red** waiting mode). If this happens, either:

- Press **Stop** to end data collection, and exit Snapshot mode. Return to High-Speed Mode, and adjust trigger settings as needed.
  (or)
- Press the **Force Trigger** button (on the oscillating bar). This forces the meter to collect Snapshot data, whether or not it finds a trigger.

  Also, check if the Show Trigger markers menu option is enabled to make sure that triggers are occurring as expected before entering Snapshot mode.

4. [**Quick Access toolbar** or **Home tab**] To end data collection, press the **Stop** icon in the toolbar or the Home tab.

8.6 Take an Energy Measurement (Joules)

The Coherent Meter Connection software measures Energy with Power Sensors using a technique called Long Pulse Energy Mode (LPEM). This is selected in the Trigger tab toolbar; for more information, see 'Trigger Tab' (p. 63).

The sensors themselves can only directly measure power. The meter firmware detects the start and end of a pulse, and integrates the intervening power readings to calculate an energy measurement for the pulse.

With "Trigger Tab" (p. 63), Long Pulse Energy Mode is selected by requesting Energy mode from a Power sensor.

However, the behavior of the user interface is different for PowerMax USB/RS ('meterless') sensors than for the LabMax-Pro SSIM or PowerMax-Pro USB/RS models. Table 8-1 summarizes the differences noticeable in the Trend and Buffer Statistics panel.

Table 8-1. User Interface Differences for Long Pulse Energy Mode

User Interface	LabMax-Pro SSIM or LabMax Touch and PowerMax-Pro USB/RS	Meterless Power Sensors (PowerMax USB/RS)
Trend Vertical Axis	***Power*** Watts	***Energy*** Joules
Trend Horizontal Axis	***Time*** Elapsed Seconds	Pulse ID
Trigger Markers showing location of energy results	Yes (at the start and end of the *Calculating* phase)	No
Status Line Messages	1. Searching for start of First Pulse 2. Calculating energy of Pulse 3. Searching for start of Next Pulse	1. Searching for start of First Pulse 2. Searching for start of Next Pulse (No explicit feedback for Calculating vs. Searching)
Measurement Panel	***Energy*** Joules • When it operates, shows most recent Energy measurement (or Mean or other view per settings in View > Output Formats > Measurements). • When stopped, periodically checks meter for recent energy measurement.	
Buffer Statistics	***Energy*** Joules • Shows statistics only for energy samples. • Count = 0 prior to first energy measurement.	
Histogram	***Energy*** Joules • Shows histogram only for energy samples. • Counts = 0 prior to first energy measurement.	

8.6.1 Measure Energy with a SSIM or LabMax Touch/Touch Pro and LM20 Sensor

This section shows how to take Energy Measurements with use of a LabMax-Pro SSIM or LabMax Touch/Touch Pro with an LM20 sensor. This is typical behavior of the user interface and is **not** new.

NOTE: When a PowerMax-Pro USB/RS sensor is used, the software operates in a similar manner.

8.6.1.1 Initial Configuration

To set initial configuration for an energy measurement:

1. Connect all equipment and open the Meter.
2. In the toolbar for the Coherent Meter Connection software:
   a.) Go to the Home tab > Operating Mode section, and select **Energy Joules** from the drop-down menu. The software sets the meter to zero.
   b.) Deselect the check box for High-Speed Mode.
3. On the on the Trigger tab, go to the Long Pulse Energy Mode section. From the drop-down menu, select the appropriate Trigger level. Figure 8-22 shows an example using the 'Low' setting:

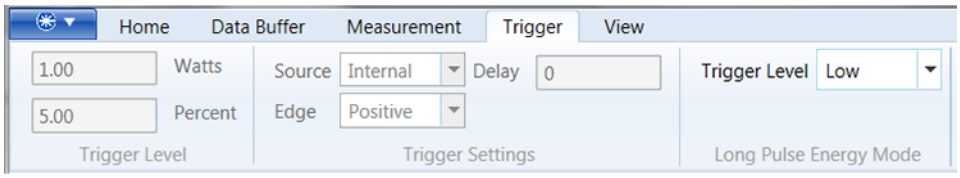

Figure 8-22. LPEM – Select Trigger Level

4. Right-click in the Trending window to display the context menu. Click to select the menu options shown in Figure 8-23:

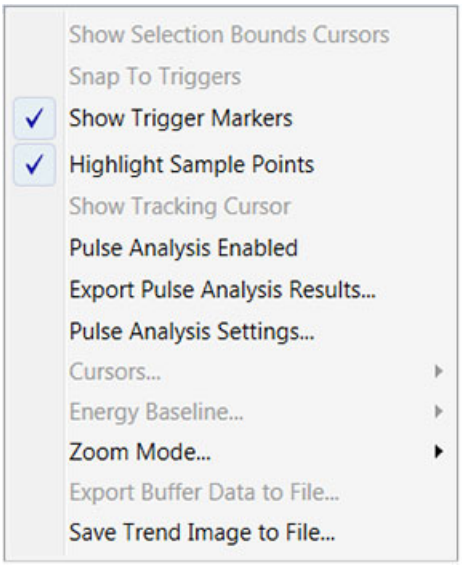

Figure 8-23. LPEM – Select Trending Chart Menu Options

The following examples chronicle how to measure energy data with use of a PowerMax LM20 sensor. Figure 8-24 shows the initial screen (an empty buffer) before pressing Start to measure energy.

