

*User Manual*  
***LabMax™-TO***  
*Laser Power Meter*





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*LabMax-TO*  
*Laser Power Meter*



7470 SW Bridgeport Rd.  
Portland, OR 97224

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#### **In the U.S.:**

Should you experience difficulties with your product, or need technical information, please visit our website: [www.Coherent.com](http://www.Coherent.com). You can obtain additional support by either telephoning our Technical Support Hotline at 1.800.343.4912, or e-mailing our Support Team at [support.instruments@Coherent.com](mailto:support.instruments@Coherent.com). Telephone coverage is available Monday through Friday (except U.S. holidays).

If you call outside our office hours, your call will be taken by our answering system and will be returned when the office reopens.

If there are technical difficulties with your product that cannot be resolved by support mechanisms outlined above, please e-mail or telephone Coherent Technical Support with a description of the problem and the corrective steps attempted. When communicating with our Technical Support Department, via the web or telephone, the model and serial number of the product will be required by the Support Engineer responding to your request.

#### **Outside the U.S.:**

If you are located outside the U.S., visit our website for technical assistance, or telephone our local Service Representative. Representative phone numbers and addresses can be found on the Coherent website: [www.Coherent.com](http://www.Coherent.com).

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## Preface

This manual contains user information for the LabMax™-TO Laser Power Meter.

## RoHS Compliance

This Coherent product is RoHS compliant.

## U.S. 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 should be obtained from Coherent or an appropriate U.S. Government agency.

## Publication Updates

To view information that may have been added or changed since this publication went to print, connect to [www.Coherent.com](http://www.Coherent.com).

## Firmware Updates

To obtain the latest version of LabMax firmware:

1. Connect to [www.Coherent.com](http://www.Coherent.com).
2. Download the firmware to a USB flash drive.

To install the update:

1. Plug LabMax into an *AC power source* and then turn the meter ON.



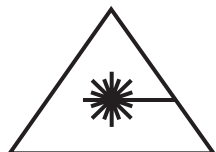
---

**Do not use battery power when installing a firmware update. A power loss during the installation process will damage the meter, which must then be returned to Coherent for repair.**

---

2. Connect the flash drive to the USB flash drive connector on the side panel of LabMax.
3. When the menu appears on the LCD, turn the Selection knob to highlight the firmware name and then press the Enter/Set button (Selection knob) to begin the installation.
4. When prompted on the installation menu, remove the flash drive and press the Exit soft key to reboot LabMax.

## **Symbols Used in This Document**



---

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

---



---

**This symbol is intended to alert the operator to the presence of dangerous voltages associated with the product that may be of sufficient magnitude to constitute a risk of electrical shock.**

---



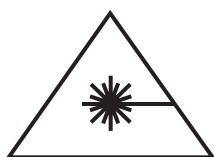
---

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

---

# SAFETY

Carefully review the following safety information to avoid personal injury and to prevent damage to this meter or any sensor connected to it. This equipment contains no user-serviceable parts. For service information, refer to “Obtaining Service” on page 153.



---

**The use and measuring of lasers is potentially dangerous. This instrument operates over wavelengths that include non-visible laser emissions.**

---

Proper laser operating practice in accordance with manufacturer recommendations is vital.

Eyewear and other personal protective equipment must be used in accordance with applicable laws and regulations.

If in doubt of correct operating procedures, consult the laser manufacturer and your laser safety officer.

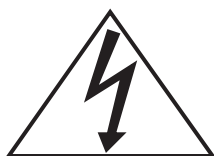
The equipment is not for use in critical medical environments.



---

**Do not operate this instrument if its panels are removed or any of the interior circuitry is exposed.**

---



---

**Do not operate this instrument in wet or damp conditions, or in an explosive atmosphere.**

---



---

**Operate this instrument only within the specified voltage range.**

---



---

**Do not operate this instrument if there are suspected failures. Refer damaged equipment to qualified Coherent service personnel.**

---



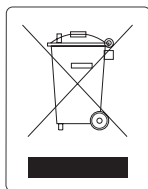
---

**Do not use battery power when installing a firmware update. A power loss during the installation process will damage the meter, which must then be returned to Coherent for repair.**

---

## **Waste Electrical and Electronic Equipment (WEEE, 2002)**

The European Waste Electrical and Electronic Equipment (WEEE) Directive (2002/96/EC) is represented by a crossed-out garbage container label (see Figure 1, below). The purpose of this directive is to minimize the disposal of WEEE as unsorted municipal waste and to facilitate its separate collection.



***Figure 1. Waste Electrical and Electronic Equipment Label***



## Declaration of Conformity

D132018

Revision AB

# Declaration of Conformity

We

Coherent, Inc.  
7470 SW Bridgeport Road  
Portland, Oregon, USA 97224

declare under sole responsibility that the

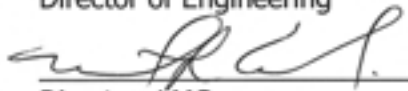
**LabMax**

meets the intent of Directive 2004/108/EC for Electromagnetic Compatibility. Compliance was demonstrated per testing to EN61326:1998 Electromagnetic Compatibility Product Family Standard for Measurement, Control and Laboratory Equipment to include the following test specifications as of September 2007:

EN61326:1998 Class A Radiated Emissions  
EN61326:1998 Class A Conducted Emissions  
EN61000-4-2:2006 Powerline Harmonics  
EN61000-4-3:2005 Powerline Voltage Fluctuation and Flicker  
EN61000-4-2:2001-04 Electrostatic Discharge – Performance Criteria A  
EN61000-4-3:2006 Radiated Immunity – Performance Criteria A  
EN61000-4-4:2004 Electrical Fast Transient Immunity - Performance Criteria B  
EN61000-4-5:2005 Electrical Slow Transient Immunity- Performance Criteria B  
EN61000-4-6:2006 Conducted RF Immunity - Performance Criteria A  
EN61000-4-11:2004 Power Line Dropout - Performance Criteria B

  
\_\_\_\_\_  
Director of Engineering

Date: 2/25/08

  
\_\_\_\_\_  
Director, LMC

Date: 2/25/08



# SOFTWARE INSTALLATION

This section explains how to install the LabMax software on the following operating systems:

- Windows XP and Windows 2000 (page 6)
- Windows VISTA (page 8)



---

**Install the LabMax software *before* physically connecting the meter to the computer.**

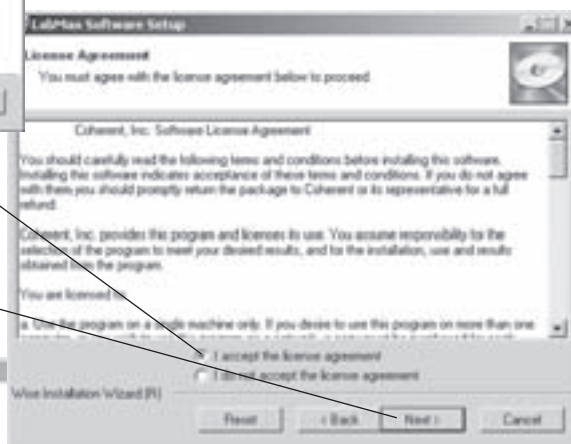
---

## Windows XP and Windows 2000

- 1** Insert the LabMax CD into your CD-ROM drive. If Autorun is enabled on your system, installation will start automatically; otherwise, select “Run” from the Start menu and then type **D:\Setup.exe** (substitute the appropriate letter of your CD-ROM drive for D).

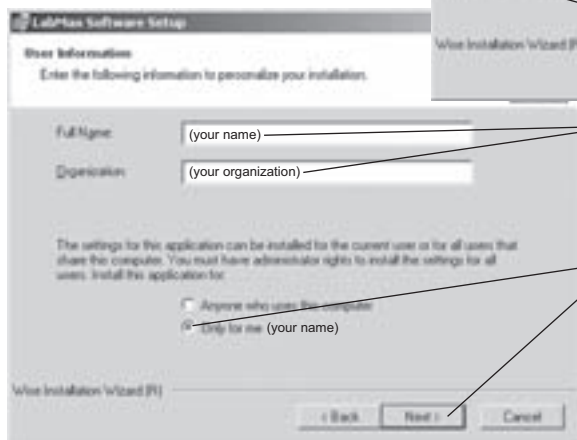


- 2** Click “Next.”



Read the License Agreement and then select “I accept the license agreement.”

- 4** Click “Next.”



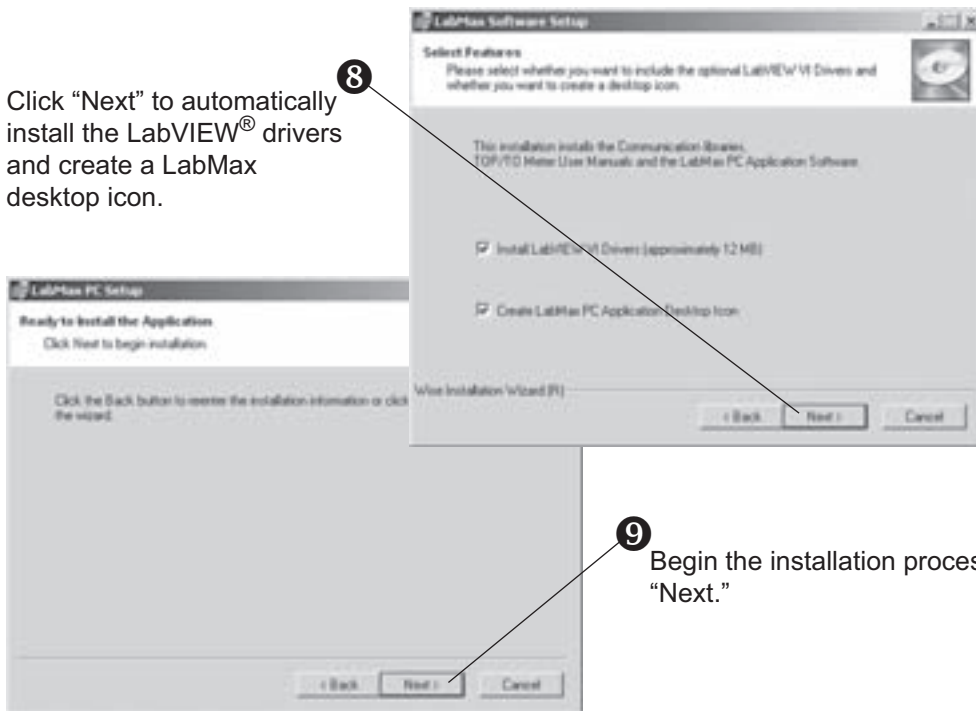
- 5** Fill in your name and the name of your organization.

- 6** Select “Only for me (your name)” and then click “Next.”

Select the default destination folder by clicking “Next.”



Click “Next” to automatically install the LabVIEW® drivers and create a LabMax desktop icon.

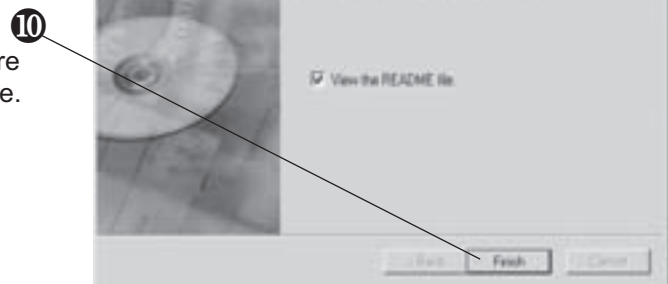


Begin the installation process by clicking “Next.”

The Updating System screen displays while the program is installing . . .

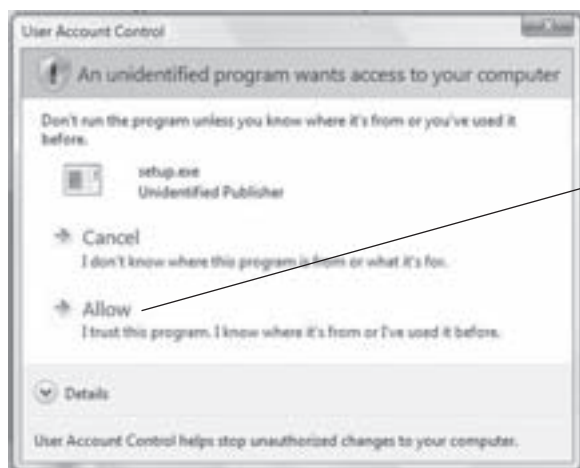


Click “Finish” to complete the software installation and view the README file.

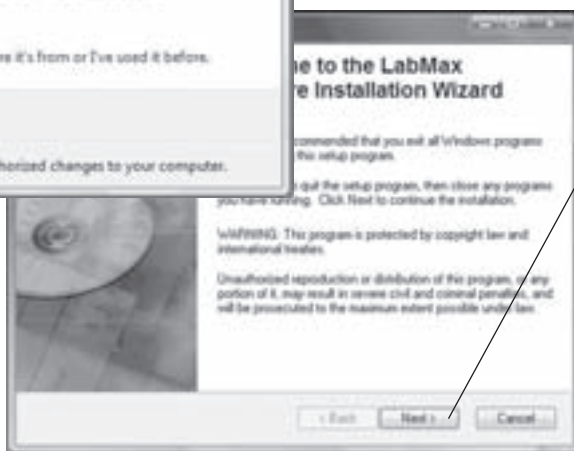


## Windows Vista

- 1** Insert the LabMax CD into your CD-ROM drive. If Autorun is enabled on your system, installation will start automatically; otherwise, select “Run” from the Start menu and then type **D:\Setup.exe** (substitute the appropriate letter of your CD-ROM drive for D).

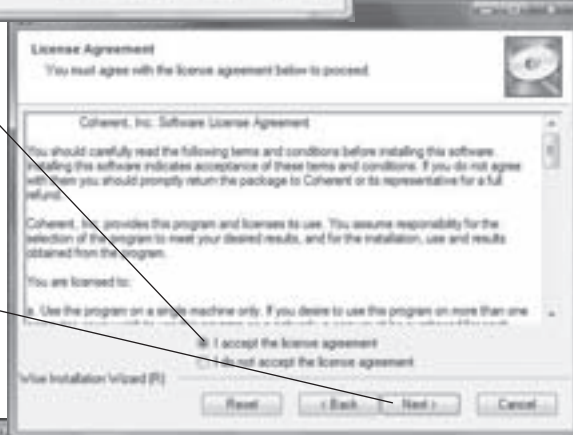


- 2** Click “Allow.”



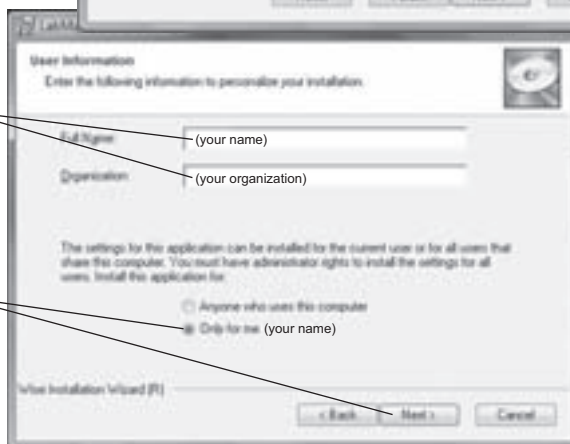
- 3** Click “Next.”

- 4** Read the License Agreement and then select “I accept the license agreement.”



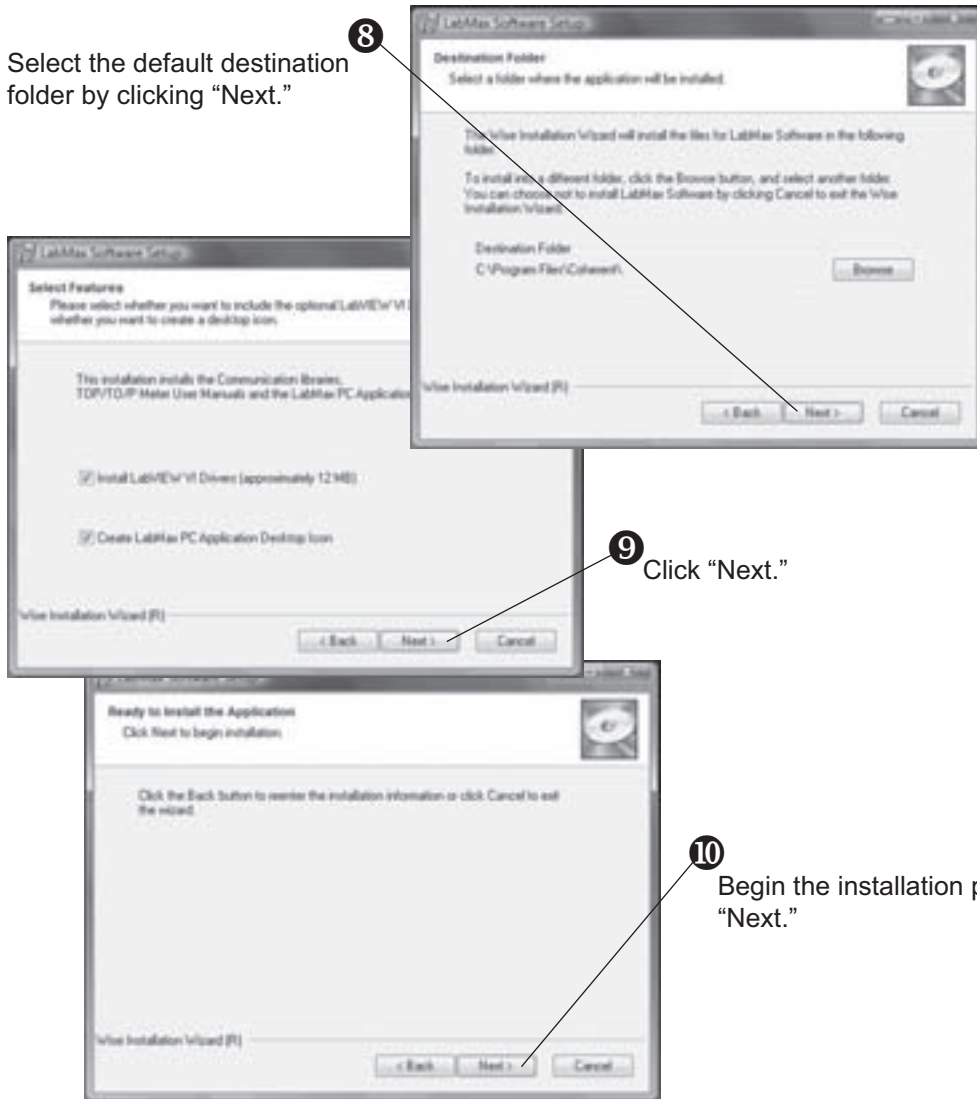
- 5** Click “Next.”

- 6** Fill in your name and the name of your organization.

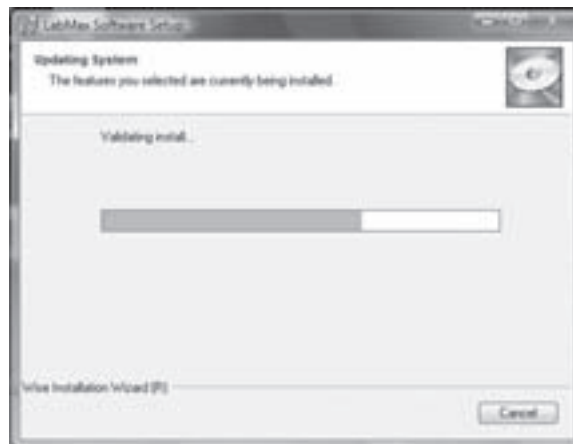


- 7** Select “Only for me (your name)” and then click “Next.”

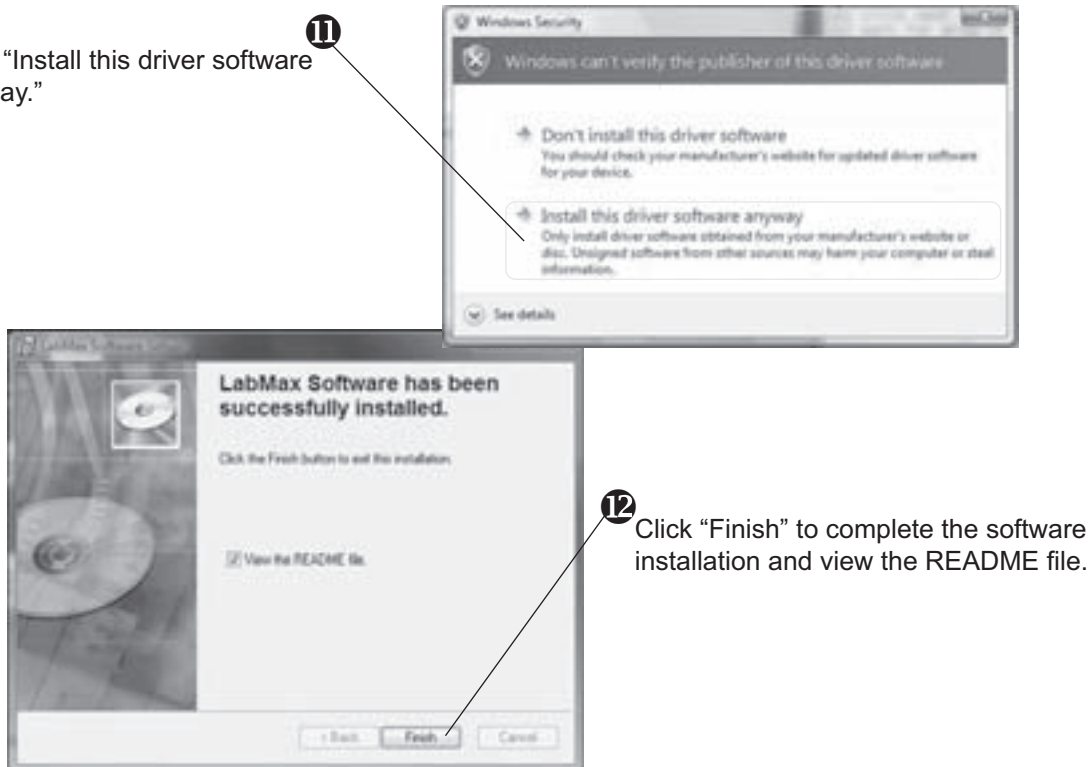
Select the default destination folder by clicking "Next."



The Updating System screen displays while the program is installing . . .



Click “Install this driver software anyway.”



Click “Finish” to complete the software installation and view the README file.

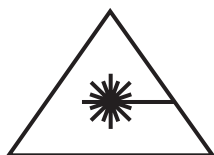


# QUICK START

This section presents “mini-tutorials” that explain how to connect a sensor to your LabMax meter, begin taking measurements within minutes, and save your data for later viewing.

- Measuring power with a thermopile or optical sensor (page 12)
- Saving data to a file on the local drive (page 13)
- Moving a file to the USB flash drive (page 14)

For detailed information about each step of the procedures introduced in this section, refer to “Operation” on page 25.



---

**Follow all laser safety procedures. The laser must be blocked or switched OFF before beginning any of the procedures described in this section.**

---



---

**Power to the LabMax meter must be OFF before beginning any of the procedures described in this section.**

---



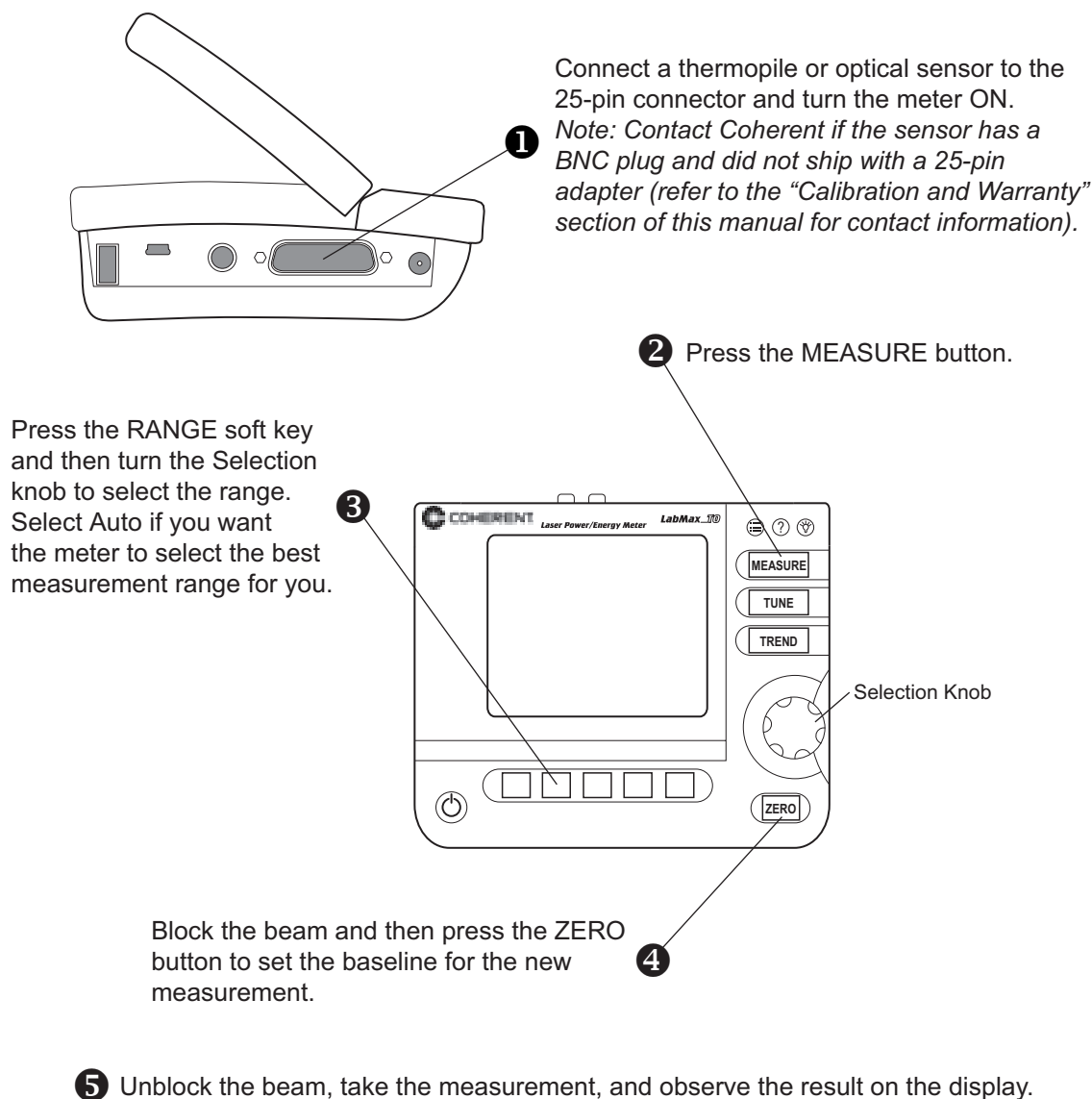
---

**Do not exceed the power/energy density limits of the sensor.**

---

## Measuring Power With a Thermopile or Optical Sensor

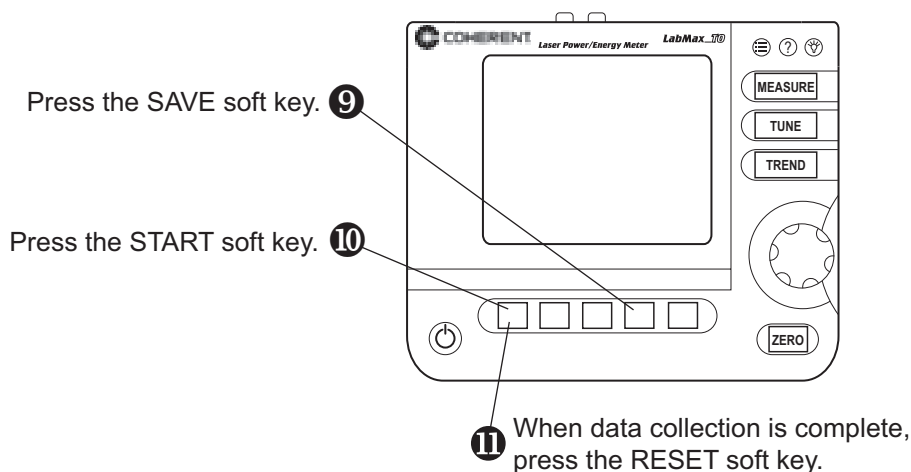
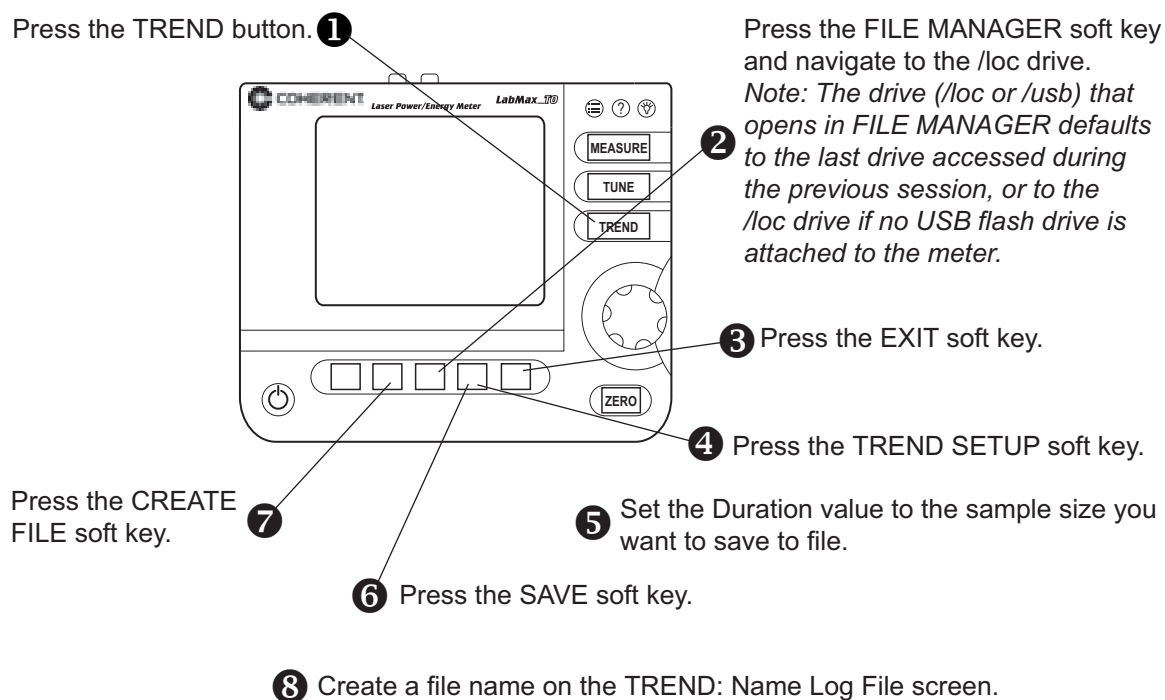
The tutorial describes how to take a power measurement using a thermopile or optical sensor.



**Figure 2. Quick Start: Measuring Power With a Thermopile or Optical Sensor**

## Saving Data to a File on the Local Drive

In this tutorial you will learn how to create—and save data to—a file that's stored on the local drive (/loc). The tutorial on page 14 shows how to move a file to the USB flash drive. You can also save data directly to the USB flash drive by navigating to the USB drive in Step 2, in the following illustration.



Data is now saved in the file created in step 8.

**Figure 3. Quick Start: Saving Data to a File on the Local Drive**

## Moving a File to the USB Flash Drive

This tutorial shows how to move a file from the local drive (/loc) to the USB flash drive (/usb) connected to LabMax.

Attach a USB flash drive to the connector on the side panel.

Press the TREND button.

Press the FILE MANAGER soft key and navigate to the /loc drive.  
*Note: The drive (/loc or /usb) that opens in FILE MANAGER defaults to the last drive accessed during the previous session, or to the /loc drive if no USB flash drive is attached to the meter.*

Highlight the file you want to move.

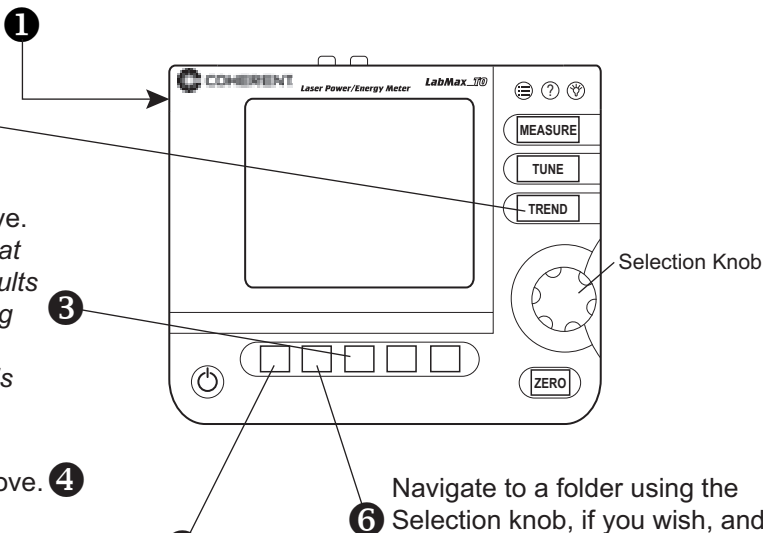
Press the COPY MOVE soft key.

Navigate to a folder using the Selection knob, if you wish, and then press the MOVE soft key.

Press the ENTER/Set button to dismiss the confirmation dialog box.

The file selected in step 4 has been moved to the /usb drive and removed from the /loc drive.

**Figure 4. Quick Start: Moving a File to the USB Flash Drive**



# DESCRIPTION

Thank you for purchasing the LabMax™-TO Laser Power Meter—a versatile, easy-to-use, single-channel power meter designed for anyone who needs to measure and analyze laser output.

This section discusses:

- Product overview (this page)
- Product features (page 16)
- Menu layout (page 17)
- Front panel (page 18)
- Side panel (page 20)
- Rear panel (page 21)
- Battery indicators (page 22)
- Battery pack replacement (page 24)
- AC adapter (page 24)

## **Product Overview**

The LabMax-TO Laser Power Meter meets your needs in new ways via onboard data logging as well as support for logging data directly to a USB flash drive. It also offers enhanced data analysis and statistics, and a form factor that allows flexible positioning and viewing angles so it can be used in areas with limited bench space. LabMax is directly compatible with most Coherent thermal and semiconductor sensors (with no need for adapters) and displays beam position for quick and accurate setup. Performance is enhanced in the form of low noise pulse energy measurement and high resolution power measurement.



## **Product Features**

Specific features of your LabMax meter include:

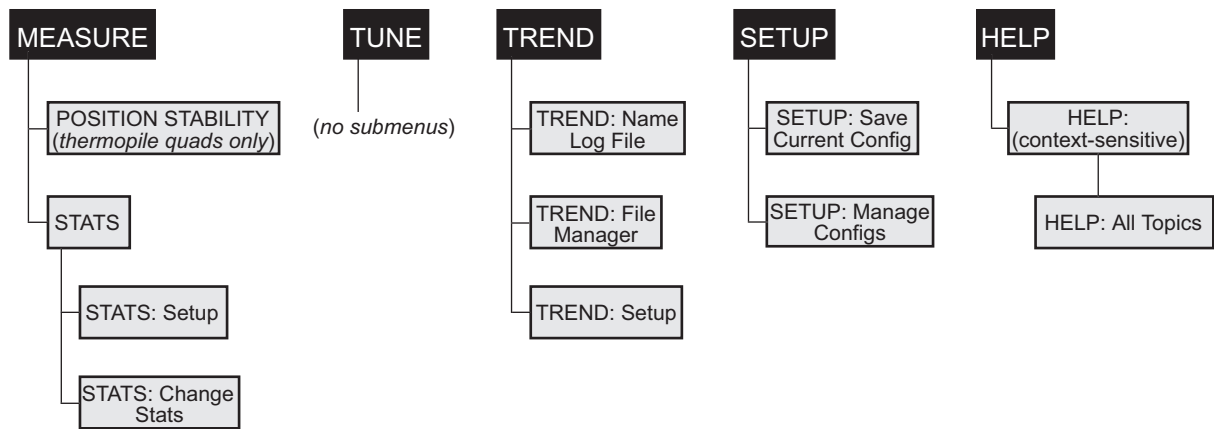
- Compatible with LM-, PM-, and PS- model thermopile sensors, and OP-2 and LM-2 model optical sensors. No adapters required.
- Displays beam position with LM-model sensors
- Supports 5-digit resolution with thermopile and optical sensors (user selectable).
- Large, graphical display with backlight. Ergonomic interface with easily accessible buttons for all features and modes. Flexible positioning of the display allows viewing from many angles.
- Digital tuning indicators - horizontal bar and trend chart formats with peak indicators.
- Onboard statistics (mean, minimum, maximum, standard deviation, range, three stability parameters, dose, and missed pulses). Display up to six user-selectable statistical parameters at a time.
- Data logging can be performed directly to a USB flash drive, or up to 400,000 points can be retained onboard the meter. The meter has a file management system that allows naming and renaming files, auto increments file names for repetitive logging events, supports folder creation and renaming, and transfers files and folders from onboard memory to USB flash drive.
- USB and RS-232 computer interfaces with full host control and drivers for both VisualBasic and LabVIEW™ programmers. Plug-and-play applications software is also supplied standard, along with USB and RS-232 cables.
- Analog output with user-selectable full-scale voltage of 1, 2 or 4V. RCA-to-BNC converter included (standard).
- External trigger input with user-selectable slope and trigger delay.
- Field-upgradeable meter internal software and operating system, with updates available on the Coherent website or e-mailed directly to the user. This feature ensures that you always have the latest LabMax features.
- Li-ion battery powered (4400 mAh pack standard), as well as the ability to operate with an AC power adapter (PSE and UL approved). Meter contains a smart charging circuit onboard to charge the rechargeable battery pack and the display has a

battery level indicator. AC power adapter and cord are included.

- LabVIEW Instrument Driver that can be used with USB or RS-232 interfaces.
- Applications software that allows you to plug the meter into your PC and immediately analyze data and log it to a file. The software is contained on the CD that ships with the meter and will also be available on our website as a free download.

## Menu Layout

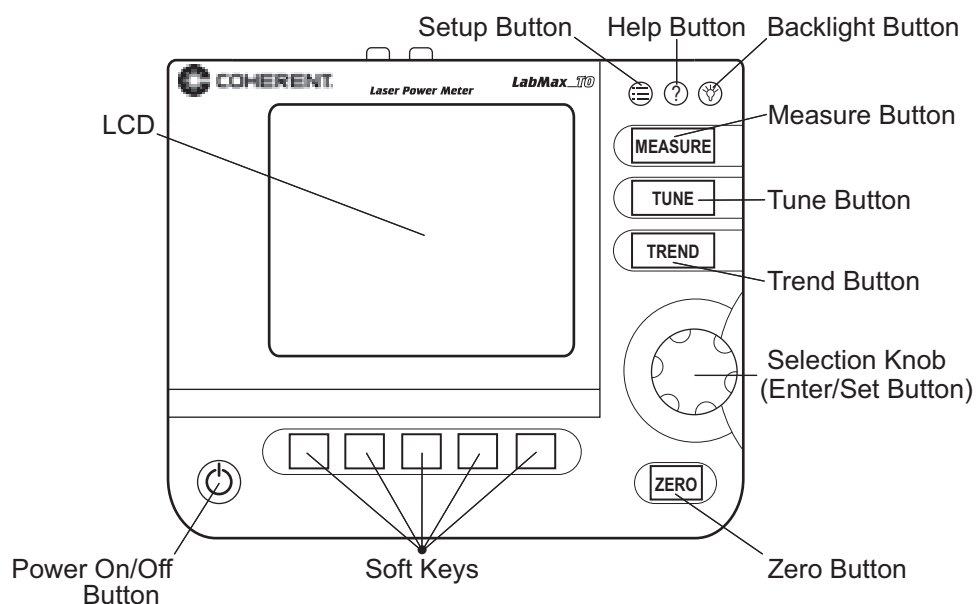
The following chart graphically depicts the LabMax menu organization.



**Figure 5. Menu Organization**

## Front Panel

The front panel (shown in Figure 6) includes a large liquid crystal display (LCD), as well as buttons, a Selection knob, and soft keys that are used to enter parameters, select modes, and change ranges



**Figure 6. Front Panel**

## Buttons

LabMax has the following buttons (refer to Figure 6 for button locations):

- SETUP
- HELP
- BACKLIGHT
- MEASURE
- TUNE
- TREND
- ZERO
- Power On/Off
- Selection knob (which also functions as the Enter/Set button when pressed, rather than turned)

For detailed information about each of the buttons, refer to “Operation” on page 25.



## Soft Keys

The five soft keys—just below the LCD—are used for three main functions:

- Navigating to a different screen. Examples: POSITION STABILITY and TREND SETUP.
- Performing an action. Examples: START and RESET.
- Making a selection from a list of possible choices. Examples: RANGE and UNITS.

For detailed information about soft keys, refer to “Operation” on page 25. To learn how to change a value, refer to “Selection Knob” on page 19.

## Power On/Off Button



If a sensor is connected to the meter when it is turned on, the meter defaults to the last mode (MEASURE, TUNE, TREND, or SETUP) used with that specific type of sensor (thermopile or optical). If the wavelength of the new sensor is out of range of the previously-selected wavelength for the sensor typed attached, the meter automatically switches to the calibration wavelength for that sensor.

A “Searching for sensor” error message will appear on the LCD if the meter is turned on without a sensor connected to it. (See “Meter and Sensor Errors” on page 161 for a complete listing and description of all error messages.)