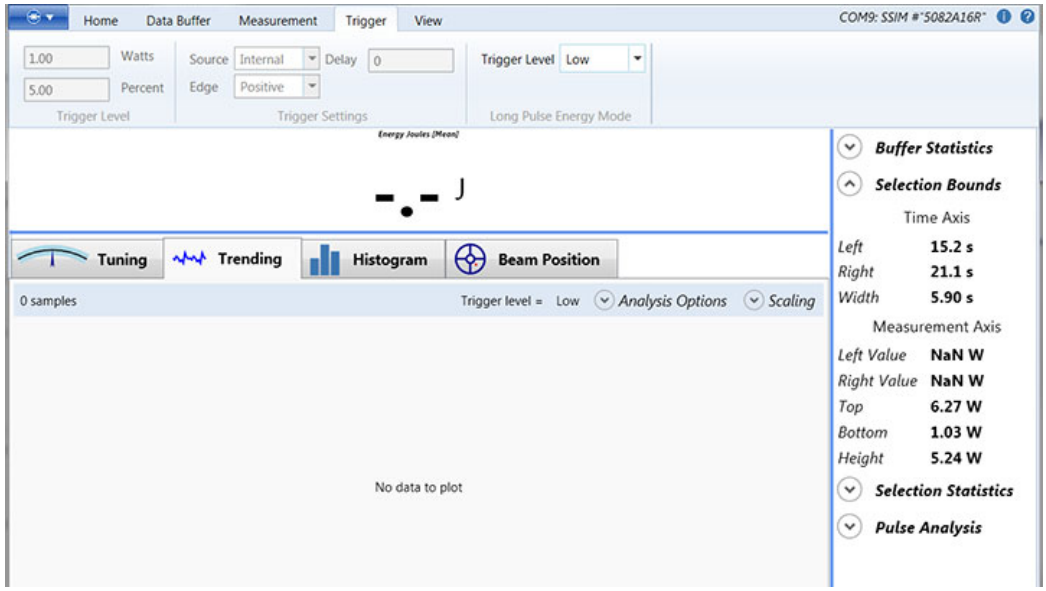

Figure 8-24. LPEM – Initial Screen Before Start

8.6.1.2 Start Energy Measurement

After you press Start, the display expands the signal to show the full range of the data, as shown in Figure 8-25.

This is done even though the signal actually is very small, generally under 4 mW.

The Count = 0, as no pulses have been detected and no energy measurements have been made.

8.6.1.3 Start of First Pulse Is Detected

After the start of the first pulse is detected, the Trending Chart shows a marker where the pulse start was detected, as shown in Figure 8-26.

This is displayed only if the menu option to Show Trigger Markers was first selected.

An Energy calculation is now in progress, searching for the end of the first pulse.