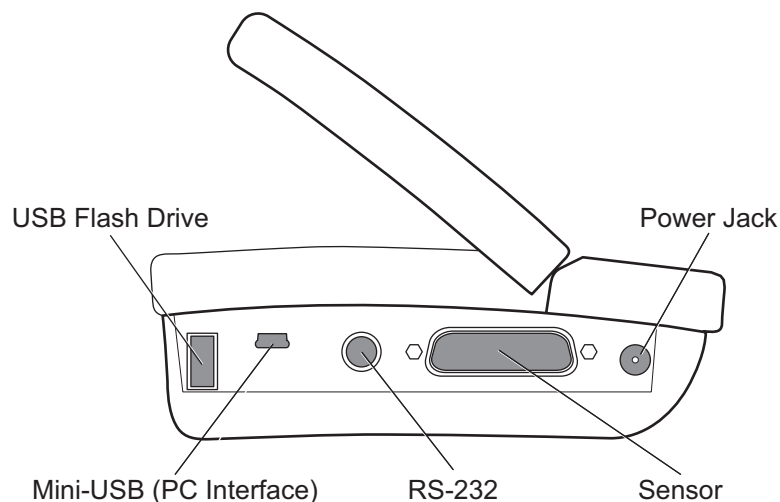
## Selection Knob



To change a value, first *turn* the Selection knob to select a specific value, and then *press* the Selection knob (which also functions as an Enter/Set button when pressed, rather than turned) to save the value.

## Side Panel

Figure 7 shows the location of the LabMax connectors on the side panel. Each of these connectors is discussed, below.



**Figure 7. Side Panel Connectors**

### USB Flash Drive Connector

This is an input connector for a USB (FAT16) flash drive.

### Mini-USB Connector

Attaching the cable—shipped with the meter—to this mini-USB connector allows communication between LabMax and a computer that has a USB interface.



---

**Install the LabMax software *before* physically connecting the meter to the computer. For information about installing the software, refer to “Software Installation” on page 5.**

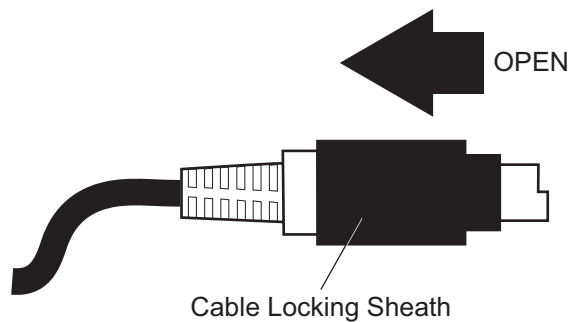
---

### RS-232 Connector

This is an RS-232, female, miniature 6-pin DIN. For a list of pin assignments, refer to Table 16 on page 157.

To connect the RS-232 cable to the meter:

1. Hold the cable locking sheath in the open position:



2. Slide the cable into the RS-232 connector on the side of the meter.
3. Release the cable locking sheath to lock the cable in place.

### Sensor Connector

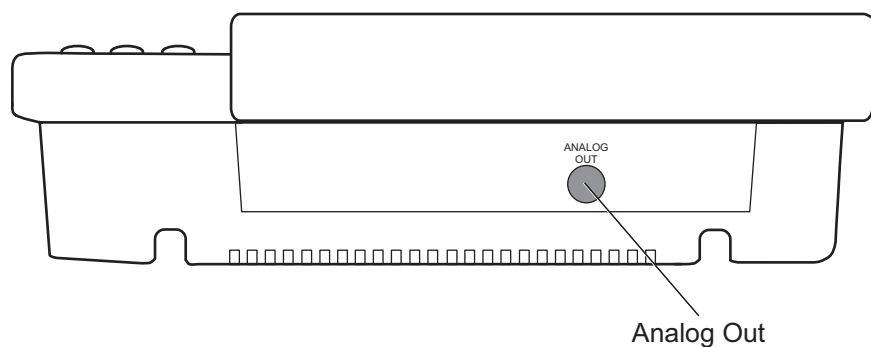
Use this connection to attach a Coherent thermopile or optical sensor to LabMax.

### Power Jack Connector

Connect the power cord—shipped with the meter—to this connector.

### Rear Panel

The following figure shows the location of the LabMax connector on the rear panel. This connector is discussed, below.




**Figure 8. Rear Panel Connectors**

## Analog Out Connector

When power is on, the Analog Out connector outputs a voltage proportional to the current laser measurement with respect to the measurement range. The output voltage is zero (0) volts when the measured energy or power is zero (0) or less. The output voltage is the full-scale output voltage when the measured energy or power is full-scale or overranged. The full-scale output voltage (1, 2, or 4V) is selected in the SETUP screen or via the host interface. Factory default full-scale output voltage is 2V.

## Battery Indicators

This section discusses three indicators that provide information on the status of the internal battery. These indicators appear in the upper left corner of the LCD.

 The Battery Life indicator visually represents the percentage of remaining battery life (refer to Table 1). This indicator only appears on the screen when a battery is installed in the meter.





---

**The Battery Life indicator will begin flashing shortly before the battery is completely discharged. To avoid loss of data, immediately either save the current information to a file, or connect AC power to the meter.**

---

**Table 1. Battery Life Indicator**

NUMBER OF VISIBLE BARS	REMAINING BATTERY LIFE
5	81 to 100%
4	61 to 80%
3	41 to 60%
2	21 to 40%
1	11 to 20%
0	0 to 10%

 The Charging indicator signals that the battery is currently being charged. It only appears on the screen when the meter is running on AC power and the installed battery has less than 100% charge. Once the battery is completely charged, the Charging indicator disappears.



The Charging Malfunction indicator only appears when there is something wrong with the battery charging process. To attempt to solve the problem, begin by removing the battery and then re-attaching it. Then unplug the AC power source from the meter and then plug it back in. If this does not clear the error, fully drain the battery and recharge it (refer to “Battery Charging Procedure,” below, for information about discharging and recharging the battery). If the Charging Malfunction indicator continues to display, call Coherent for assistance (refer to Table 14, “Coherent Service Centers,” on page 154 for contact information).

## Battery Charging Procedure



---

**To achieve greater battery fuel gauge accuracy, complete the following procedure. *This procedure must be repeated whenever a new battery pack is installed (including when you first receive the meter) and can be repeated at any time to reset the fuel gauge registers.***

---

1. Install the battery pack into LabMax (in the case of a new meter, the battery pack comes already installed). Refer to “Battery Pack Replacement” on page 24 to see how to attach the battery connector to the meter.
2. Fully-charge the battery pack by running the meter on AC power for at least eight hours.
3. Fully-discharge the battery pack by unplugging LabMax from the AC source and then running the meter using only battery power. Let the meter run until it automatically shuts off (which indicates a dead battery).
4. Fully-charge the battery pack again (> 8 hr.).

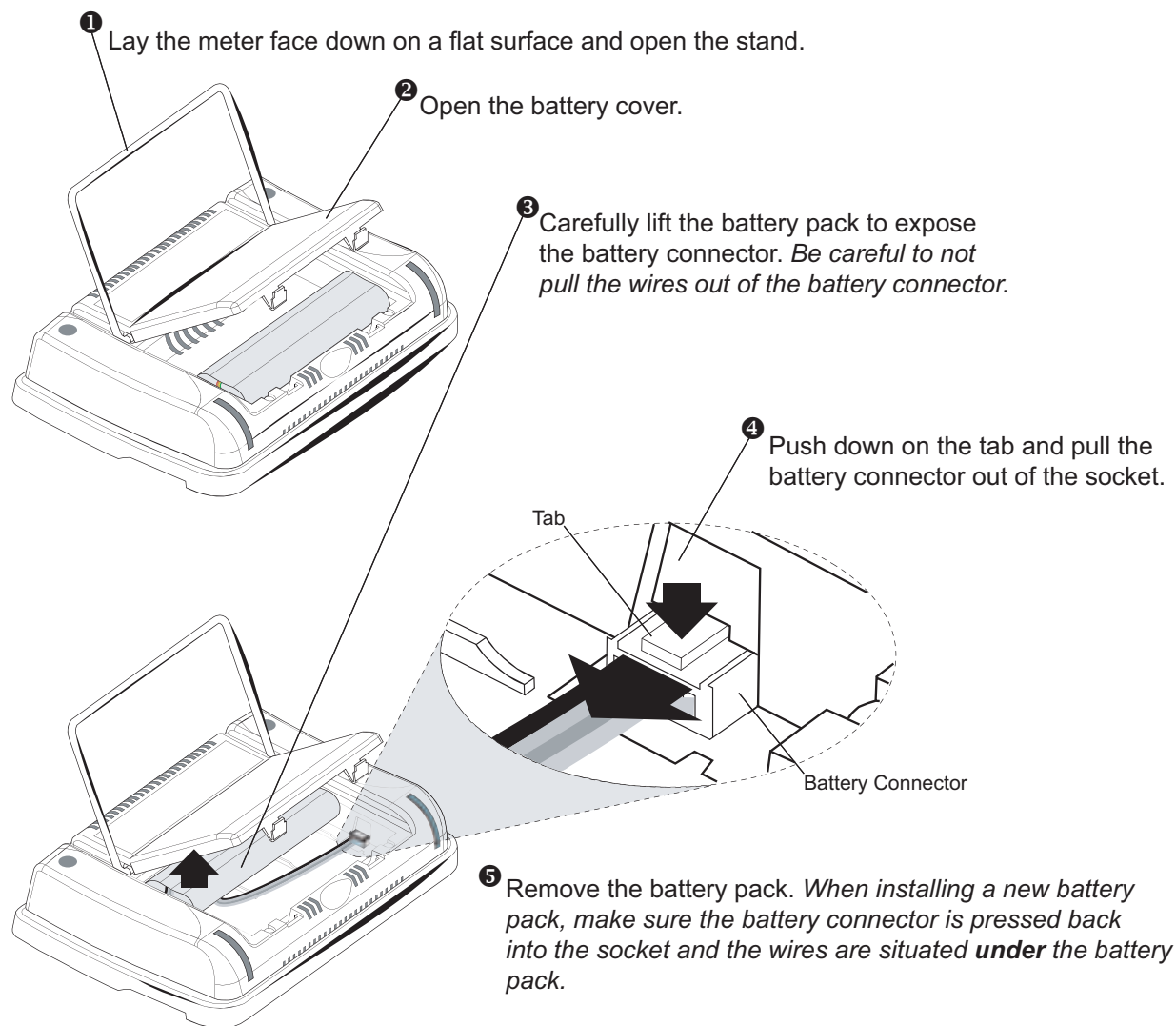
---

**It can take up to one minute for LabMax to update the Battery Charge indicator after the installation of a new battery or after attaching an AC power adapter.**

---

## Battery Pack Replacement

Figure 9 illustrates how to replace the LabMax standard battery pack. To review battery specifications, refer to “Appendix A: Specifications” on page 155.



**Figure 9. Battery Pack Replacement**

## AC Adapter

Using an AC adapter prolongs battery life. LabMax automatically senses when an adapter is being used.

# OPERATION

This section discusses:

- Units (this page)
- MEASURE (this page)
- TUNE (page 40)
- TREND (page 43)
- ZERO (page 59)
- SETUP (page 60)
- HELP (page 88)
- BACKLIGHT (page 89)

## Units

Measurement units are expressed in terms listed in the following table:

**Table 2. Joules and Watts Units**

JOULES <sup>A</sup>	WATTS <sup>A</sup>
pJ (picojoules)	pW (picowatts)
nJ (nanojoules)	nW (nanowatts)
µJ (microjoules)	µW (microwatts)
mJ (millijoules)	mW (milliwatts)
J (joules)	W (watts)
	kW (kilowatts)

A. When area correction is enabled, all units are expressed in terms of per cm<sup>2</sup>. In other words, the /cm<sup>2</sup> suffix is always appended to the units.

## MEASURE

MEASURE

The MEASURE mode provides three primary functions: Measure Power, Measure Energy, and Statistics. Each of these functions are discussed in detail, below.

## Measurement Display and Range Selection

The graphical display update rate for numeric measurement is three times per second.

Measurement range is selected in decade steps. Range selection is dependent on the sensor type and characteristics, as well as user-determined measurement settings.

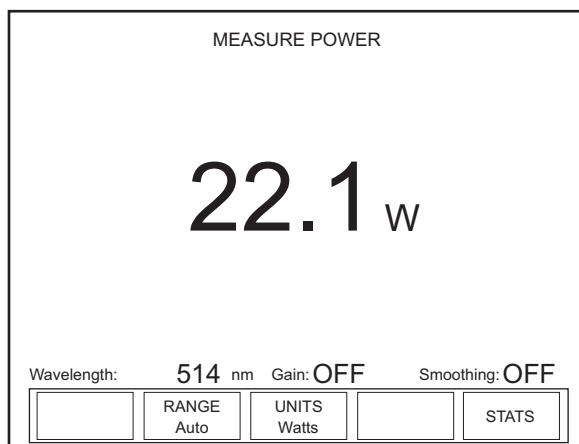
LabMax uses the “3’s” Rule—a display formatting rule in which the display value is not allowed to exceed 3, 30, or 300, depending on where the decimal point falls, with the decimal point located in a fixed position, as determined by the current range. Typically if a reading exceeds the “3’s” limit, the instrument is over-ranged or, in the case of Auto Ranging, the instrument will automatically range up.

*Over-ranging* refers to a meter setup condition in which the sensor output signal is greater than the maximum allowable level for the selected range. OVR appearing on the display signifies an over-range condition. Over-ranging generates invalid data.

## Measure Power

### Thermopile Sensors

Figure 10 shows an example of how the MEASURE POWER screen looks when a thermopile sensor is connected to the meter (for thermopile quad sensors, refer to “Thermopile Quad Sensors” on page 27):



**Figure 10. MEASURE POWER: Thermopile Sensors**

This screen contains the live reading and also shows the following indicators: Wavelength, Gain, and Smoothing. Note that Figure 10 shows an example screen with Area Correction turned OFF. With



Area Correction turned ON, the screen looks slightly different. (A summary of indicator behavior is provided in “Appendix C: Onscreen Indicators” on page 163.)

### Soft Keys

There are three soft keys on this screen: RANGE, UNITS, and STATS.

#### *RANGE*

Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

#### *UNITS*

Pressing the UNITS soft key toggles the measurement units between Watts and Joules.

#### *STATS*

Refer to “Statistics” on page 32 for information about the STATS menu.

### Over-Temperature Condition

*(thermopile sensors only)* Whenever the meter detects a sensor over-temperature condition, a Sensor Over Temp dialog message appears on the screen. *This message does not appear unless a sensor over-temperature condition exists.*



### Thermopile Quad Sensors

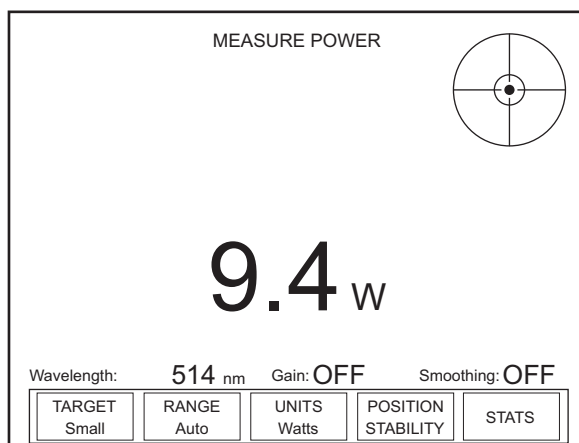
---

**If a Sensor Over Temp message appears on the screen, turn the laser off immediately and let the sensor cool down.**

---

Figure 11 shows an example of how the MEASURE POWER screen looks when a thermopile quad sensor is connected to the meter. In addition to the live display, there is a positional target that is used to

make sure the beam is aligned to the center of the sensor before taking a measurement. The outer edge of the bulls eye target represents the outer edge of the sensor's active area.



**Figure 11. MEASURE POWER: Thermopile Quad Sensors**

This screen contains the live reading and also shows the following indicators: Wavelength, Gain, and Smoothing. (A summary of indicator behavior is provided in “Appendix C: Onscreen Indicators” on page 163.)

### Soft Keys

There are five soft keys on this screen: TARGET, RANGE, UNITS, POSITION STABILITY, and STATS.

#### TARGET

Available values: Small and Large.

To adjust the size of the target, toggle the TARGET soft key.

#### RANGE

Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

*UNITS*

Pressing the UNITS soft key toggles the measurement units between Watts and Joules.

*POSITION STABILITY*

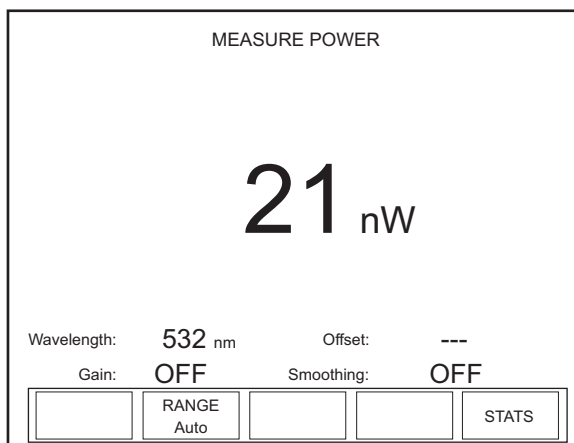
Refer to “POSITION STABILITY” on page 38.

*STATS*

Refer to “Statistics” on page 32 for information about the STATS menu.

**Optical Sensors**

Figure 12 shows an example of how the MEASURE POWER screen looks when an optical sensor is connected to the meter:



**Figure 12. MEASURE POWER: Optical Sensors**

This screen contains the live reading and also shows the following indicators: Wavelength, Offset, Gain, and Smoothing. (A summary of indicator behavior is provided in “Appendix C: Onscreen Indicators” on page 163.)

**Soft Keys**

There are two soft keys on this screen: RANGE and STATS.

*RANGE*

Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

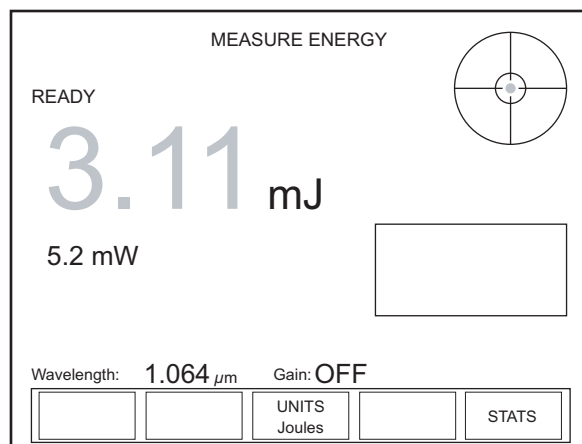
### STATS

Refer to “Statistics” on page 32 for information about the STATS menu.

## Measure Energy

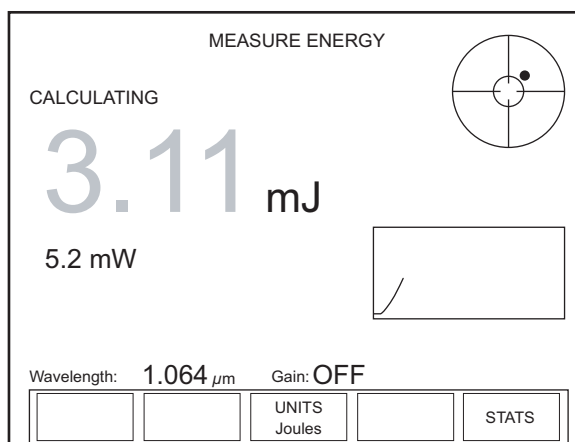
### Thermopile Sensors, Long Pulse Joules

Connecting a thermopile sensor to the meter and switching to Joules mode displays the screen shown in Figure 13. This mode measures the energy of single pulses between 1 millisecond and 10 seconds in length, and with energies from 5 mJ to hundreds of joules. The energy range is sensor dependent. More sensitive thermopiles (such as a PS10Q) are required to measure long mJ pulses.



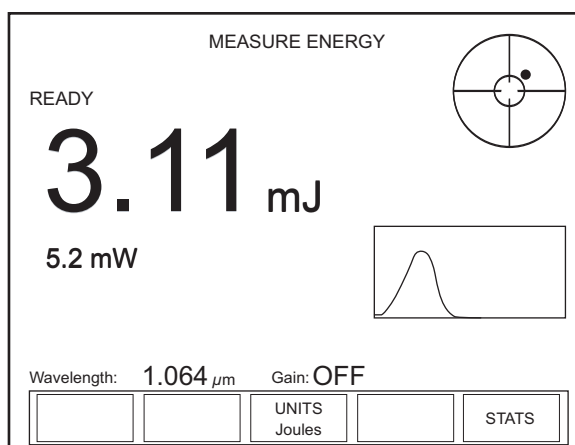
**Figure 13. MEASURE ENERGY: Thermopile Sensors (Long Pulse Joules)**

Display Smoothing and Speedup are not active in this mode. When a pulse is received, the READY indicator in the upper left of the screen changes to CALCULATING, the position indicator shows the beam position in the crosshairs, and a plot of the thermopile response begins (Figure 14).



**Figure 14. MEASURE ENERGY: Thermopile Sensors (Long Pulse - Active)**

Once the calculation has been completed, the new Joules value is displayed, the CALCULATING indicator is replaced with READY, and the plot stops (Figure 15). After two seconds, the Joules value dims and the beam position dims in its final position):



**Figure 15. MEASURE ENERGY: Thermopile Sensors (Long Pulse - After Pulse)**

## RANGE

When measuring energy with a thermopile sensor, the meter automatically determines the appropriate range. The range value cannot be manually changed.

## UNITS

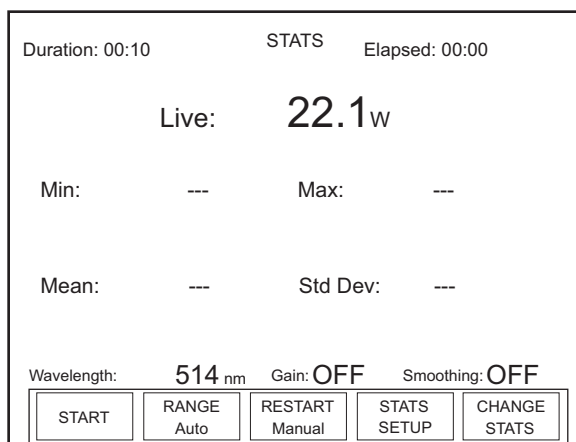
Pressing the UNITS soft key toggles the measurement units back to Watts and displays the MEASURE POWER screen.

## STATS Soft Key

Pressing the STATS soft key displays the STATS screen. For details on the STATS screen, refer to “Statistics” on page 32.

## Statistics

Pressing the STATS soft key from the MEASURE screen will display the screen in Figure 16.



**Figure 16. STATS: Thermopile and Optical Sensors**

The STATS screen displays the live measurement and, by default, the Min, Mean, Max, and Standard Deviation values. It is possible to modify the parameters shown on this screen by selecting up to six statistics for display. (To learn how to select different statistics, refer to “CHANGE STATS” on page 35.)

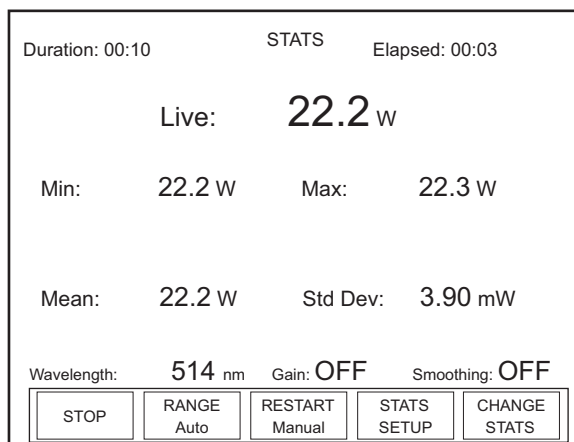
The Duration indicator in the upper left corner of the STATS screen can be changed in Stats Setup (discussed under “STATS SETUP Description” on page 35). See “Appendix C: Onscreen Indicators” on page 163 for a summary of indicators and their behavior.

## Soft Keys

There are five soft keys on this screen: START, RANGE, RESTART, STATS SETUP, and CHANGE STATS.

### START

Pressing the START soft key begins data collection. The statistics appear on the screen as the batch is collected (see the following example):



**Figure 17. STATS: Data Collection (In Process)**

---

**Pressing the STOP key—which appears in place of the START key during data collection—ends data collection.**

---

### RANGE

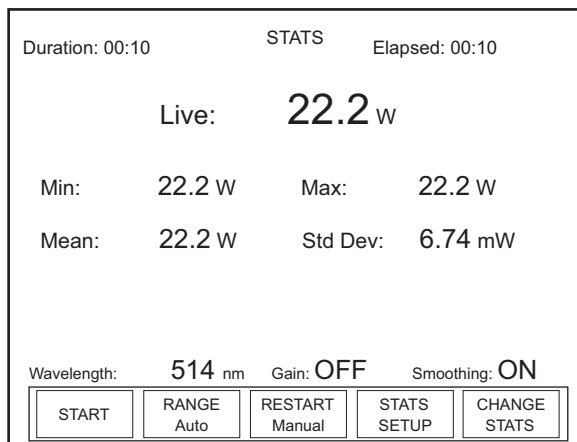
Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

## RESTART

The RESTART soft key on the STATS screen toggles between Manual (factory default) mode and Auto mode.



**Figure 18. STATS: Statistics Readout**

## Manual Mode

In *Manual* mode, pressing the START soft key begins data collection. Data collection ends by:

- Pressing the STOP soft key—which appears in place of the START key during data collection.
- Reaching the time duration that was set for data collection (see “STATS SETUP Description” on page 35 for information about setting the time duration).

## Auto Mode

Auto mode acts similar to Manual mode, except that once data collection reaches the time duration, the batch automatically starts over.

As with Manual RESTART, pressing the STOP soft key immediately stops data collection.

## STATS SETUP

Refer to “STATS SETUP Description” on page 35.



*CHANGE STATS*

Pressing the CHANGE STATS soft key on the STATS screen displays the following screen:

STATS: Change Stats

☒ Min  
☐ Max  
☐ Mean  
☐ Standard deviation  
☐ Range  
☐  $\sigma$  / mean in %  
☐  $2 \sigma$  / mean in % (stability)  
☐  $3 \sigma$  / mean in %

Select up to 6 parameters to display

EXIT

**Figure 19. STATS: Change Stats**

Up to six items can be selected for display on the STATS screen.

To select an item:

1. Turn the Selection knob to move the highlight up or down the list.
2. Press the ENTER/SET button to select or de-select an item.
3. Press the EXIT soft key to save the settings and exit Change Stats mode.

*STATS SETUP Description*

Statistics batch size is specified on this screen. The total amount of time and the rate at which data is collected can be adjusted.

By default, thermopile and optical sensors are sampled 10 times per second. This is the maximum sampling rate possible.

To change the current stat settings, press the STATS SETUP soft key to display the STATS: Setup screen:

STATS: Setup		
Display units:	<input type="text" value="Watts"/>	
Duration:	00:00:00:10	(days:hr:min:sec)
Sampling rate:	10	samples every (hr:min:sec) 00:00:01
Batch Size:	100	
<div> <input data-bbox="495 688 597 737" type="button" value=" &lt;&lt;- "/> <input data-bbox="609 688 711 737" type="button" value="-&gt;&gt; "/> <input data-bbox="820 688 917 737" type="button" value="SAVE"/> <input data-bbox="928 688 1026 737" type="button" value="CANCEL"/> </div>		

**Figure 20. STATS: Setup (Thermopile and Optical Sensors)**

### Soft Keys

There are four soft keys on this screen: <<-/->> (Previous/Next directional arrows), SAVE, and CANCEL.

<<- and ->> (directional arrows)

Parameters on this screen are changed by using one of the following procedures. The procedure that should be used depends on the type of parameter you want to modify.

#### “Single” Parameters

This type of parameter—Display units, for example—has only one modifiable field. To change a value for this type of parameter:

1. Press the ENTER/SET button until the parameter you want to change is highlighted.
2. Turn the Selection knob to change the parameter value.
3. Press the ENTER/SET button to move to the next parameter.
4. Continue this process until the values for all the parameters are correct.
5. Once the values for all the parameters are correct, press the SAVE soft key to save the parameters and display the STATS screen.

### “Multiple” Parameters

This type of parameter—Duration, for example—contains several fields that can be modified. To change a value for this type of parameter:

1. Press the ENTER/SET button until the parameter you want to change is highlighted.
2. Turn the Selection knob to change the parameter value.
3. Press either of the directional arrows soft keys (<<- or ->>) to move the highlight to another value within the same parameter.
4. Repeat steps 2 and 3 until all values for that parameter are correct.
5. Press the ENTER/SET button to move to the next parameter.
6. Once the values for all the parameters are correct, press the SAVE soft key to save the parameters and display the STATS screen.

### *SAVE*

Pressing the SAVE soft key saves whatever changes were made since the last SAVE and displays the STATS screen.

### *CANCEL*

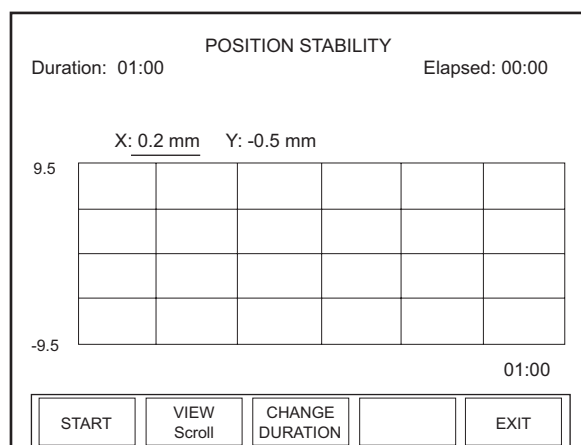
Pressing the CANCEL soft key discards all changes that were made since the last SAVE and displays the STATS screen.

## Detailed Procedures

This section provides in-depth information about specific topics that were briefly discussed earlier.

### POSITION STABILITY

When a quad thermopile sensor is attached to the meter, pressing the POSITION STABILITY soft key on the MEASURE POWER screen will display a screen similar to the following:



**Figure 21. MEASURE POWER: POSITION STABILITY**

The X-axis of the graph is time and the Y-axis is based on the diameter of the sensor active area.

The Duration indicator in the upper left shows how long the meter will collect data. The Elapsed indicator in the upper right corner begins its count when the START soft key is pressed.

The actual X and Y values (just above the graph) update as the data is collected.

#### Soft Keys

There are four soft keys on this screen: START, VIEW, CHANGE DURATION, and EXIT.

#### START

Pressing the START soft key starts data collection and toggles the soft key to STOP. When data collection completes (either by pressing the STOP button or as determined by the previously-set duration), the button toggles to START again. Pressing START when there is already data on screen, clears that data and starts data collection over.

### VIEW

The VIEW soft key toggles between Scroll and Fit:

- Fit—Fits the entire duration on the X-axis in one screen
- Scroll—Pages the data every minute

### CHANGE DURATION

Pressing the CHANGE DURATION soft key accesses the Duration field in the upper left corner of the screen, as shown here:

Duration: 00:00:01 POSITION STABILITY Elapsed: 00:00

X: 0.2 mm Y: -0.5 mm

9.5

-9.5

00:01

<<- >>- CHANGE DURATION EXIT

**Figure 22. POSITION STABILITY: Duration**

To change the duration:

1. Use the left and right arrow soft keys to highlight an individual duration field (hours, minutes, or seconds).
2. Turn the Selection knob to change the value of the currently-highlighted field.
3. Repeat steps 1 and 2 until the desired duration has been entered.
4. To save the duration, either press the ENTER/SET button (which will display the POSITION STABILITY screen), or press the EXIT soft key (which will exit POSITION STABILITY mode and display the MEASURE POWER screen).

### EXIT

Pressing the EXIT soft key displays the MEASURE POWER screen.

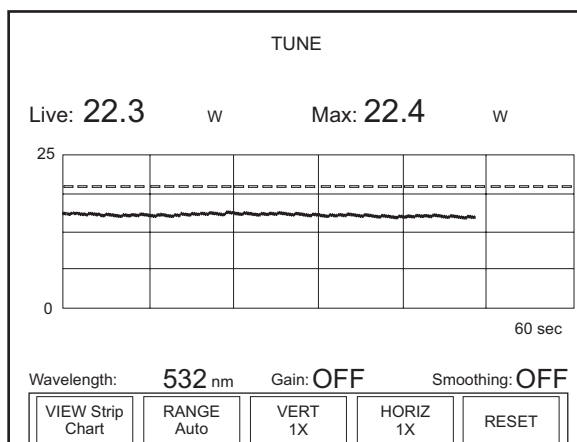
## TUNE



Pressing the TUNE button on the front panel of the meter will enter the TUNE mode. This mode is used in place of an analog needle to monitor the laser output while tuning or tweaking the laser. Typically the laser output is being maximized during the process, and both tuning screens—Strip chart and Bar chart—contain peak indicators and display the maximum measured value since the laser Reset event. Details of the strip chart and bar chart are discussed next.

## Strip Chart

Figure 23 shows an example Strip chart screen for both thermopile and optical sensors. Press the RESET soft key to reset the peak indicator, maximum measured value, and vertical scale. When the Vertical scale factor is set to 1X, pressing the RESET soft key will also clear the display. When in a higher scale factor, the screen is not cleared but the factors are reset and the plot is centered on the live reading.



**Figure 23. TUNE: Strip Chart (Thermopile and Optical Sensors)**

### Soft Keys

There are five soft keys on this screen: VIEW, RANGE, VERT, HORIZ, and RESET.

#### VIEW

Pressing the VIEW soft key at the bottom of the TUNE screen toggles between the Strip chart and the Bar chart (for more information about Bar charts, refer to “Bar Chart” on page 41).

### *RANGE*

Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

### *VERT*

Pressing the VERT soft key zooms in and out on the Y-axis presented in the TUNE chart. Zooming does not disturb data collection. Available zoom levels are 1, 2, 5, 10, and 20X.

To change the VERT level:

1. Press the VERT soft key.
2. Turn the Selection knob to change the VERT value.
3. When the desired value appears, press the VERT soft key (or the ENTER/SET button) to lock in the VERT value.

### *HORIZ*

Pressing the HORIZ soft key zooms in and out on the X-axis presented in the TUNE chart. Zooming does not disturb data collection. Available zoom levels are 1, 2, 5, 10, and 20X.

To change the HORIZ level:

1. Press the HORIZ soft key.
2. Turn the Selection knob to change the HORIZ value.
3. When the desired value appears, press the HORIZ soft key (or the ENTER/SET button) to lock in the HORIZ value.

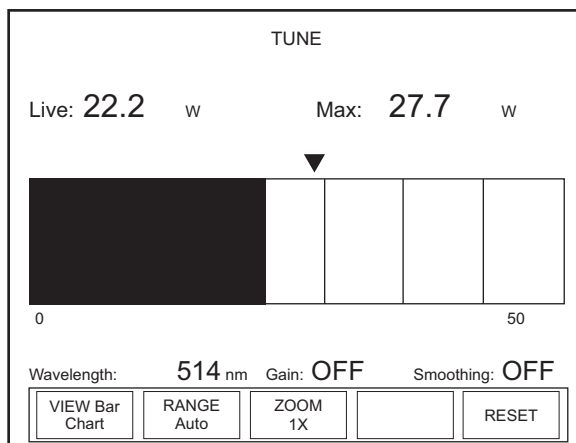
### *RESET*

Pressing this soft key resets the Max value.

## **Bar Chart**

Figure 24 shows an example Bar chart screen for thermopile and optical sensors. Press the RESET soft key to reset the peak indicator, maximum measured value, and vertical scale. When the Zoom scale

factor is set to anything greater than 1X, pressing the RESET soft key will also reset the x-axis scale factors to center the indicator bar on the live value.



**Figure 24. TUNE: Bar Chart (Thermopile and Optical Sensors)**

### Soft Keys

There are four soft keys on this screen: VIEW, RANGE, ZOOM, and RESET.

#### VIEW

Pressing the VIEW soft key at the bottom of the TUNE screen toggles between the Bar chart and the Strip chart (for more information about Strip charts, refer to “Strip Chart” on page 40).

#### RANGE

Available values: Auto (factory default), and the allowable ranges for the attached sensor.

To adjust the range:

1. Press the RANGE soft key.
2. Turn the Selection knob to change the range value.
3. When the desired value appears, press the RANGE soft key (or the ENTER/SET button) to lock in the RANGE value.

#### ZOOM

Pressing the ZOOM soft key zooms in and out on the Y-axis presented in the TUNE chart. Zooming in on the displayed data is useful if you are trying to resolve small changes in laser output that



cannot be easily seen in the full scale, non-zoomed state. Zooming does not disturb data collection. Available zoom levels are 1, 2, 5, 10, and 20X.

To change the ZOOM level:

1. Press the ZOOM soft key.
2. Turn the Selection knob to change the ZOOM value.
3. When the desired value appears, press the ZOOM soft key (or the ENTER/SET button) to lock in the ZOOM value.

### RESET

Pressing this soft key resets the Max value.

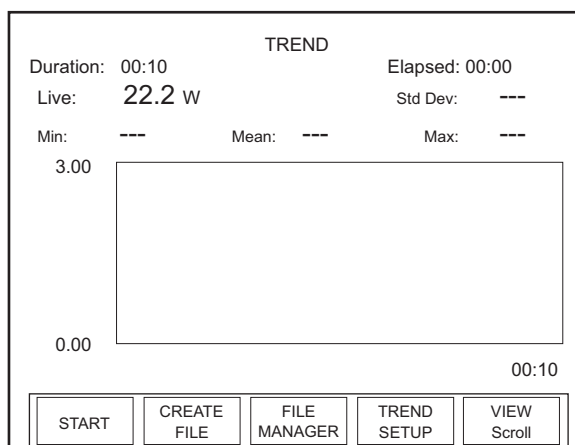
## TREND



Trend is the mode in which data can be logged to a file onboard the meter or to a USB flash drive. Additionally, the trend history of the data is displayed as it is logged.

Versatile data logging in trend mode is supported by a File Management function that provides file naming (including auto-sequencing of file names), folder creation, as well as saving, moving, and deleting files and folders.

Pressing the TREND button on the front panel displays the following screen:



**Figure 25. TREND: Thermopile and Optical Sensors**

The indicator in the upper left corner—Duration—displays the factory default batch size setting. If this setting is acceptable, press the START soft key to begin data collection. To change the duration:

- Press the TREND SETUP soft key on the TREND screen to display the TREND: Setup menu.
- Use the left arrow and right arrow soft keys to advance through the individual duration fields (days, hours, minutes, or seconds).
- When a specific field is highlighted, turn the Selection knob to change the value of that field.
- Press the SAVE soft key to save the new duration and display the TREND screen.
- Press the START soft key to begin data collection.

To save the data locally, do one of the following:

- Use the CREATE FILE soft key to create and name a file *before* starting data collection (refer to “Name Log File” on page 49).
- Use the SAVE DATA soft key—which appears in place of the CREATE FILE soft key once data collection is complete—to save a file *after* data collection. This is useful if you decide you want to keep the data after collecting it and viewing it on the trend chart. For more information, refer to “TREND Screen After Data Collection” on page 47.

## Soft Keys

There are five soft keys on the main TREND screen: START, CREATE FILE, FILE MANAGER, TREND SETUP, and VIEW.

### *START*

Pressing the START soft key on the main TREND screen starts data collection.

### *CREATE FILE*

Refer to “Name Log File” on page 49.

### *FILE MANAGER*

The FILE MANAGER screen is discussed in detail under “File Manager” on page 52.

*TREND SETUP*

The TREND SETUP screen is discussed in detail under “TREND Setup” on page 57.

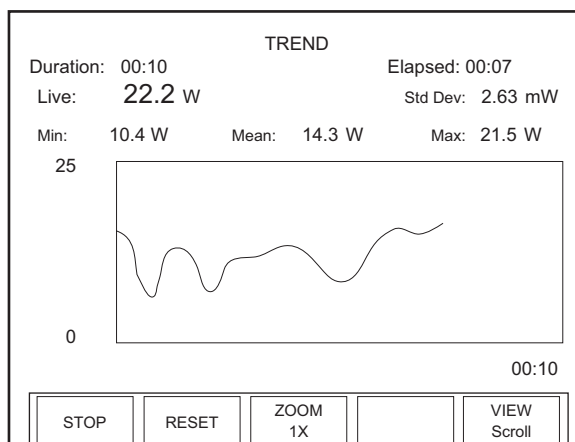
*VIEW*

The VIEW soft key on the main TREND screen toggles between Scroll and Fit:

- Fit—Fits the entire duration on the X-axis in one screen
- Scroll—Pages the data every minute

## TREND Screen During Data Collection

Figure 26 shows an example of how the TREND screen looks during data collection:



**Figure 26. TREND: During Data Collection**

**Soft Keys**

There are four soft key on this screen: STOP, RESET, ZOOM, and VIEW

*STOP*

Pressing the STOP soft key immediately stops batch collection and displays the soft keys described under the heading “TREND Screen After Data Collection” on page 47.

### *RESET*

Pressing the RESET soft key stops batch collection, clears the screen, and displays the soft keys described under the heading “TREND” on page 43.

### *ZOOM*

The ZOOM soft key zooms in or out on the Y-axis presented in the TREND chart. Zooming does not disturb data collection.

To change the zoom:

1. Press the ZOOM soft key.
2. Turn the Selection knob to select a new zoom level.
3. When the desired value appears, press the ZOOM soft key (or the ENTER/SET button) to lock in the ZOOM value.

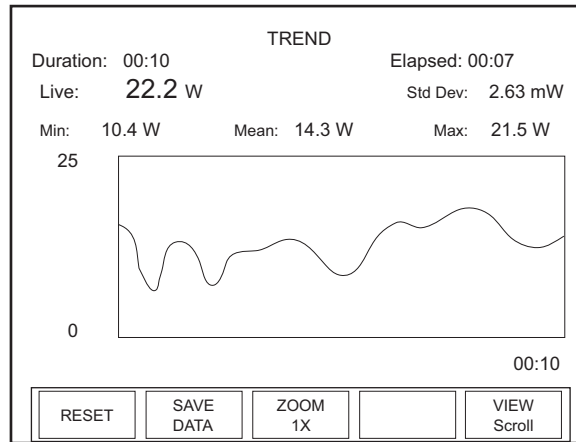
### *VIEW*

The VIEW soft key toggles between Fit and Scroll. It is possible to toggle back and forth between Fit and Scroll during data collection.