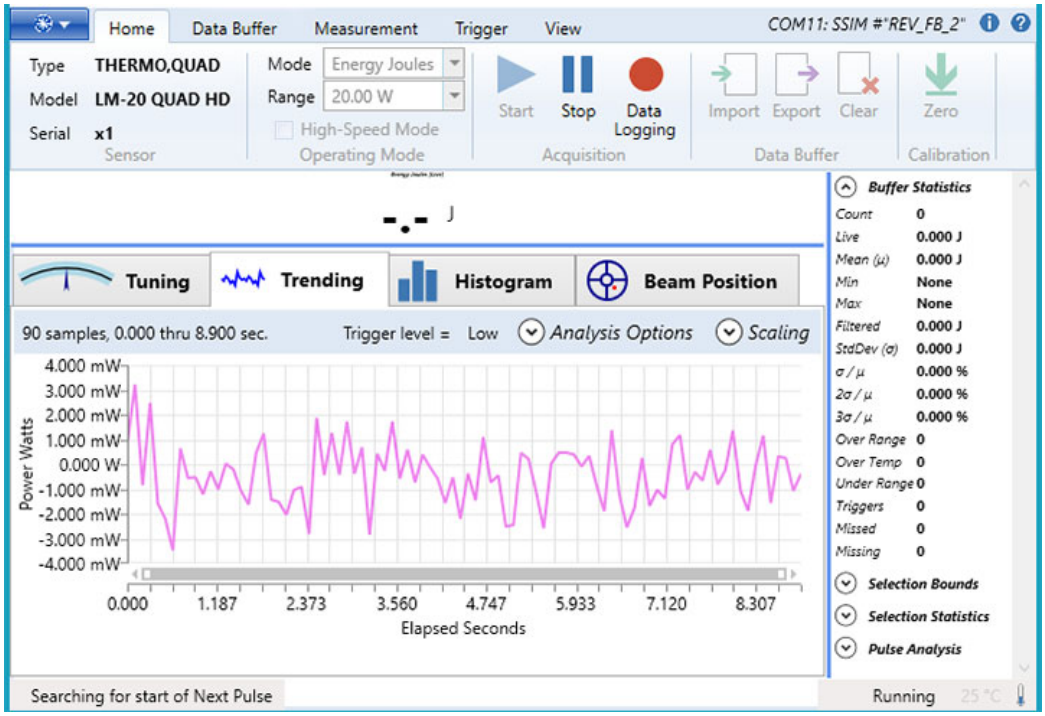

Figure 8-25. LPEM – Start Energy Measurement

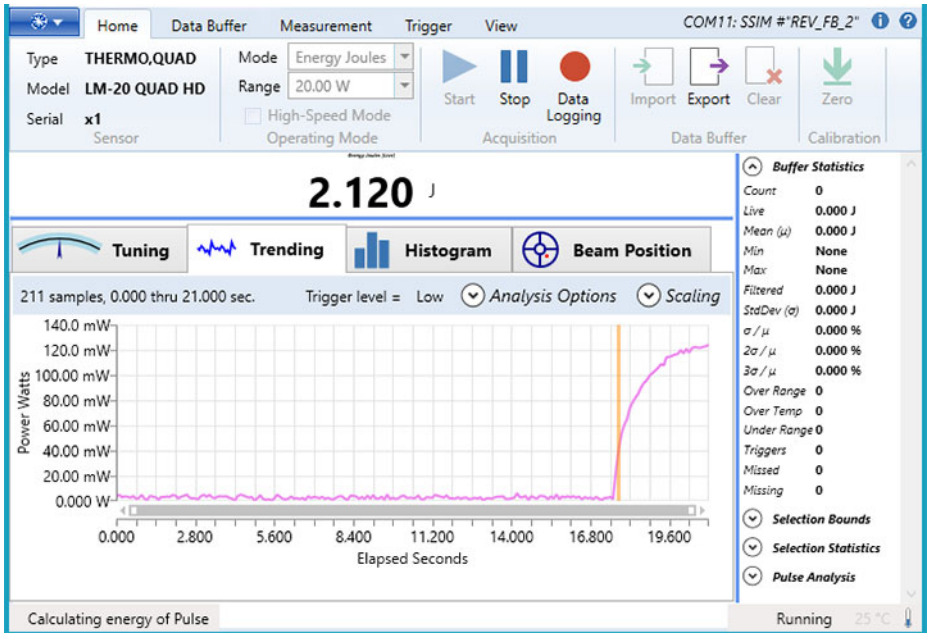

Figure 8-26. LPEM – Start of First Pulse Detected

8.6.1.4 End of First Pulse Is Detected

After the end of the first pulse is detected, the Trending window displays two markers (shown in Figure 8-27) where the first pulse started and ended. This is displayed only if the menu option to Show Trigger Markers was first selected.

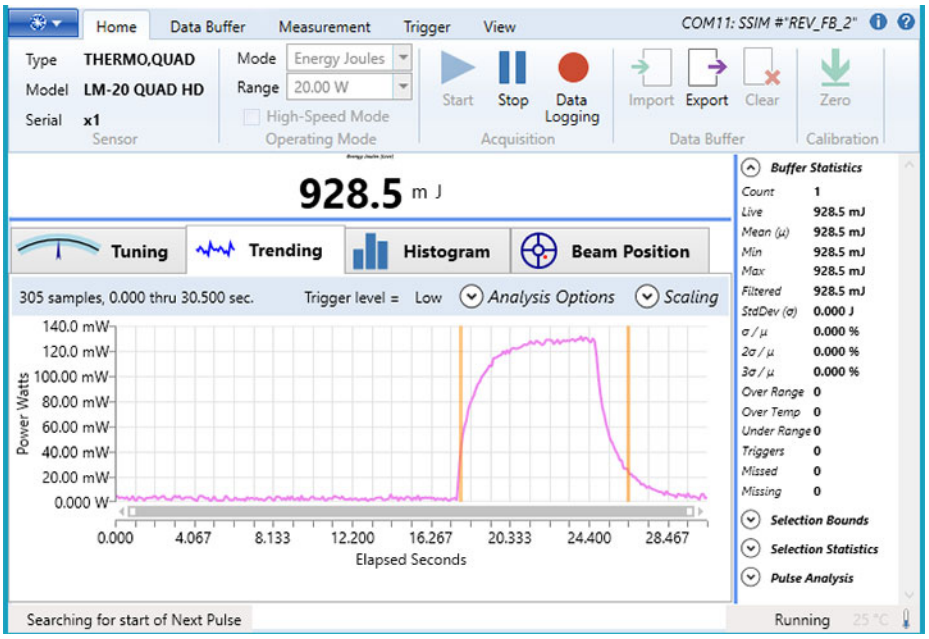

Figure 8-27. LPEM – End of First Pulse Detected

The Count = 1 because one energy measurement has been made. The Measurement window displays the current energy measurement. The software now searches for the start of the next pulse.

8.6.1.5 Second Pulse Is Detected

After second pulse is detected, the Measurement window shows most recent energy reading, as shown in Figure 8-28. The Count = 2 in the Buffer Statistics panel because two energy measurements have been made.

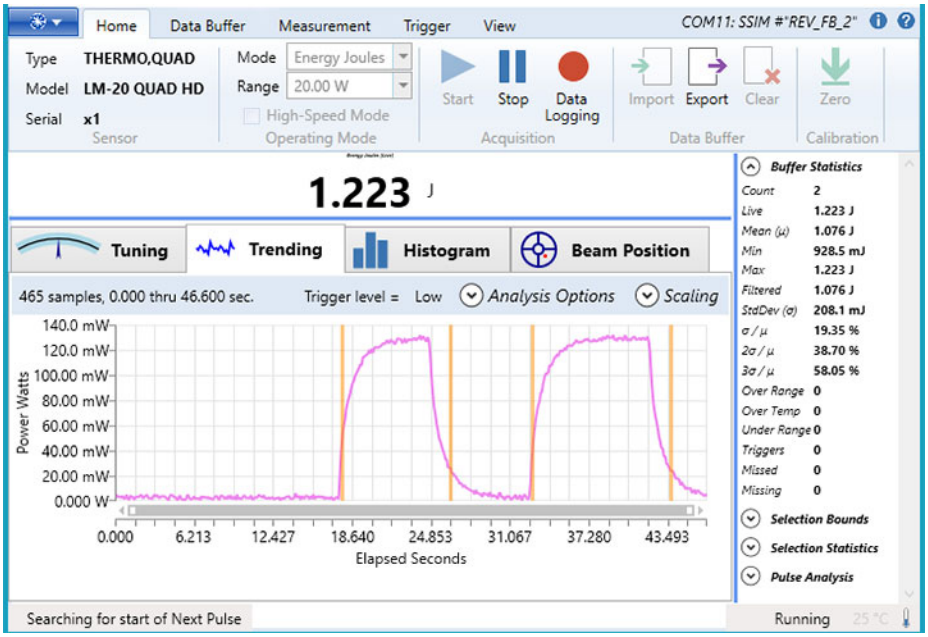

Figure 8-28. LPEM – Second Pulse Detected

8.6.1.6 Third Pulse is Detected

The software continues searching for the start of the next pulse. After third pulse is detected and the user clicks **Stop**, the results shown in Figure 8-29 are displayed.

- The Measurement window shows the final energy reading
- The Trending window displays Power vs. Time
- There are over 600 Power samples
- There are 3 energy Pulses / Measurements Samples
- There are 6 markers that show the starting and ending times of each pulse
  (only if the Show Trigger Markers menu option is selected)

The Statistics panel summarizes all 3 energy samples.