- Fit—Fits the entire duration on the X-axis in one screen. The collected data is decimated to allow it to be viewable on a single screen.
- Scroll—Pages the data. After the trend is completed, the data on previous pages can be viewed. If viewing in Scroll mode, turn the Selection knob to scroll back through the data. In this viewing mode, every logged data point is visible.

## TREND Screen After Data Collection

Figure 26 shows an example of what the TREND screen looks like after data collection:



**Figure 27. TREND: After Data Collection**

### Soft Keys

There are four soft keys on this screen: RESET, SAVE DATA, ZOOM, and VIEW.

#### *RESET*

Pressing the RESET soft key stops batch collection, clears the screen, and displays the soft keys described under the heading “TREND” on page 43.

## SAVE DATA

Pressing this soft key displays the following screen:

TREND: File Manager	
/loc	
Name	Size (bytes)
> .	190
Tmp Data Save	
SAVE AS	CREATE FOLDER CANCEL

**Figure 28. TREND: File Manager (Save Data)**

There are three soft keys on this screen: SAVE AS, CREATE FOLDER, and CANCEL.

Pressing the SAVE AS soft key will display the TREND: Save Tmp As screen:

TREND: Save Tmp As	
a	b c d e f g h i j
k	l m n o p q r s t
u	v w x y z 0 1 2 3
4	5 6 7 8 9 - space
Rotate Knob to choose letter. Press to select.	
BACK SPACE	SAVE CANCEL

**Figure 29. TREND: Save Tmp As**

To create a file:

1. Select the first character of the file name by turning the Selection knob and then pressing the ENTER/SET button when the

desired letter or number is highlighted. The character will appear in the blank box immediately below the screen heading.

---

**To delete a character, use the BACKSPACE soft key.**

---

2. Repeat step 1 until the entire new file name appears in the box.
3. Press the SAVE soft key, which will display a file management dialog screen confirming the file is being copied.
4. Once copying is complete (as indicated by the bar on the dialog screen displaying the text, *100%*), press the ENTER/SET button to dismiss the dialog box.

Pressing the CREATE FOLDER soft key on the TREND: File Manager screen displays the TREND: Create New Folder screen (refer to “CREATE FOLDER” on page 56).

Pressing the CANCEL soft key displays the main TREND screen.

### *ZOOM*

The ZOOM soft key zooms in or out on the Y-axis presented in the TREND chart. Zooming does not disturb data collection.

To change the zoom:

1. Press the ZOOM soft key.
2. Turn the Selection knob to select a new zoom level.
3. When the desired value appears, press the ZOOM soft key (or the ENTER/SET button) to lock in the ZOOM value.

### *VIEW*

The VIEW soft key toggles between Fit and Scroll.

- Fit—Fits the entire duration on the X-axis in one screen
- Scroll—Pages the data every minute

## **Detailed Procedures**

This section provides in-depth information about specific topics that were briefly discussed earlier.

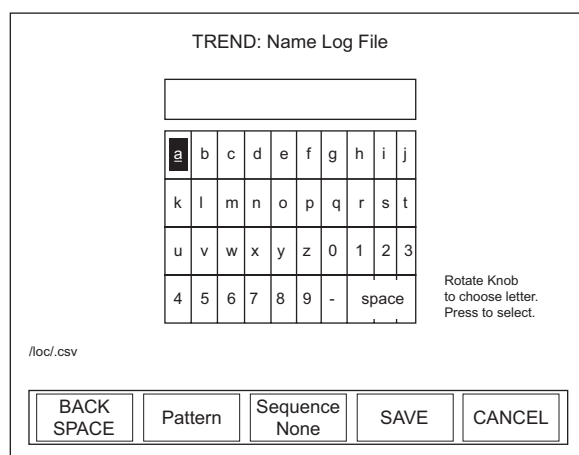
### **Name Log File**

Use this screen to create a file before starting data collection. The log file is saved to the location previously navigated in File Manager. For example, if you use File Manager to navigate to a USB flash

drive that is attached to the meter, and then subsequently create a named log file, the file will be saved to the folder in the USB flash drive you had previously navigated to. If you did not previously navigate to a specific location in File Manager, the file is saved to the local drive in the meter.

To create a file:

1. Press the CREATE FILE soft key on the TREND screen to display the TREND: Name Log File screen (Figure 30):



**Figure 30. TREND: Name Log File**

2. Select the first character of the file name by turning the Selection knob and then pressing the ENTER/SET button when the desired letter or number is highlighted. The character will appear in the blank box immediately below the screen heading.

---

**To delete a character, use the BACKSPACE soft key.**

---

3. Repeat step 2 until the entire file name appears in the box.
4. Press the SAVE soft key to save the new file name and display the TREND screen.

---

**The new file name will appear on the bottom left of the TREND screen (just above the START soft key).**

---



## Soft Keys

There are five soft keys on this screen: BACKSPACE, Pattern, Sequence, SAVE, and CANCEL.

### *BACKSPACE*

This soft key backspaces one editable field and deletes the character that was there.

### *Pattern*

Pressing this soft key appends the current date to the file name. This feature is a useful way to manage logged data. The date is appended to any name you entered in the Name File dialog box. For example, if today is February 2, 2008, and you name a file */loc/test.csv*, pressing the Pattern soft key will change the file name to */loc/test02-04-08.csv*. Note that pressing this soft key also changes the soft key name from Pattern to Pattern Date.

### *Sequence*

The Sequence soft key toggles between Auto and None (factory default).

- Auto—Appends a sequentially-incrementing identification number to the file name. As files are created by pressing the START and STOP soft keys (on the TREND screen), the identification number in the file name automatically increments. This is useful if you are creating several similar log files and want to prevent accidental overwriting of one of the data files. It is also useful in identifying the order in which data files were created. The Pattern and Sequence functions can be used together.
- None—Does not append an identification number to the file name

### *SAVE*

Pressing the SAVE soft key saves whatever changes were made since the last SAVE and displays the TREND screen.

### *CANCEL*

Pressing the CANCEL soft key discards all changes that were made since the last SAVE and displays the TREND screen.

## File Manager

This screen allows the user to modify or delete current files and directories, or create a new folder. Figure 31 shows an example of the TREND: File Manager screen, which is available by pressing the FILE MANAGER soft key on the main TREND screen:

TREND: File Manager	
/loc	
Name	Size (bytes)
» .	10
■ test.csv	6300
<div> <div>COPY MOVE</div> <div>DELETE</div> <div>RENAME</div> <div>CREATE FOLDER</div> <div>EXIT</div> </div>	

**Figure 31. TREND: File Manager**

To navigate to a specific directory:

1. Turn the Selection knob to highlight the name of the folder you want to access.
2. Press the ENTER/SET button. If the folder is closed, pressing the ENTER/SET button will open and expand its contents. Likewise, pressing this button will close an open folder. Opening a folder displays all the subfolders and files within that particular folder.

---

**To display a list of files and directories stored on a USB flash drive that is attached to the meter, turn the Selection knob to highlight the top line of the names (“..”) that appear on the TREND: File Manager screen and then press the ENTER/SET button. The USB flash drive will be shown in the list of drives. The LOC (local) drive is flash memory onboard the meter. Files saved to the local drive are retained after powering down the meter.**

---

## Soft Keys

There are five soft keys on this screen: COPY MOVE, DELETE, RENAME, CREATE FOLDER, and EXIT.

### COPY MOVE

To copy a file to another location (while retaining the file in its original location):

1. Turn the Selection knob to highlight the name of the file you want to copy.
2. Press the COPY MOVE soft key on the TREND: File Manager screen. (Pressing this soft key changes the name of the first soft key to COPY and the second soft key to MOVE.)
3. Use the Selection knob to navigate to the location where you want to copy the file. Note that you can create a new folder during this process by pressing the Create Folder soft key.
4. Press the COPY soft key, which will display a file management dialog screen confirming the file is being copied.
5. Once copying is complete (as indicated by the bar on the dialog screen displaying the text, *100%*), press the ENTER/SET button to dismiss the dialog box.

To move a file to another location (and delete the file from its original location):

1. Turn the Selection knob to highlight the name of the file you want to move.
2. Press the COPY MOVE soft key on the TREND: File Manager screen. (Pressing this soft key changes the name of the first soft key to COPY and the second soft key to MOVE.)
3. Use the Selection knob to navigate to the location where you want to move the file. Note that you can create a new folder during this process by pressing the Create Folder soft key.
4. Press the MOVE soft key, which will display a file management dialog screen confirming the file is being moved.
5. Once moving is complete (as indicated by the bar on the dialog screen displaying the text, *100%*), press the ENTER/SET button to dismiss the dialog box.

## DELETE

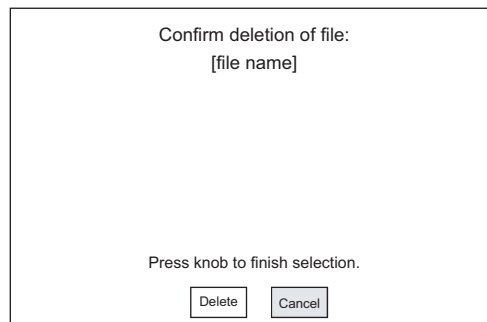
---

Copying, moving, or deleting an entire folder affects all of the contents (files and subfolders) of that particular directory. These functions allow quick folder/file management to a USB flash drive or onboard local memory. Keep in mind, however, that once a folder and its contents are deleted, they cannot be recovered. Whenever a file or folder is deleted, a deletion confirmation box will appear on the screen.

---

To delete a file:

1. Turn the Selection knob to highlight the file name.
2. Press the DELETE soft key. The following confirmation message will appear:



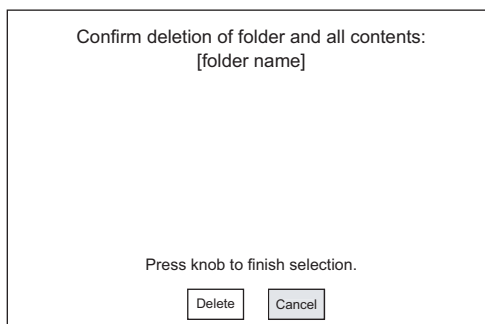
**Figure 32. TREND: File Manager (File Deletion Confirmation)**

3. Turn the Selection knob to highlight Delete in the Delete File Confirmation window.
4. Press the ENTER/SET button to delete the file and display the TREND: File Manager screen.

To delete a folder:

1. Turn the Selection knob to highlight the name of the folder you want to delete.

2. Press the DELETE soft key. The following confirmation message will appear:



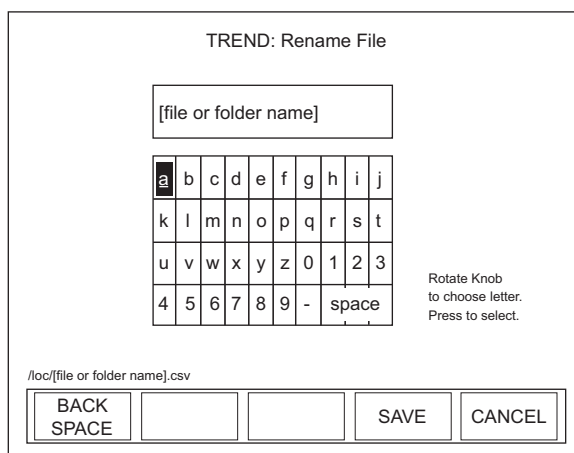
**Figure 33. TREND: File Manager (Folder Deletion Confirmation)**

3. Turn the Selection knob to highlight Delete.
4. Press the ENTER/SET button to delete the folder and display the TREND: File Manager screen.

### RENAME

Use this function to rename a file or folder.

1. On the TREND: File Manager screen, turn the Selection knob to highlight the name of the file or folder you want to rename.
2. Press the RENAME soft key to display a screen similar to the one shown in Figure 34.



**Figure 34. TREND: Rename File or Folder**

3. Using the BACKSPACE soft key, delete the current name.

---

**To delete a character at any time, use the BACKSPACE soft key.**

---

4. Select the first character of the new name by turning the Selection knob and then pressing the ENTER/SET button when the desired letter or number is highlighted. The character will appear in the blank box immediately below the screen heading.
5. Repeat step 4 until the entire name appears in the box.
6. Press the SAVE soft key to save the new name and display the TREND: File Manager screen.

### **Soft Keys**

There are three soft keys on the TREND: Rename File screen: BACKSPACE, SAVE, and CANCEL.

#### *BACKSPACE*

This soft key backspaces one editable field at a time and deletes the character that was there.

#### *SAVE*

Pressing the SAVE soft key saves whatever changes were made since the last SAVE.

#### *CANCEL*

Pressing the CANCEL soft key discards all changes that were made since the last SAVE and returns to the TREND: File Manager screen.

### CREATE FOLDER

Use this function on the TREND: File Manager screen to create a folder on the local drive or USB flash drive. Subfolders can be created within a folder.

Pressing the CREATE FOLDER soft key displays the screen shown in Figure 35:

TREND: Create New Folder

[Empty text input field]

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z	0	1	2	3
4	5	6	7	8	9	-	space		

Rotate Knob to choose letter. Press to select

BACK SPACE    [ ]    [ ]    SAVE    CANCEL

**Figure 35. TREND: Create New Folder**

### Soft Keys

There are three soft keys on this screen: BACKSPACE, SAVE, and CANCEL.

#### BACKSPACE

This soft key backspaces one editable field at a time and deletes the character that was there.

#### SAVE

Pressing the SAVE soft key saves whatever changes were made since the last SAVE.

#### CANCEL

Pressing the CANCEL soft key discards all changes that were made since the last SAVE and returns to the TREND: File Manager screen.

#### EXIT

Pressing the EXIT soft key in the File Manager screen displays the main TREND screen.

## TREND Setup

Use Trend Setup to select the batch duration and sampling rate.

The factory default (and maximum) sampling rate for both thermopile and optical sensors is 10 samples per second.

The ability to specify both a duration and a sampling rate offers the flexibility of collecting data on the performance of a laser over a desired period of time while managing the quantity of data gathered.

Example: If you are using a thermopile sensor, you could set up the meter to log one data point per minute for seven days, resulting in 10,080 data points.

Pressing the TREND SETUP soft key on the main TREND screen displays a screen similar to the following:

TREND: Setup			
Display units:	Watts		
Duration:	00:00:00:10	(days:hr:min:sec)	
Sampling rate:	10	samples every (hr:min:sec)	00:00:01
Batch Size: 100			
Maximum Batch Size: 466,033			
<div> <div>&lt;&lt;-</div> <div>-&gt;&gt;</div> <div></div> <div>SAVE</div> <div>CANCEL</div> </div>			

**Figure 36. TREND: Setup (Thermopile and Optical Sensors)**

### Soft Keys

There are four soft keys on this screen: <<-/->> (Previous/Next directional arrows), SAVE, and CANCEL.

<<- and ->> (directional arrows)

Parameters on this screen are changed by using one of the following procedures. The procedure that should be used depends on the type of parameter you want to modify.

#### “Single” Parameters

This type of parameter—Display units, for example—has only one modifiable field. To change a value for this type of parameter:

1. Press the ENTER/SET button until the parameter you want to change is highlighted.
2. Turn the Selection knob to change the parameter value.
3. Press the ENTER/SET button to move to the next parameter.



4. Continue this process until the values for all the parameters are correct.
5. Once the values for all the parameters are correct, press the SAVE soft key to save the parameters and display the STATS screen.

#### “Multiple” Parameters

This type of parameter—Duration, for example—contains several fields that can be modified. To change a value for this type of parameter:

1. Press the ENTER/SET button until the parameter you want to change is highlighted.
2. Turn the Selection knob to change the parameter value.
3. Press either of the directional arrows soft keys (<<- or ->>) to move the highlight to another value within the same parameter.
4. Repeat steps 2 and 3 until all values for that parameter are correct.
5. Press the ENTER/SET button to move to the next parameter.
6. Once the values for all the parameters are correct, press the SAVE soft key to save the parameters and display the STATS screen.

#### *SAVE*

Pressing the SAVE soft key saves whatever changes were made since the last SAVE and displays the TREND screen.

#### *CANCEL*

Pressing the CANCEL soft key discards all changes that were made since the last SAVE and displays the TREND screen.

## **ZERO**



Pressing the ZERO button sets the current sensor input voltage as the zero baseline voltage. ZERO is not functional when the meter is in HELP mode.

If zeroing is unsuccessful—which means that the power input is too large to null—re-zero in a more stable environment or select a different range. The meter always zeros all available ranges for the attached sensor. When a zero procedure is in process, no other button

events are queued or activated until the procedure ends. The zero procedure immediately terminates if the sensor is disconnected or if an error is encountered.

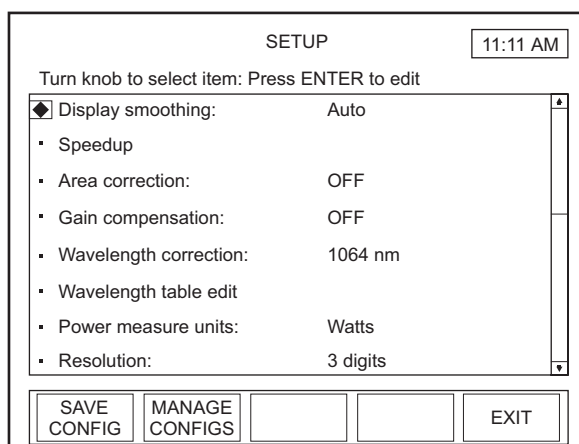
Normally you should press ZERO while the laser is turned off, or while the laser beam is blocked. If a finite power level is present at the sensor, the instrument will attempt to null it out.

The meter is only able to zero a finite level of offset. When zeroing on a selected range is unsuccessful, the text “Zeroing...” is replaced with the following error dialog: “Bad zero. The power input is too large to null. Re-zero in a more stable environment or select a different range.”

## SETUP



Pressing the SETUP button on the front panel will display the main SETUP screen (Figure 37):



**Figure 37. SETUP**

On the SETUP screen, a diamond indicator appears to the left of the currently-selected item. To change the value of an item, *turn* the Selection knob to move the indicator up or down the list and when the bullet is next to the desired item, *press* the ENTER/SET button (the Selection knob) to select that item. (See Figure 7 on page 20 for the location of the Selection knob, all buttons, and the soft keys.) Depending on which item is selected, editing will be available either on a list that appears to the right of the selected item, or on a new screen that will automatically open when an item is selected.

To leave SETUP:

- Press the EXIT soft key (directly below the LCD, first key on the right),
- or
- Press the MEASURE, TUNE, or TREND button

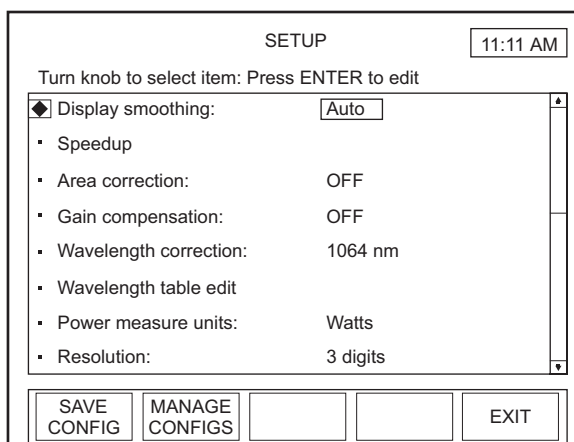
---

**Unless a setting is incompatible with the attached sensor, all SETUP parameters remain in effect—even if the meter is shut down and powered up at a later time.**

---

## Display Smoothing

Display smoothing uses a rolling box-car average to smooth the displayed measurement. This can be useful if individual measurement values are too noisy. Smoothing is applied to all displayed measurements on all screens. In the case of quadrant position-sensing thermopile sensors, display smoothing is applied to the position indicator within the bulls eye.



**Figure 38. SETUP: Display Smoothing**

Available values: AUTO (factory default), MANUAL, and OFF.

To change a value:

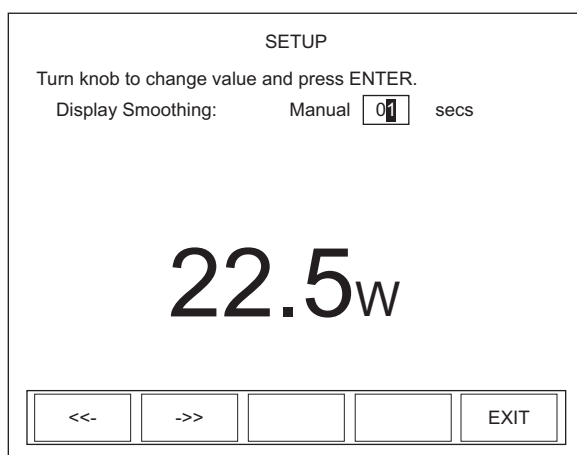
1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Display smoothing.
2. Press the ENTER/SET button to highlight the editable field (Figure 38).

3. Turn the Selection knob to change the value.
4. Press the ENTER/SET button to save the value and return to the main SETUP screen.

---

**If you select Manual as the Display Smoothing value, pressing the ENTER/SET button will display the screen shown in Figure 39. This allows the results of smoothing the setting to be observed on the live measurement during setup. Continue to step 5.**

---



**Figure 39. SETUP: Display Smoothing (Thermopile and Optical Sensors - Manual Mode)**

5. Turn the Selection knob to change the number of seconds.

---

**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---

6. Press the ENTER/SET button—or the EXIT soft key—to save the value and exit Display Smoothing mode.

---

**Press the EXIT soft key at any time to save all current values and return to the main SETUP screen.**

---

## Speedup

(thermopile sensors only) This command selects the speedup mode for the host interface data output.

SETUP: Speedup

Turn knob to change value and press ENTER.

Tune:

Measure: ON

Analog Out: ON

Data Store: ON

**Figure 40. SETUP: Speedup**

Available values: ON (factory default) and OFF.

Speedup can be turned ON or OFF for the following features: Tune, Measure, Analog Out, and Data Store.

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Speedup.
2. Press the ENTER/SET button to Display the SETUP: Speedup screen (Figure 40).
3. Press the ENTER/SET button to highlight the value of the feature you want to change.
4. Turn the Selection knob to change the value.
5. Press the ENTER/SET button to lock in the current value and move the highlight to the next editable field.

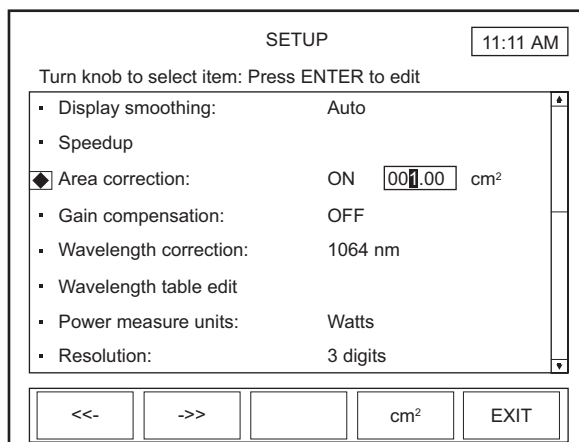
---

**Pressing the ENTER/SET button after highlighting Data Store, or pressing the EXIT soft key at any time will save all the locked-in values, exit Speedup mode, and return to the main SETUP screen.**

---

## Area Correction

Area Correction allows the measurement value to be displayed in terms of a unit area. The measured value (in watts or joules) is divided by the area entered here. This mode is most commonly used in processes where the energy density (fluence) or power density—rather than the absolute energy or power—is of paramount importance. Typically in these applications the sensor aperture is completely flooded by laser light, and the sensor aperture is entered here.



**Figure 41. SETUP: Area Correction**

Available values: ON and OFF (factory default).

Available range: 0.01 to 500.00 cm<sup>2</sup> or 0.1 to 250 mm.

Available units: cm<sup>2</sup> and mm. The area can be entered in terms of area in square centimeters or in terms of the diameter of the active area in millimeters. When entering the active area in terms of the diameter, the active area must be circular.

---

**Most Coherent sensors utilize circular apertures, so the ability to enter the active area in terms of the diameter in millimeters is often an easier process than calculating the area yourself.**

---

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Area Correction.
2. Press the ENTER/SET button to highlight the editable field (Figure 41).
3. Turn the Selection knob to change the value.

4. Press the ENTER/SET button to save the value.

---

**If you select ON as the Area Correction value, pressing the ENTER/SET button will display the range field (shown as 001.00 in Figure 41, above) and the unit of measurement (cm<sup>2</sup> in Figure 41). Continue to step 5.**

---

5. Turn the Selection knob to change the range value.

---

**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---

6. Press the ENTER/SET button to save the value and exit Area Correction mode.

---

**Pressing the EXIT soft key at any time while in SETUP will leave the SETUP program.**

---

To change the unit of measurement:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Area Correction.
2. Press the ENTER/SET button to highlight the first field and set Area Correction to ON.
3. Press the ENTER/SET button to move the highlight to the Area Correction value field. This action will display the Unit soft key (next to EXIT at the bottom of the LCD).
4. Toggle the Unit soft key to select either cm<sup>2</sup> or mm as the unit of measurement.
5. Press the ENTER/SET button to save the value.

---

**If there is a diameter in the sensor EEPROM, it is used as the default when the meter powers up; otherwise, the last-entered value is used.**

---

## Gain Compensation

Gain Compensation lets the user adjust the measured values based upon the gain factor entered here. Measurement values are multiplied by the gain factor.

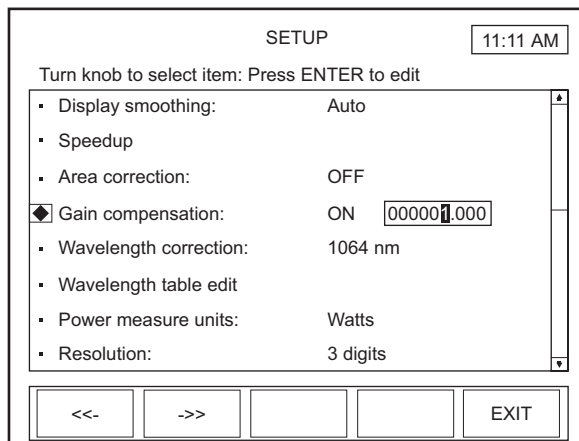
Gain compensation has several uses:

- Accounting for filters or other optical attenuators upstream in the beam path.
- Measuring a small pick-off beam from a beamsplitter and wanting to calibrate the meter to display the power or energy of the main beam.
- Self-calibrating a meter and sensor system, based upon the your own calibration system.

---

**If you are using gain as a calibration factor, be sure to save a custom configuration (refer to “Save Current Config” on page 83). It is possible to save multiple configurations for multiple sensor serial numbers, which allows you to recall particular configurations by pressing the MANAGE CONFIGS soft key and then selecting a particular configuration file.**

---



**Figure 42. SETUP: Gain Compensation**

Available values: ON and OFF (factory default).

Available range: 0.001 to 100000

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Gain Compensation.



2. Press the ENTER/SET button to highlight the first field.
3. Turn the Selection knob and display ON in the Gain Compensation field and then press the ENTER/SET button to move the highlight to the Gain Compensation value field (shown as 000001.000 in Figure 42).
4. Turn the Selection knob to change the value.

---

**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---

5. Press the ENTER/SET button to save the value and exit Gain Compensation mode.

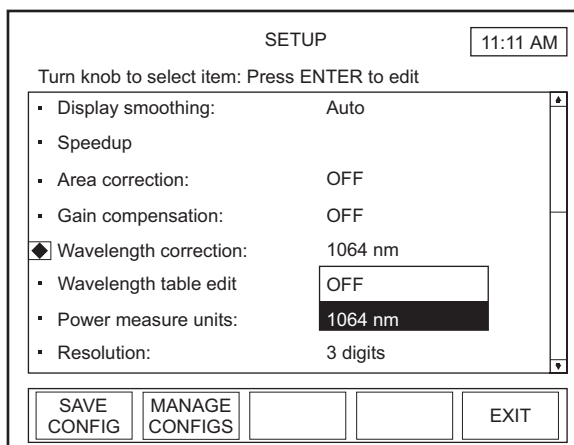
---

**Pressing the EXIT soft key at any time while in SETUP will leave the SETUP program.**

---

## Wavelength Correction

Wavelength Correction lets the user select the sensor wavelength.



**Figure 43. SETUP: Wavelength Correction**

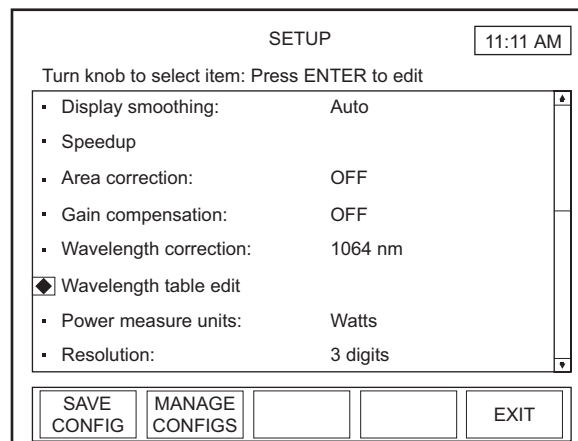
Available values: OFF and wavelengths that are available for the attached sensor.

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Wavelength Correction.
2. Press the ENTER/SET button to display a dropdown list of available wavelengths (similar to the list shown in Figure 43, above).
3. Turn the Selection knob to highlight the desired value.
4. Press the ENTER/SET button to save the value and exit Wavelength Correction mode.

## Wavelength Table Edit

This item lets the user add or delete sensor wavelengths.



**Figure 44. SETUP: Wavelength Table Edit**

Available values: All available pre-set wavelengths.

To access the Edit Wavelength Table screen:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Wavelength Table Edit (Figure 44).

2. Press the ENTER/SET button to display the SETUP: Edit Wavelength Table screen. From this screen, you can add or delete a wavelength, as explained next.

---

**On this screen, wavelengths below 1000 nm display in terms of nanometers, and wavelengths above 1000 nm display in terms of microns.**

---

## Adding a Wavelength

SETUP: Edit Wavelength Table  
Turn knob to select wavelength:

Note: current operating wavelength is not editable.

193 nm	Current Sensor
248 nm	Min: 248 nm
266 nm	Op: 1.064 $\mu$ m
532 nm	Cal: 514 nm
1,064 $\mu$ m	Max: 10,600 $\mu$ m
10,600 $\mu$ m	

[ ] [ ] [ ADD ] [ DELETE ] [ EXIT ]

**Figure 45. SETUP: Edit Wavelength Table**

From the SETUP: Edit Wavelength Table screen (Figure 45):

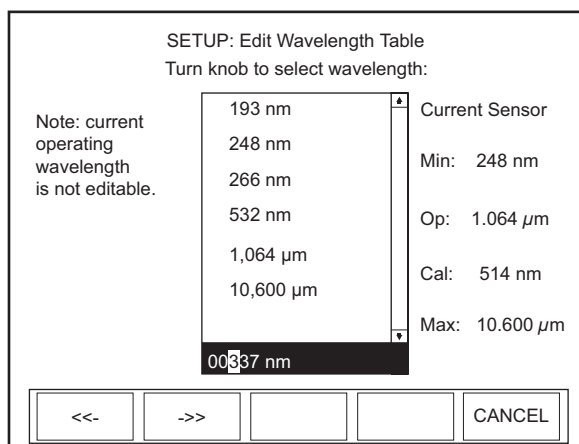
1. Press the ADD soft key.

2. Turn the Selection knob to display a new wavelength. The wavelength will appear at the bottom of the dropdown list (in the following example, the new wavelength is 00337 nm).

---

**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---



**Figure 46. SETUP: Edit Wavelength Table (Adding a Wavelength)**

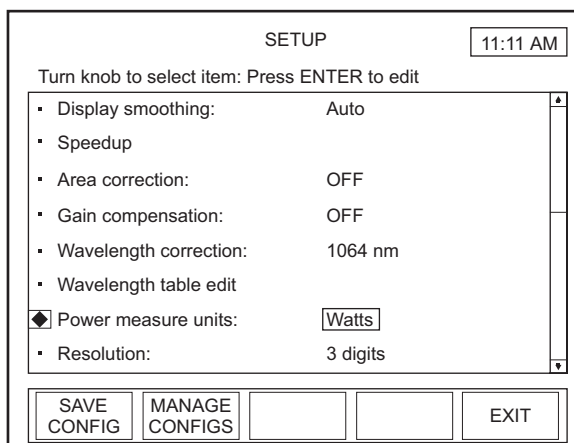
3. Press the ENTER/SET button to add the new wavelength to the dropdown list.
4. Press the EXIT soft key to exit Edit Wavelength Table mode and return to the main SETUP screen.

## Deleting a Wavelength

From the SETUP: Edit Wavelength Table screen (Figure 45):

1. Turn the Selection knob to highlight the wavelength you want to delete.
2. Press the DELETE soft key to remove the wavelength from the dropdown list.
3. Press the EXIT soft key to exit Edit Wavelength Table mode and return to the main SETUP screen.

## Power Measure Units



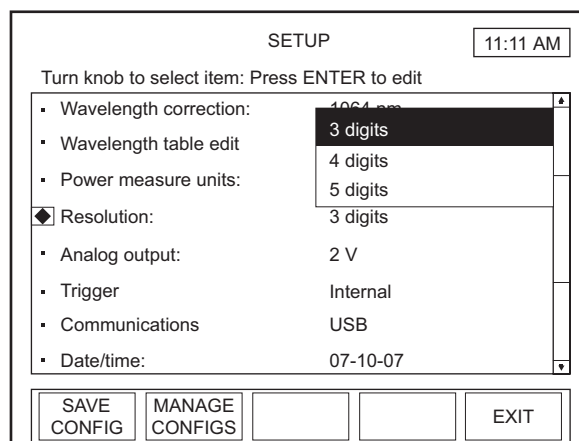
**Figure 47. SETUP: Power Measure Units**

Available values: Watts (factory default) and dBm.

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Power Measure Units.
2. Press the ENTER/SET button to highlight the value field (Figure 47).
3. Turn the Selection knob to change the value.
4. Press the ENTER/SET button to save the value and exit Power Measure Units mode.

## Resolution



**Figure 48. SETUP: Resolution**

Available values: See the following table:

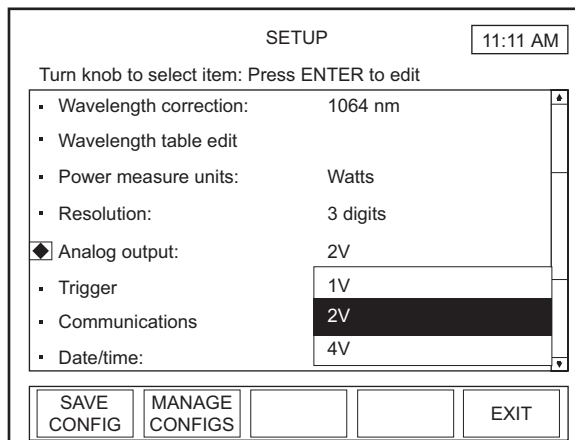
**Table 3. Sensor Resolution Ranges**

SENSOR TYPE	RANGE	FACTORY DEFAULT
Thermopile	3, 4, 5	3
Optical	3, 4, 5	3

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Resolution.
2. Press the ENTER/SET button to display a dropdown list of available resolutions (similar to the list shown in Figure 48, above).
3. Turn the Selection knob to highlight the desired value.
4. Press the ENTER/SET button to save the value and exit Resolution mode.

## Analog Output



**Figure 49. SETUP: Analog Output**

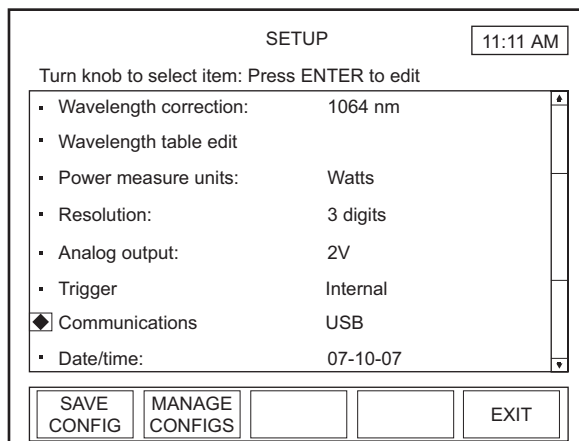
Available values: 1, 2 (factory default), and 4V.

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Analog Output.
2. Press the ENTER/SET button to display a dropdown list of available voltages (similar to the list shown in Figure 49, above).
3. Turn the Selection knob to highlight the desired value.
4. Press the ENTER/SET button to save the value and exit Analog Output mode.

## Communications

Use Communications to define the host interface type that will be used to communicate with a PC. The factory default is USB. If you cannot communicate with the meter via a PC, the most likely reason is that the Communications type is not set correctly on this screen.



**Figure 50. SETUP: Communications**

Available values: See the following table:

**Table 4. Communication Values and Factory Defaults**

SETTING LABEL	VALUES	FACTORY DEFAULT
Host	USB, RS-232	USB
RS-232 Baud Rate	9600, 19200, 38400, 57600, 115200	19200
RS-232 Stop Bits	1, 2	1
RS-232 Parity	None, Odd, Even	None
RS-232 Flow Control	None, Xon/Xoff	None

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Communications (Figure 50).



2. Press the ENTER/SET button to Display the SETUP: Communications screen (Figure 51).

SETUP: Communications

Turn knob to change value and press ENTER.

Host: RS-232

RS-232 Baud rate: 19200

RS-232 Stop bits: 1

RS-232 Parity: None

RS-232 Flow control: None

GPIB Id:

[ ] [ ] [ ] [ ] EXIT

**Figure 51. SETUP: Communications (Changing the Values)**

3. Turn the Selection knob to change a value.

---

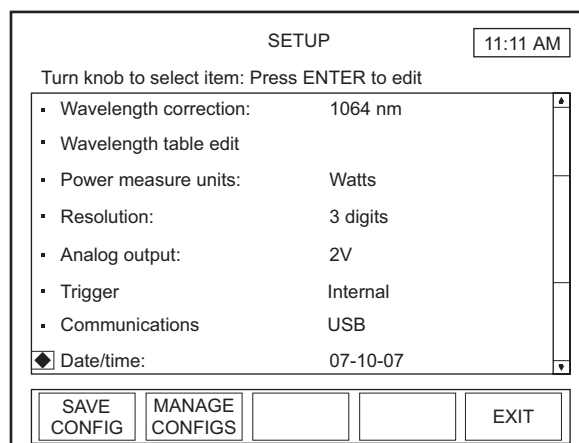
**Selecting RS-232 as the Host value will display the editable fields shown in Figure 51. Continue to step 4.**

---

4. Press the ENTER/SET button to lock in the value and move the highlight to the next editable field (except for USB, which does not have other editable fields).
5. Continue the process until all the values on the screen are correct.
6. Press the EXIT soft key to save the values and exit Communications mode.

## Date/Time

Enter the date and time here. Date/time is only used for naming files and for date and time information within the Microsoft Windows operating system file manager.



**Figure 52. SETUP: Date/Time**

Available values: See the following table:

**Table 5. Date/Time Ranges and Factory Defaults**

SETTING	RANGE	FACTORY DEFAULT
Date Format	mm-dd-yy dd-mm-yy	mm-dd-yy
Date	Limits of Data function	Initially set during Factory testing
Time	hr:min (24-hour format)	Initially set during Factory testing

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Date/Time (Figure 52).

2. Press the ENTER/SET button to Display the SETUP: Date screen (Figure 53).

SETUP: Date 11:11 AM

Turn knob to change value and press ENTER.

Date Format: mm-dd-yy

Date: 2007 10 07

Time: 11 : 11

EXIT

**Figure 53. SETUP: Date/Time (Changing the Values)**

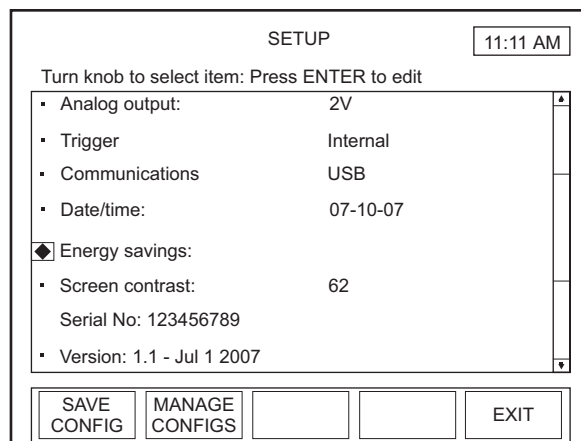
3. Turn the Selection knob to change a value.
4. Press the ENTER/SET button to lock in the value and move to the next editable field.
5. Continue the process until all the values on the screen are correct.
6. Press the EXIT soft key to save the values and exit Date mode.

---

**Pressing the EXIT soft key at any time will save the current values and return to the main SETUP screen.**

---

## Energy Savings



**Figure 54. SETUP: Energy Savings**

Available values: See the following table:

**Table 6. Energy Savings Ranges and Factory Defaults**

SETTING	RANGE	FACTORY DEFAULT
Backlight Auto Off	OFF, ON (1 to 60 min. idle)	Battery: OFF AC: OFF
Meter Auto Off	OFF, ON (1 to 60 min. idle)	Battery: OFF AC: N/A

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Energy Savings (Figure 54).

2. Press the ENTER/SET button to Display the SETUP: Energy Savings screen (Figure 55).

SETUP: Energy Savings

Turn knob to change value and press ENTER.