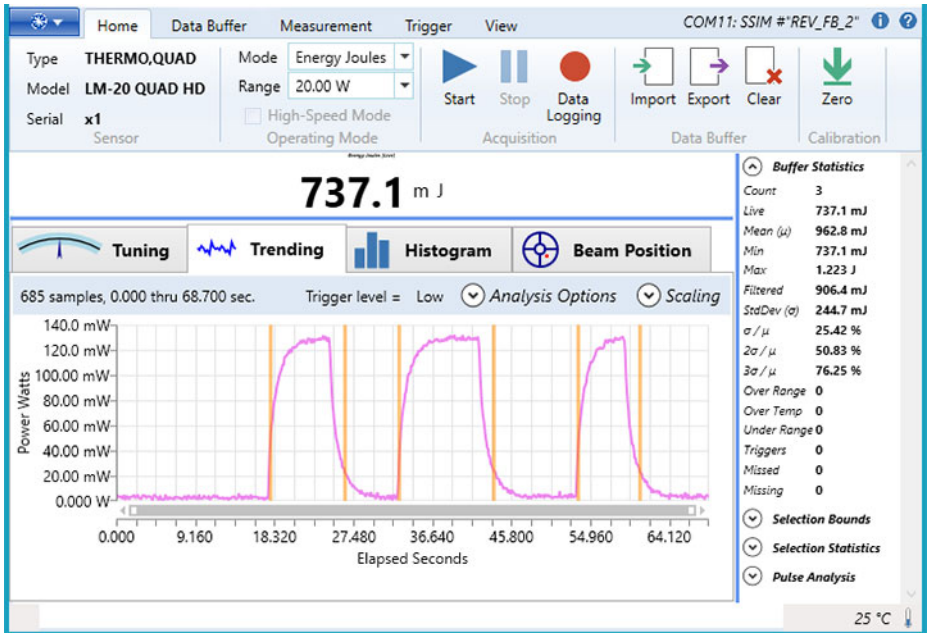

Figure 8-29. LPEM – Third Pulse Detected, User Clicks Stop

8.6.2 PowerMax-USB LM3 Sensor, Measure Power Data

Figure 8-30 shows a typical power measurement. This example uses a PowerMax-USB LM3 sensor.

You must select Highlight Sample Points in the Trending window context menu to view all of the ‘first sample’ points, as shown in Figure 8-31. Otherwise, the Trending window displays only a dashed horizontal line.

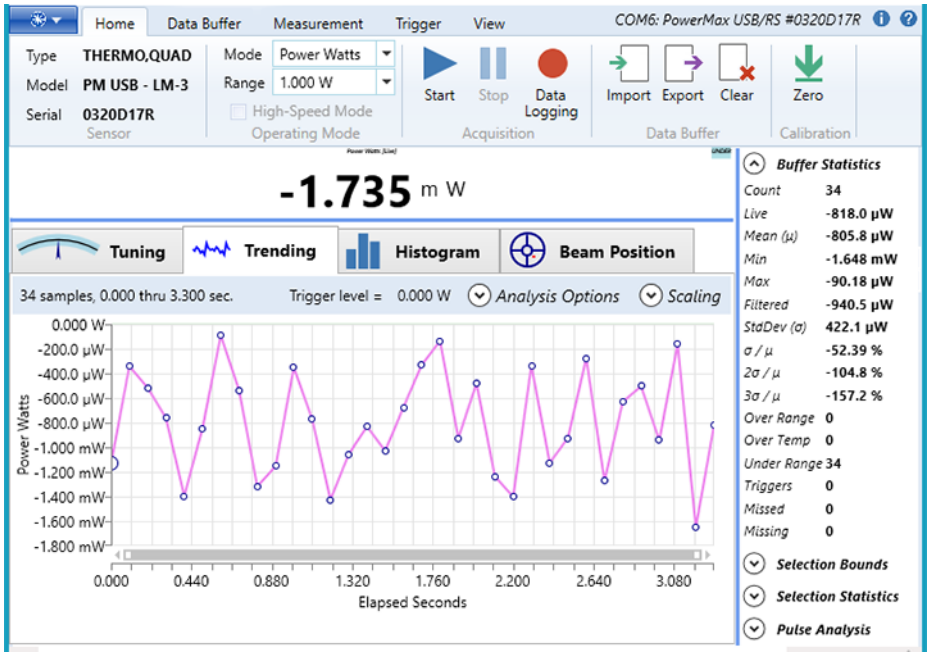

Figure 8-30. LPEM – Power Measurement for Sensor

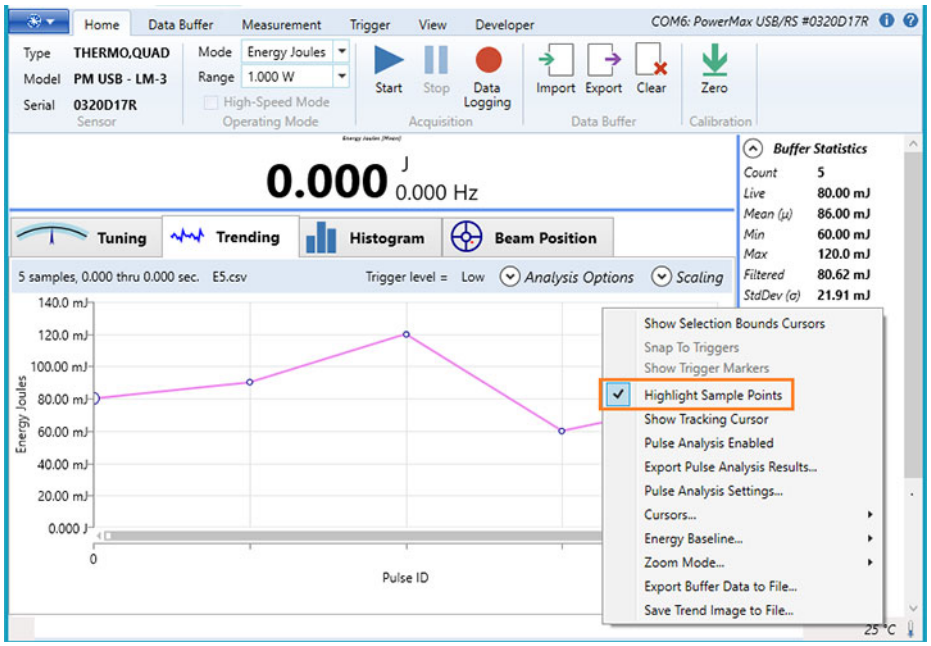

Figure 8-31. Select Highlight Sample Points

8.6.3 PowerMax-USB LM3 Sensor, Measure Energy Data

The illustrations in this section show the Coherent Meter Connection software with a meter reading Energy data.