On battery:

Backlight Auto off:	<input type="text" value="ON"/>	01 min idle
Meter Auto off:	ON	15 min idle

On AC Power:

Backlight auto off:	ON	01 min idle
---------------------	----	-------------

<<-
->>


EXIT

**Figure 55. SETUP: Energy Savings (Changing the Values)**

3. Turn the Selection knob to change a value.

---

**Selecting ON as a value on the SETUP: Energy Savings screen will display an editable field next to that value (as shown in Figure 55). Continue to step 4.**

---

4. Press the ENTER/SET button to move the highlight to the next editable field.
5. Turn the Selection knob to change the value.

---

**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---

6. Press the ENTER/SET button to move the highlight to the next field.
7. Continue that process until all values are correct.

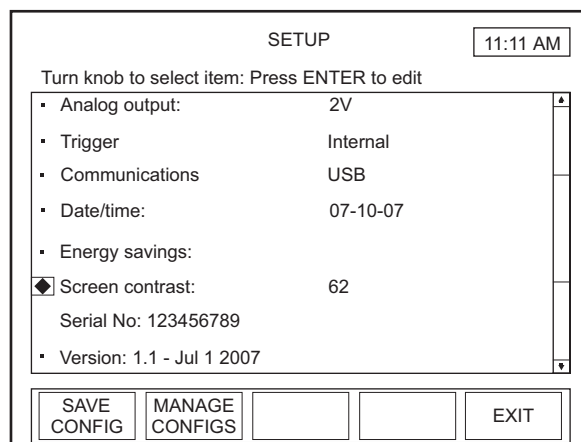
8. Press the EXIT soft key to save the values and exit Energy Savings mode.

---

**Pressing the EXIT soft key at any time will save the current values and return to the main SETUP screen.**

---

## Screen Contrast



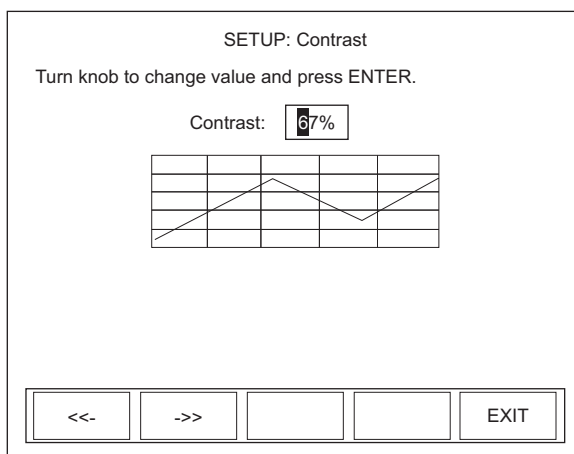
**Figure 56. SETUP: Screen Contrast**

Available values: 1 to 99.

To change a value:

1. On the main SETUP screen, turn the Selection knob to move the diamond indicator to Screen Contrast (Figure 56).

2. Press the ENTER/SET button to Display the SETUP: Contrast screen (Figure 57).



**Figure 57. SETUP: Screen Contrast (Changing the Values)**

3. Turn the Selection knob to change the contrast value.

---

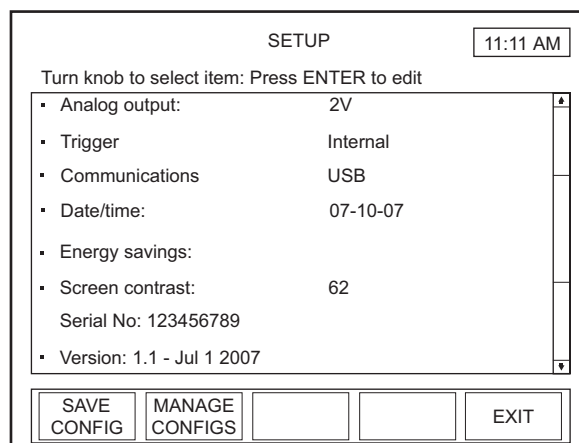
**The directional arrow soft keys (<<- and ->>) can be used to move the highlight to a different digit before using the Selection knob to change the value.**

---

4. Press the EXIT soft key to save the value and exit Contrast mode.

## Serial Number

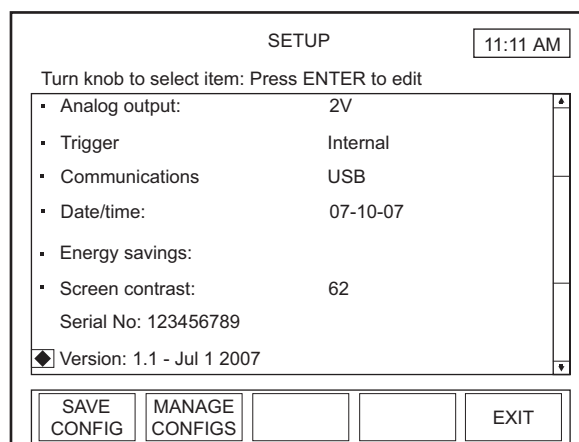
This field displays the instrument serial number.



**Figure 58. SETUP: Serial No.**

## Version

This field displays the version number of the installed firmware.



**Figure 59. SETUP: Version**

## Soft Keys

There are three soft keys on the main SETUP screen: SAVE CONFIG, MANAGE CONFIGS, and EXIT.

### *SAVE CONFIG*

Refer to “Save Current Config” on page 83.



*MANAGE CONFIG*

Refer to “Manage Configs” on page 85.

*EXIT*

Pressing this soft key will exit SETUP and display the screen last viewed prior to entering SETUP mode.

## Detailed Procedures

This section provides in-depth information about specific topics that were briefly discussed earlier.

### Save Current Config

This function saves a custom configuration file that records the meter settings listed in the following table:

**Table 7. Custom Configuration File Meter Settings (Sheet 1 of 2)**

Analog output voltage scale	Power measure units
Area correction area	RS-232 baud rate
Area correction area specification units	RS-232 flow control
Area correction on/off state	RS-232 parity
Autorange on/off state	RS-232 stop bits
Backlight auto off time under AC power	Speedup applied to analog output on/off state
Backlight auto off time under battery power	Speedup applied to host data on/off state
Backlight on/off state under AC power	Speedup applied to numerical display on/off state
Backlight on/off state under battery power	Speedup applied to tune graph on/off state
Current full scale range	Statistics batch size for thermopile and optical sensors
Date format	Statistics display sub mode
Display contrast	Statistics output selections
Display mode	Statistics restart mode
Display smoothing on/off state for thermopile and optical sensors	Statistics sub sample rate for thermopile and optical sensors
Display smoothing window size for thermopile and optical sensors	Sync bus direction
External trigger delay	Trend batch size for thermopile and optical sensors
Favorite wavelength list	Trend display sub mode

**Table 7. Custom Configuration File Meter Settings (Sheet 2 of 2)**

Gain compensation factor	Trend sub sample rate for thermopile and optical sensors
Gain compensation on/off state	Trend view mode
Host communication port	Trigger level
Joules/Watts mode	Trigger slope
Meter auto off time	Trigger source
Meter on/off state	Tune view mode
Numerical display resolution	Wavelength correction on/off state
Position stability graph duration	Wavelength of operation
Position stability view mode	

Pressing the SAVE CONFIG soft key on the main SETUP screen displays the following screen:

SETUP: Save Current Config

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z	0	1	2	3
4	5	6	7	8	9	-	space		

Rotate Knob to choose letter.  
Press to select.

BACK  
SPACE

SAVE

EXIT

**Figure 60. SETUP: Save Current Config**

To create a new configuration file name:

1. Select the first character of the file name by turning the Selection knob and then pressing the ENTER/SET button when the

desired letter or number is highlighted. The character will appear in the blank box immediately below the screen heading.

---

**To delete a character, use the BACKSPACE soft key.**

---

2. Repeat step 1 until the entire file name appears in the box.
3. Press the SAVE soft key to save the new file name, exit Save Current Config mode, and display the SETUP: Manage Configs screen, discussed next.

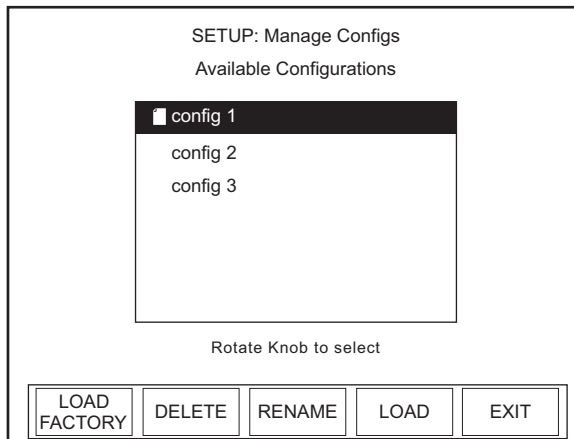
---

**Pressing the EXIT soft key at any time will display the main SETUP screen.**

---

## Manage Configs

This screen allows you to work with previously-created configuration files. Pressing the MANAGE CONFIGS soft key on the main SETUP screen (or saving a current configuration, as explained above) displays the following screen:



**Figure 61. SETUP: Manage Configs**

## Soft Keys

There are five soft keys on this screen: LOAD FACTORY, DELETE, RENAME, LOAD, and EXIT.

### *LOAD FACTORY*

To load the configuration file that was shipped with your LabMax, press the LOAD FACTORY soft key. This action will load the factory defaults and exit the Setup program.

### *DELETE*

To delete a file:

1. Turn the Selection knob to highlight the file name you want to delete.
2. Press the DELETE soft key. The following confirmation message will appear:



**Figure 62. SETUP: Manage Configs (File Deletion Confirmation)**

3. Turn the Selection knob to highlight Delete.
4. Press the ENTER/SET button to delete the file and return to the SETUP: Manage Configs screen. The file that was just deleted will no longer appear on the list of available configurations.

### *RENAME*

To rename a configuration file:

1. Turn the Selection knob to highlight the file you want to rename.

2. Press the RENAME soft key to display the following screen:

SETUP: Rename Config

[original\_name]

a	b	c	d	e	f	g	h	i	j
k	l	m	n	o	p	q	r	s	t
u	v	w	x	y	z	0	1	2	3
4	5	6	7	8	9	-	space		

Rotate Knob to choose letter. Press to select.

BACK SPACE          SAVE    EXIT

**Figure 63. SETUP: Rename Config**

3. Press the BACKSPACE soft key to erase the old file name (labeled original\_name in Figure 63, above).
4. Select the first character of the new file name by turning the Selection knob and then pressing the ENTER/SET button when the desired letter or number is highlighted. The character will appear in the blank box immediately below the screen heading.

---

**To delete a character, use the BACKSPACE soft key.**

---

5. Repeat step 1 until the entire file name appears in the box.
6. Press the SAVE soft key to save the new file name and display the SETUP: Manage Configs screen. The file that was just renamed will appear on the list of available configurations.

### LOAD

To load a previously-saved configuration file:

1. Turn the Selection knob to highlight the file name in the Available Configurations list.
2. Press the LOAD soft key. This action will load the highlighted file and return to the main SETUP screen.

## EXIT

Pressing this soft key will exit Manage Configs mode and display the main SETUP screen.

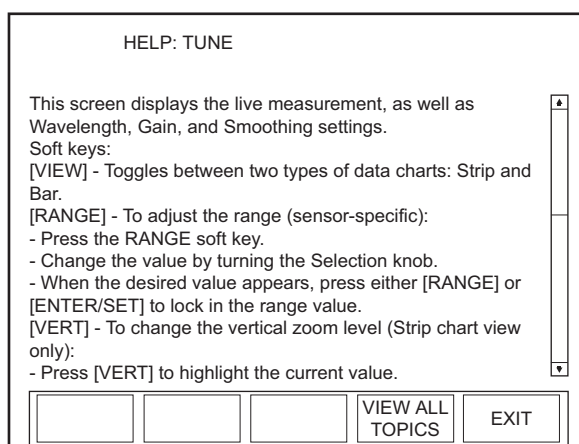
## HELP

LabMax offers two types of Help: Context-sensitive and general. This section describes both types.

### Context-Sensitive Help



Pressing this front panel button at any time will access information specific to the current screen. For example, pressing the HELP button while viewing the TUNE screen will display help specific to TUNE:



**Figure 64. HELP (Context-Sensitive)**

If the Help information is more than one screen long, turn the Selection knob to scroll.

### Soft Keys

There are two soft keys on this screen: VIEW ALL TOPICS and EXIT.

#### VIEW ALL TOPICS

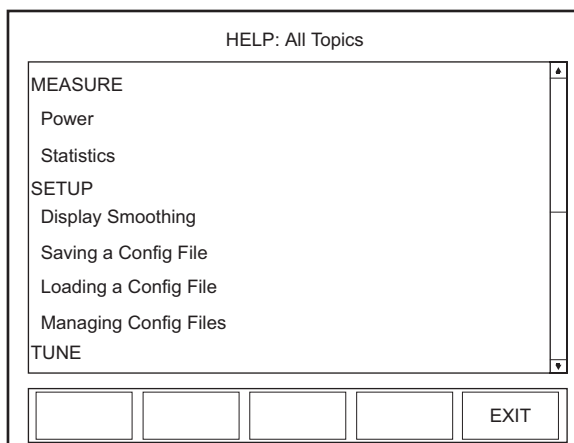
Pressing this soft key will access a list of all available Help topics (refer to “General Help”, below).

#### EXIT

Pressing this soft key will exit SETUP and display the screen last viewed prior to entering SETUP mode.

## General Help

Pressing the VIEW ALL TOPICS soft key at the bottom of any context-sensitive Help screen will access a list of all available Help topics:



**Figure 65. HELP (All Topics)**

Turn the Selection knob to highlight an item and then press the ENTER/SET button to view the Help for that specific topic.

### Soft Keys

There is one soft key on this screen: EXIT.

### EXIT

Pressing this soft key will exit SETUP and display the screen last viewed prior to entering SETUP mode.

## BACKLIGHT



Press this button to turn the LCD backlight ON or OFF.





## SPECIAL TOPICS

This section discusses:

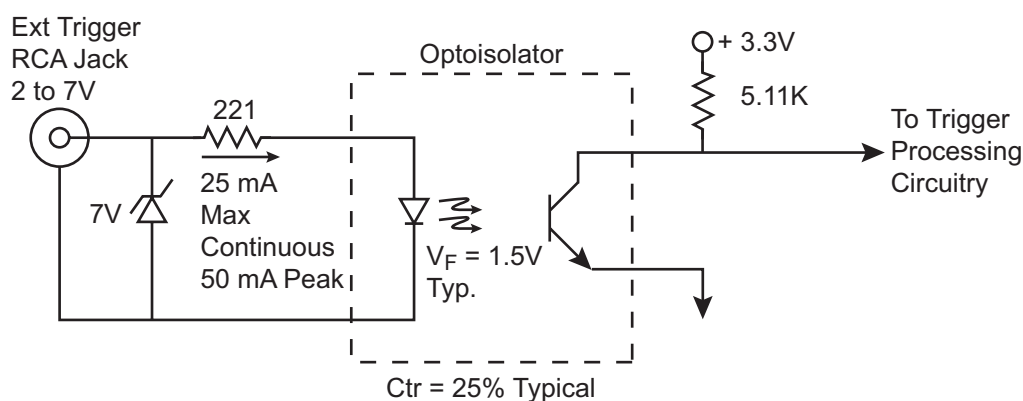
- Analog output (this page)
- Understanding the external trigger circuit (this page)

### Analog Output

When power is on, the Analog Out connector outputs a voltage proportional to the current laser measurement. The output voltage is zero (0) volts when the measured energy or power is zero (0) or less. The output voltage is the full-scale output voltage when the measured energy or power is full-scale or overranged. The full-scale output voltage (1, 2, or 4V) is selected via the meter or the host interface. Factory default full-scale output voltage is 2V.

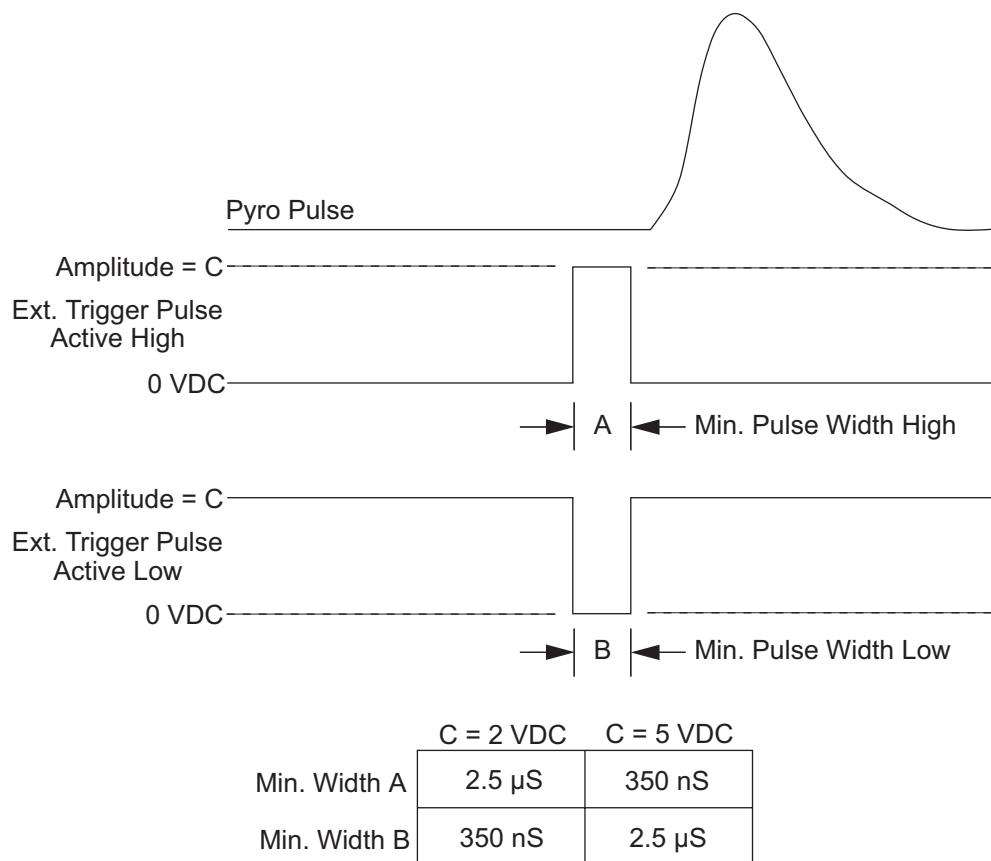
### Understanding the External Trigger Circuit

To prevent ground loop noise from interfering with accurate measurement, the external trigger input is optically isolated from the LabMax internal ground by an optoisolator. The following figure shows a simplified schematic of the external trigger input circuitry.



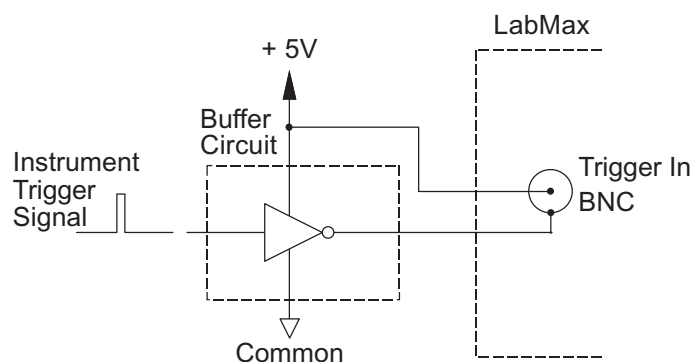
**Figure 66. External Trigger Input Circuitry**

Figure 67 shows the minimum pulse width required by the external trigger pulse.



**Figure 67. External Trigger Minimum Pulse Width**

To turn on the optoisolator LED, the external trigger source must be capable of sourcing at least 5 mA at a minimum of 2 VDC into the external trigger input. If the trigger source is not capable of sourcing these minimum values, the trigger source will need to be buffered. One possible buffer circuit is shown in Figure 68.



**Figure 68. Boosting Source Current of Triggering Device**

The external trigger signal can be either a rising or a falling edge. Trigger polarity is selected in the SETUP: Trigger menu.




---

**Trigger signals greater than 7 VDC can damage the optoisolator and should be avoided.**

---



# HOST INTERFACE

This section discusses:

- Special considerations (this page)
- Host Command quick reference (page 98)
- Commands and queries (page 107)
- Host Interface glossary (page 149)

## ***Special Considerations***

### **Message Terminators**

Messages between the meter and the host computer are comprised entirely of ASCII string characters. No binary messages are supported. All message strings passing through the host interface will be terminated to signal the end of a message string.

### **Messages Received by the Meter**

Messages received by the meter must be terminated by a carriage return (decimal 13). A line feed (decimal 10) following the carriage return is ignored so that messages can be terminated with a carriage return and line feed pair. A command or query is considered incomplete without the terminator.

### **Messages Sent by the Meter**

All messages sent by the meter, with the exception of USB Binary Streaming Data, are terminated by a carriage return (decimal 13) and line feed (decimal 10) pair. The maximum length of any message sent by the meter is limited to 4096 bytes.

## Using the RS-232 Interface

### Data Flow Control

The host controls the flow of data from the meter using software flow control. Software flow control uses standard bi-directional XON/XOFF methods for serial communication software flow control. Flow control selection is user-configurable.