8.6.3.1 Search for Start of First Pulse

Figure 8-32 shows an empty buffer, waiting for an energy measurement while it searches for the start of the first pulse.

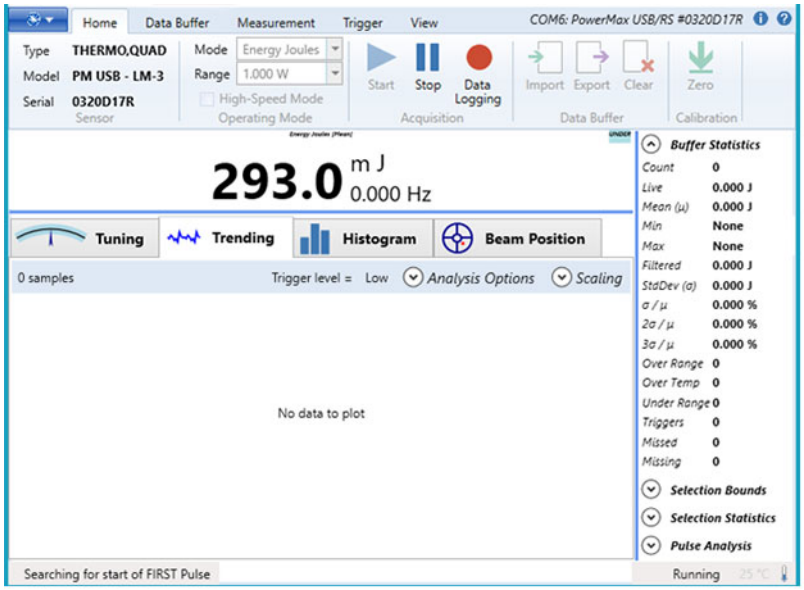

Figure 8-32. LPEM – Empty Buffer

8.6.3.2 Search for the First Pulse

The Trending chart generally shows lines connecting many samples. However, when measuring energy with standard PowerMax or EnergyMax sensors, the capture buffer contains only a single sample when the first energy sample is measured. This first sample is displayed as an enlarged point with an explicit label and a faint dashed line, as highlighted in Figure 8-33.

You must select Highlight Sample Points in the Trending window context menu to view all of the 'first sample' points (see Figure 8-31). Otherwise, if this option is not selected, the Trending window displays only a dashed horizontal line.

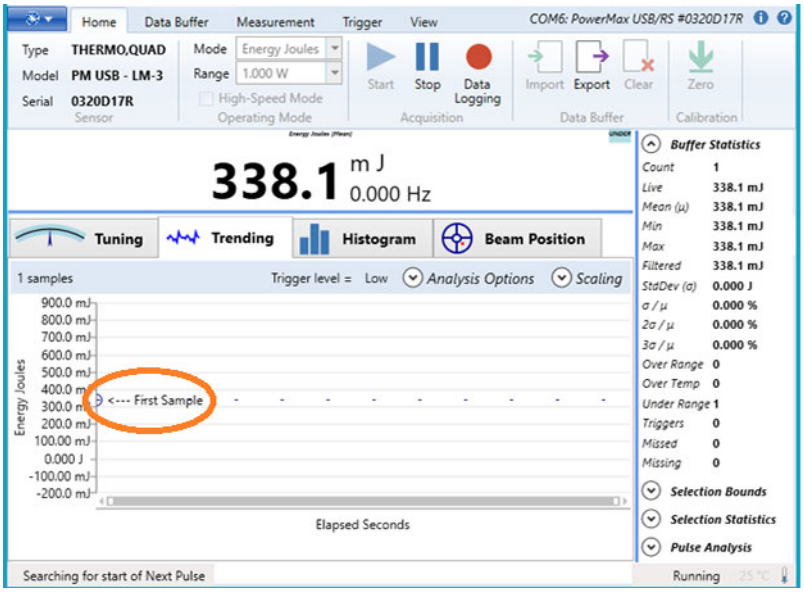

Figure 8-33. LPEM – Measure First Sample

8.6.3.3 Measure a Second Pulse

After a second pulse was measured, the samples are obvious, shown in Figure 8-34.

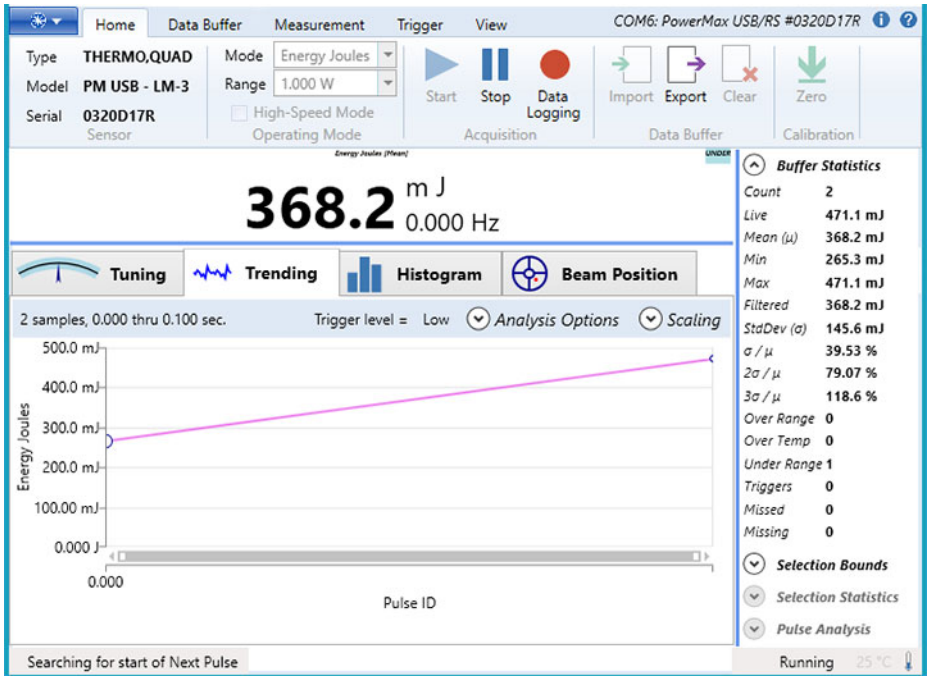

Figure 8-34. LPEM – Measure a Second Pulse

8.6.3.4 After Several Pulses Are Measured

After several more pulses are measured, the Trending window displays the sample points, shown in the example in Figure 8-35:

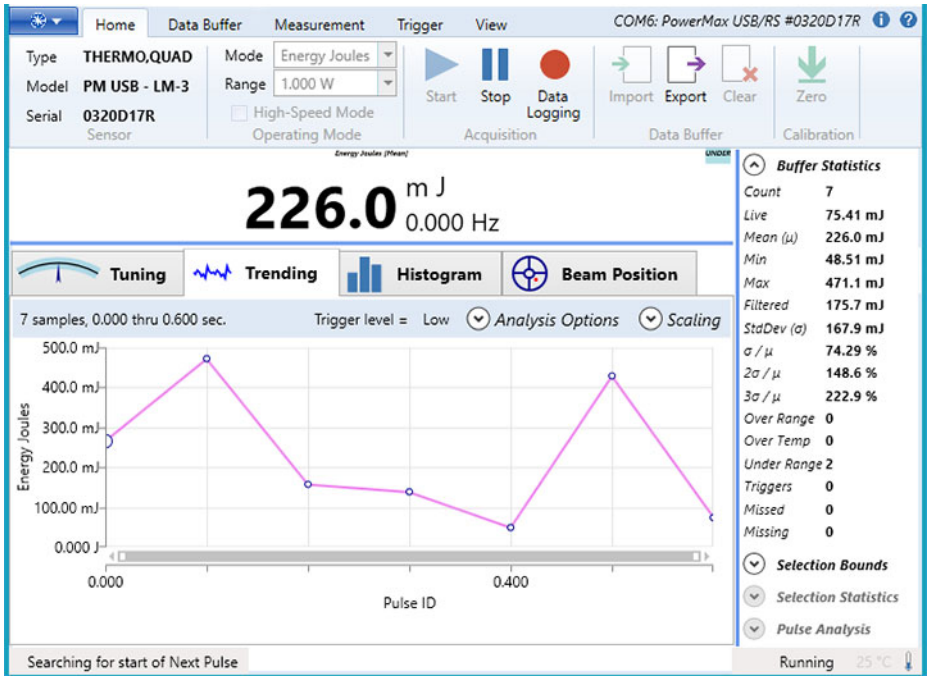

Figure 8-35. LPEM – Measure More Pulses

I Safety and Compliance

This section describes general requirements for safety for persons when using Coherent Meter Connection software with lasers when using Coherent meters or sensor.

I.1 Laser and Electrical Safety

Carefully review the laser and electrical safety information and precautions provided by the equipment manufacturer of the devices used with Coherent Meter Connection, including the use of shielding and personal protective equipment.

WARNING!
Use of controls or adjustments or performance of procedures other than those specified in this manual can result in exposure to hazardous radiation.

WARNING!
When working with electrical power systems, the rules for electrical safety must be strictly followed. Failure to do so can result in the exposure to damaging levels of electricity.

I.2 Compliance

This section describes compliance with various government requirements for safety, environmental regulations, and control law.

I.2.1 Laser Safety Standards

Following are sources for information about laser safety standards, as well as safety equipment.

I.2.1.1 Inside the United States:

The applicable United States Government laser safety requirements are contained in 21 CFR Title 21 Chapter 1, Subchapter J, Part 1040 ("*Performance standards for light-emitting products")*. The text of this federal standard is available from:

U.S. Food and Drug Administration
Center for Devices and Radiological Health (CDRH)
Document Mail Center – WO66-G609
Sliver Spring, MD 20993-0002

Website: www.fda.gov

I.2.1.2 Outside of the United States:

For jurisdictions outside of the United States:

Safety of laser products - Part 1: Equipment classification and requirements
IEC 60825-1 / EN 60825-1

Safety of laser products - Part 14: A user's guide
IEC 60825-1 / EN 60825-1

Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use
IEC 61010-1 / EN 61010-1

I.2.1.3 Publications and Guidelines

International Electrotechnical Commission (IEC)
www.iec.ch

Safety of laser products - Part 1: Equipment classification and requirements
BS EN 60825-1
British Standard Institute
www.bsigroup.com

American National Standard for Safe Use of Lasers
ANSI Z136 Series
American National Standards Institute (ANSI)
www.ansi.org

A Guide for Control of Laser Hazards
American Conference of Governmental
and Industrial Hygienists (ACGIH)
www.acgih.org

Laser Safety Guide
Laser Institute of America
www.lia.org

I.2.2 CE Marking

The European Community requirements for product safety are specified in the Low-Voltage Directive (LVD) (published in 2014/35/EU).

This Directive requires that lasers comply with the standard EN 61010-1/IEC 61010-1 “Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use” and EN 60825-1/IEC 60825-1 “Safety of Laser Products”. Compliance with the European requirements is certified by CE Marking.

I.2.3 Electromagnetic Compatibility

The primary issue for electromagnetic compatibility is to design covers, shielding, grounding, routing of electrical cable assemblies, and control elements with the correct safety features for a complete system.

Coherent products have been tested and shown to be compliant with the relevant requirements of the following directives for Electromagnetic Compatibility EN 61326-1_Ed2:2013 (IEC 61326-1_Ed2:2012) and EN 61000-3-2:2006.

I.2.4 Environmental Compliance

This section shows compliance with various environmental regulatory directives to identify hazardous substances.

I.2.4.1 EU REACH

Coherent products are classified as “articles” according to EU REACH definition, as follows:

> Article means an object which, during production, is given a special shape, surface or design that determines its function to a greater degree than its chemical composition. (REACH, Article 3(3))

Articles as defined by REACH regulations are exempt from registration as long as they are not intended to release a chemical substance.

To the best of our knowledge, all Coherent product meet the definition of “article” according to REACH.

In addition, to the best of our knowledge, Coherent products do not contain any Substances of Very High Concern (SVHC) above the legally mandated thresholds included in the REACH SVHC list, which is updated every six months. The current SVHC list is available on-line at https://echa.europa.eu/candidate-list-table.

I.2.4.2 RoHS Compliance

The European Union RoHS Directive EN 50581:2012 restricts the use of certain hazardous substances in electrical and electronic equipment. Coherent is in compliance with this Directive and can provide RoHS certification upon request. Compliance of this laser with the EMC requirements is certified by the CE mark.

I.2.4.3 China RoHS Compliance

This section details compliance with the China RoHS (Restriction of Hazardous Substances) Regulation SJ/T 11364-2014.

This Regulation restricts the use of certain hazardous substances in electrical and electronic equipment. The China RoHS Regulation applies to the production, sale, and import of products into the Peoples Republic of China.

Any hazardous substances in Coherent products are shown on the material declaration table included with the equipment.

The China RoHS Regulation also requires that the date of manufacture be identified. This information is provided on the *Certificate of Calibration* shipped with each product.

I.2.4.4 Waste Electrical and Electronic Equipment (WEEE, 2002)

The European Union Waste Electrical and Electronic Equipment (WEEE) Directive (2012/19/EU) is represented by a crossed-out garbage container label. The WEEE Directive applies to your product and any peripherals marked with this symbol.

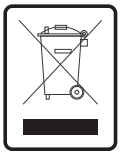

Figure I-1. WEEE Label

The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.

NOTICE

Do not dispose of these products as unsorted municipal waste. Contract your local distributor for procedures for recycling this equipment.

II Warranty

Coherent laser meters and sensors come with a standard one-year warranty.

For information about limited and extended device warranties as well as warranty limitations, please refer to the product manuals for the devices being used with the Coherent Meter Connection software.

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COHERENT

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