### Service Request

The meter signals the host that data is available to read—specifically, when either the measurement data or error queues transition from empty to non-empty. The host waits for the service request marker (ASCII ENQ or decimal 5 byte), which will indicate that data is available. Available data is either measurement data records or statistics data records (see “Sample Measurement Data Collection” on page 141), or error records (see “Error Record Reporting and Collection” on page 114). The service request marker is not sent when the meter sends a reply from a query.

## Using the USB Interface

### Service Request

The meter signals the host that data is available to read—specifically, when either the measurement data or error queues transition from empty to non-empty. The host waits for the attention message, which will indicate that data is available. Available data is either measurement data records or statistics data records (see “Sample Measurement Data Collection” on page 141), or error records (see “Error Record Reporting and Collection” on page 114). The attention message is not sent when the meter sends a reply from a query.

### Binary Streaming Data

When the meter is connected to a host and USB is enabled, the meter can optionally send a binary record for each measurement sample. This capability may be enabled by the host via the streaming data commands.

### Notation Conventions

Notation conventions specified by the SCPI and IEEE 488.2 Standards are followed unless otherwise specified.

## Syntax

Syntax specified by the SCPI and IEEE 488.2 Standards is followed unless otherwise specified.

The base-10 numeric data format specification is used heavily in this section and covered in the IEEE 488.2 Standard. Unless otherwise specified, numeric data items are represented as:

- Integer values
- Non-scientific notation floating point values
- Scientific notation floating point values (upper or lower case E)

For example, the following data values are functionally equivalent:

- 31256
- 31256.0
- 3.1256E4
- 31.256E3
- +3.1256E+4.

Unless otherwise specified, non-numeric data items (typically referred to as strings) are not quoted.

The meter interprets hexadecimal data using the following rules:

- Upper case and lower case are accepted (“FE” is the same as “fe”)
- Leading zeroes are not required and will be accepted (“0A” is the same as “A”)
- The data string may optionally be preceded by a “0x” or “0X” C hexadecimal notation idiom (0xD2C4 is the same as D2C4)
- Following the optional “0x” prefix, the acceptable characters comes from the list 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, a, b, c, d, e, f, A, B, C, D, E, and F

Enumerated values must match exactly using the long form/short form comparison rules defined under the SCPI Standard.

## Host Command Quick Reference

The following table gives a brief description of all LabMax Host commands. For detailed information about a specific command, go to the page referenced in the right-hand column.

**Table 8. Host Command Quick Reference (Sheet 1 of 9)**

SCPI COMMON COMMANDS		
COMMAND	DESCRIPTION	PAGE #
<i>IEEE-488.2 Common Commands</i>		
*IDN?	Queries the meter identification string, such as model name, firmware version, and firmware date.	107
SYSTEM OPTIONS		
COMMAND	DESCRIPTION	PAGE #
<i>Local Control Lockout</i>		
SYSTem:REMOte	Places the meter in remote mode.	107
SYSTem:LOCal	Places the meter in local mode.	108
<i>System Status</i>		
SYSTem:STATus?	Queries the system status.	108
<i>Backlight Control</i>		
DISPlay:BACKlight	Controls the backlight on/off state.	109
DISPlay:BACKlight?	Queries the backlight on/off state.	109
SYSTem:OPTion:BACKlight:AOff:ACPower	Controls the LCD backlight auto-off timeout timer when the meter is under AC power.	109
SYSTem:OPTion:BACKlight:AOff:ACPower?	Queries the LCD backlight auto-off timeout timer when the meter is under AC power.	109
SYSTem:OPTion:BACKlight:AOff:BPOWer	Controls the LCD backlight auto-off timeout timer when the meter is under battery power.	109
SYSTem:OPTion:BACKlight:AOff:BPOWer?	Queries the LCD backlight auto-off timeout timer when the meter is under battery power.	109
<i>Power Auto-Off</i>		
SYSTem:OPTion:POWer:AOff	Sets the power auto-off timeout when the meter is under battery power.	110
SYSTem:OPTion:POWer:AOff?	Queries the power auto-off timeout when the meter is under battery power.	110



**Table 8. Host Command Quick Reference (Sheet 2 of 9)**

<i>Meter Configuration Management</i>		
MEMory:STAtE:CATalog?	Queries the list of stored configuration files that was saved by the user.	110
MEMory:STAtE:SAVE	Stores the current configuration to the named configuration file.	111
MEMory:STAtE:RECall	Loads and activates the configuration held in the named configuration file.	111
MEMory:STAtE:DELeTe	Deletes the named configuration file.	111
MEMory:STAtE:REName	Renames the named configuration file.	111
<b>COMMUNICATIONS</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Interface Select</i>		
SYSTem:COMMunicate:INTerface	Selects the interface for host communication.	112
SYSTem:COMMunicate:INTerface?	Queries the interface for host communication.	112
<i>Message Handshaking</i>		
SYSTem:COMMunicate:HANDshaking	Selects the state of SCPI message round trip handshaking.	112
SYSTem:COMMunicate:HANDshaking?	Queries the state of SCPI message round trip handshaking.	112
<i>Serial Port-Specific</i>		
SYSTem:COMMunicate:SERial:BAUD	Selects the transmit and receive baud rates together.	112
SYSTem:COMMunicate:SERial:BAUD?	Queries the transmit and receive baud rates together.	112
SYSTem:COMMunicate:SERial:PARity	Selects the parity bit setting.	113
SYSTem:COMMunicate:SERial:PARity?	Queries the parity bit setting.	113
SYSTem:COMMunicate:SERial:SBITs	Selects the number of stop bits used.	113
SYSTem:COMMunicate:SERial:SBITs?	Queries the number of stop bits used.	113
SYSTem:COMMunicate:SERial:PACE	Selects the flow control method for meter to host communication.	113
SYSTem:COMMunicate:SERial:PACE?	Queries the flow control method for meter to host communication.	113
SYSTem:COMMunicate:SERial:SERvice	Selects the state of the service request marker feature	113
SYSTem:COMMunicate:SERial:SERvice?	Queries the state of the service request marker feature	113

**Table 8. Host Command Quick Reference (Sheet 3 of 9)**

<i>USB Port-Specific</i>		
SYSTem:COMMunicate:USB:STREam	Enables the transmission of binary streaming data on the USB interface.	114
SYSTem:COMMunicate:USB:STREam?	Queries the transmission of binary streaming data on the USB interface.	114
<b>ERROR RECORD REPORTING AND COLLECTION</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Error Count Query</i>		
SYSTem:ERRor:COUNT?	Queries the number of error records in the error queue	115
<i>Error Query</i>		
SYSTem:ERRor:NEXT?	Queries the next error record(s) in the error queue.	116
<i>All Error Query</i>		
SYSTem:ERRor:ALL?	Queries all error records in the error queue.	116
<i>All Error Clear</i>		
SYSTem:ERRor:CLear	Clears all error records in the error queue.	117
<b>MEASUREMENT SETUP AND CONTROL</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Measurement Mode Select</i>		
CONFigure:MEASure	Sets the meter measurement mode	117
CONFigure:MEASure?	Queries the meter measurement mode	117
<i>Power Measurement Units Select</i>		
CONFigure:PUNits	Sets the display measurement units for power measurements	117
CONFigure:PUNits?	Queries the display measurement units for power measurements	117
<i>Display Mode Select</i>		
CONFigure:DISPlay:PRImary CONFigure:DISPlay:STATistics CONFigure:DISPlay:PSTability CONFigure:DISPlay:TUNE CONFigure:DISPlay:TREND	Sets the display mode.	117
CONFigure:PSTability:VMode	Sets the position stability view mode to be used when position stability display mode is active.	118
CONFigure:PSTability:VMode?	Queries the position stability view mode.	118

**Table 8. Host Command Quick Reference (Sheet 4 of 9)**

CONFigure:TUNE:VMode	Sets the tune view mode to be used when tune display mode is active.	118
CONFigure:TUNE:VMode?	Queries the tune view mode.	118
CONFigure:TREND:VMode	Sets the trend chart view mode to be used when trend display mode and trend chart display sub mode are active.	118
CONFigure:TREND:VMode?	Queries the trend chart view mode.	118
<i>Area Correction</i>		
CONFigure:AREA:CORRection	Enables or disables area correction.	119
CONFigure:AREA:CORRection?	Queries area correction.	119
CONFigure:AREA:APERture	Sets the aperture area	119
CONFigure:AREA:APERture?	Queries the aperture area	119
<i>Analog Output Full Scale Voltage</i>		
CONFigure:AOUT:FSCale	Selects the full scale output voltage at the analog output connector.	120
CONFigure:AOUT:FSCale?	Queries voltage at the analog output connector.	120
<i>Speedup</i>		
CONFigure:SPEedup:HOST	Selects the speedup mode for the host interface data output.	120
CONFigure:SPEedup:HOST?	Queries the speedup mode for the host interface data output.	120
CONFigure:SPEedup:AOUT	Selects the speedup mode for the analog output.	120
CONFigure:SPEedup:AOUT?	Queries the speedup mode for the analog output.	120
CONFigure:SPEedup:DISPlay	Selects the speedup mode for the panel numeric display.	120
CONFigure:SPEedup:DISPlay?	Queries the speedup mode for the panel numeric display.	120
CONFigure:SPEedup:TUNE	Selects the speedup mode for the panel tune display.	120
CONFigure:SPEedup:TUNE?	Queries the speedup mode for the panel tune display.	120
<i>Display Data Smoothing</i>		
CONFigure:AVERage:TIME	Sets the display data smoothing window size in seconds.	121
CONFigure:AVERage:TIME?	Queries the display data smoothing window size.	121

**Table 8. Host Command Quick Reference (Sheet 5 of 9)**

<i>Wavelength Correction</i>		
CONFigure:WAVElength:CORRection	Enables or disables wavelength correction.	121
CONFigure:WAVElength:CORRection?	Queries wavelength correction.	121
CONFigure:WAVElength:WAVElength	Sets the operational wavelength.	121
CONFigure:WAVElength:WAVElength?	Queries the operational wavelength.	121
CONFigure:WAVElength:LIST	Sets the wavelength table entries for the meter.	122
CONFigure:WAVElength:LIST?	Queries the wavelength table entries.	122
<i>Gain Compensation</i>		
CONFigure:GAIN:COMPensation	Enables or disables gain compensation.	122
CONFigure:GAIN:COMPensation?	Queries gain compensation.	122
CONFigure:GAIN:FACTor	Sets the gain compensation factor	122
CONFigure:GAIN:FACTor?	Queries the gain compensation factor	122
<i>Probe Zero</i>		
CONFigure:ZERO	Sets the current sensor input voltage as the zero baseline voltage.	123
CONFigure:ZERO?	Queries the current sensor input voltage.	123
<i>Range Select</i>		
CONFigure:RANGE:SElect	Selects the meter measurement range.	123
CONFigure:RANGE:SElect?	Queries the meter measurement range.	123
CONFigure:RANGE:AUTO	Enables or disables automatic selection of the meter measurement range.	123
CONFigure:RANGE:AUTO?	Queries the meter measurement range.	123
<i>Statistics Mode Control</i>		
CONFigure:STATistics:BSIZE:TIME	Sets the statistics batch size (time).	124
CONFigure:STATistics:BSIZE:TIME?	Queries the statistics batch size.	124
CONFigure:STATistics:RATE:FREQuency	Sets the statistics sampling rate (time).	124
CONFigure:STATistics:RATE:FREQuency?	Queries the statistics sampling rate.	124
CONFigure:STATistics:RMode	Selects the action to be taken at the end of a statistical batch.	125
CONFigure:STATistics:RMode?	Queries the action to be taken at the end of a statistical batch.	125
CONFigure:STATistics:STARt	Terminates the current statistical batch and starts a new one.	125

**Table 8. Host Command Quick Reference (Sheet 6 of 9)**

CONFigure:STATistics:STOP	Terminates the current statistical batch if a batch is in progress.	125
<i>Position Stability Mode Control</i>		
CONFigure:PSTability:DURation	Sets the position stability cycle time.	126
CONFigure:PSTability:DURation?	Queries the position stability cycle time.	126
CONFigure:PSTability:START	Terminates the current position stability display cycle and starts a new one.	126
CONFigure:PSTability:STOP	Terminates the current position stability display cycle if a position stability display cycle is in progress.	126
<i>Tune Mode Control</i>		
CONFigure:TUNE:Schart:ZOOM:VERTical	Sets the vertical zoom mode when the tune strip chart display mode is active.	126
CONFigure:TUNE:Schart:ZOOM:VERTical?	Queries the vertical zoom mode when the tune strip chart display mode is active.	126
CONFigure:TUNE:Schart:ZOOM:HORizontal	Sets the horizontal zoom mode when the tune strip chart display mode is active.	127
CONFigure:TUNE:Schart:ZOOM:HORizontal?	Queries the horizontal zoom mode when the tune strip chart display mode is active.	127
CONFigure:TUNE:CLEar	Clears the tune strip or bar chart display, depending on which one is active.	127
<i>Trend Mode Control</i>		
CONFigure:TREND:START	Terminates the current trend cycle and starts a new one.	127
CONFigure:TREND:STOP	Terminates the current trend cycle if a cycle is in progress.	128
CONFigure:TREND:BSIZE:TIME	Sets the trend cycle duration.	128
CONFigure:TREND:BSIZE:TIME?	Queries the trend cycle duration.	128
CONFigure:TREND:RATE:FREQuency	Sets the trend sampling rate.	128
CONFigure:TREND:RATE:FREQuency?	Queries the trend sampling rate.	128
MMEMory:CATalog?	Queries trend data file mass storage information and a list of trend data files stored in the current working directory.	129
MMEMory:CDIRectory	Sets the current working directory.	130
MMEMory:CDIRectory?	Queries the current working directory.	130
MMEMory:MDIRectory	Creates a new directory.	131
MMEMory:DELeTe	Deletes a file.	131

**Table 8. Host Command Quick Reference (Sheet 7 of 9)**

MMEMory:RDIRectory	Removes a directory.	131
MMEMory:REName	Renames a file or directory.	131
MMEMory:CoPY	Copies a source file to a destination.	132
MMEMory:STORe	Stores data generated from the last completed and unnamed trend cycle to a trend data file in mass storage.	132
MMEMory:NAME	Sets the name of the file that will apply when the next open command is sent.	133
MMEMory:OPeN	Opens the previously-named file for transmission by placing all data records contained in the file in the record transmit queue.	133
MMEMory:FETCh:NRECORDs?	Queries the number of unread data records available from the data stream of the currently-open trend data file.	134
MMEMory:FETCh:NEXt?	Queries the next unread and available data record(s) of the currently-open trend data file.	134
MMEMory:FETCh:ALL?	Queries all unread and available data records of the currently-open trend data file.	134
MMEMory:CLoSE	Closes the currently-open file.	134
<i>Measurement Data Format</i>		
CONFigure:READings:SEND	Selects which values are sent when sample data records are reported over the host interface.	137
CONFigure:READings:SEND?	Queries which values are sent when sample data records are reported over the host interface.	137
CONFigure:READings:HEADers	Selects whether or not data value identification strings will prefix data values reported over the host interface.	139
CONFigure:READings:HEADers?	Queries whether or not data value identification strings will prefix data values reported over the host interface.	139
CONFigure:READings:CONTInuous	Selects if data delivery is presented in a continuous stream or the last available data record.	140
CONFigure:READings:CONTInuous?	Queries type of data delivery.	140
<i>Numeric Display Resolution</i>		
CONFigure:RESolution:THERmopile	Sets the number of display digits used when a thermopile sensor is attached.	140
CONFigure:RESolution:THERmopile?	Queries the number of display digits used when a thermopile sensor is attached.	140

**Table 8. Host Command Quick Reference (Sheet 8 of 9)**

CONFigure:RESolution:OPTical	Sets the number of display digits used when an optical sensor is attached.	141
CONFigure:RESolution:OPTical?	Queries the number of display digits used when an optical sensor is attached.	141
<b>SAMPLE MEASUREMENT DATA COLLECTION</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Data Gating</i>		
INITiate	Enables measurement data collection.	141
ABORt	Disables measurement data collection.	141
<i>Data Query</i>		
FETCh:NRECORDs?	Queries the number of unread data records available at the time of the query.	142
FETCh:NEXT?	Queries the next unread available measurement data record(s) at the time of the query.	142
FETCh:ALL?	Queries all unread available measurement data records at the time of the query.	142
FETCh:MISSing?	Queries the missing data count due to a measurement data transmission queue full condition.	142
<b>STATISTICS DATA COLLECTION</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Statistics Data Gating</i>		
STATistics:INITiate	Enables statistical data collection	143
STATistics:ABORt	Disables statistics data collection	143
<i>Statistics Data Query</i>		
STATistics:FETCh:NRECORDs?	Queries the current number of unread statistics data records available	144
STATistics:FETCh:NEXT?	Queries the next unread available statistics data record(s)	144
STATistics:FETCh:ALL?	Queries all unread available statistics data records	144
STATistics:FETCh:MISSing?	Queries the missing record count due to a statistics data transmission queue full condition	144
<b>DISPLAY</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Display Contrast</i>		
DISPlay:CONTRast	Sets the display contrast.	145

**Table 8. Host Command Quick Reference (Sheet 9 of 9)**

DISPlay:CONTrast?	Queries the contrast value.	145
<i>Display Text</i>		
DISPlay:TEXT	Sets the display text in the measurement display area.	145
<i>Text Clear</i>		
DISPlay:CLEar	Clears the display text and enables measurement data to be displayed live.	145
<b>METER AND SENSOR DEVICE INFORMATION</b>		
<b>COMMAND</b>	<b>DESCRIPTION</b>	<b>PAGE #</b>
<i>Meter</i>		
SYSTem:TIME	Sets the time maintained within the meter.	146
SYSTem:TIME?	Queries the time maintained within the meter.	146
SYSTem:DATE	Sets the date maintained within the meter.	146
SYSTem:DATE?	Queries the date maintained within the meter.	146
SYSTem:DATE:FORMat	Sets the panel display date format used by the meter.	146
SYSTem:DATE:FORMat?	Queries the panel display date format used by the meter.	146
SYSTem:INFormation:INSTrument:SNUMber?	Queries the meter serial number.	146
SYSTem:INFormation:INSTrument:CDAte?	Queries the calibration date of the meter.	146
<i>Sensor</i>		
SYSTem:INFormation:PROBe:TYPE?	Queries the currently-connected sensor type.	147
SYSTem:INFormation:PROBe:MODEl?	Queries the currently-connected sensor model.	147
SYSTem:INFormation:PROBe:SNUMber?	Queries the serial number of the sensor.	147
SYSTem:INFormation:PROBe:RESPOnsivity?	Queries the currently-connected sensor calibration responsivity.	148
SYSTem:INFormation:PROBe:CDAte?	Queries the calibration date of the sensor.	148
SYSTem:INFormation:PROBe:TEMPerature?	Queries the head temperature of the sensor.	148
SYSTem:INFormation:PROBe:DIAMeter?	Queries the sensor diameter.	148



## Commands and Queries

### SCPI Common Commands

The SCPI Standard specifies a standard set of IEEE-488.2 common commands. All common commands and queries start with an asterisk.

### IEEE-488.2 Common Commands

To maintain compatibility with the USB and RS-232 communication channels of the meter, only those commands which are common to all channels are supported.

#### Identification Query

Queries the meter identification string, such as model name, firmware version, and firmware date.

Query: \*IDN?

Reply: "Coherent, Inc - LabMax - " + <version> + " - " + <firmware date>

The dash sign separates all fields within the reply string. The first field is always "Coherent, Inc". The second field is the product name, "LabMax". The third field is the version number, having the format "V<major>.<minor><optional qualifier characters>". The fourth field is the firmware date, having the form "<3 character month name> <day of the month> <year>". The reply string is not quoted.

For example, a typical identification string looks like:

"Coherent, Inc - LabMax - V1.3 - Jul 05 2006" (note that the quotes are not transmitted)

### System Options

The system commands control functionality that is exclusive of the meter measurement functions. These commands can be sent at any time without affecting a measurement in progress.

### Local Control Lockout

#### Remote Mode

This command places the meter in remote mode. The data wheel and all front panel buttons, except the power button, are ignored while remote mode is active. To cancel remote mode, either turn off the software controlling the meter or press any key on the meter to bring

up a dialog that will allow remote mode to be canceled. Note: It is possible for the software to get out of sync with the meter if local control is taken while the application software is running.

Command: SYSTem:REMOte

Query: None

### Local Mode

This command places the meter in local mode. The data wheel and all front panel buttons are enabled while local mode is active.

Command: SYSTem:LOCal

Query: None

## System Status

This query gets the system status. Status is returned in a string expressed in upper case hexadecimal integer form. The 32-bit status word is a bit-mapped status indicator. If a bit is set, the associated status is active; otherwise it is inactive. Table 9 describes the status bit mapping.

**Table 9. Status Bit Definitions**

BIT NUMBER	MASK	STATUS DESCRIPTION
0	00000001	Battery is low
1	00000002	Sensor damage temperature is exceeded
2	00000004	Valid sensor is attached
3	00000008	USB flash drive is attached
4	00000010	Future use
5	00000020	Batch data collection is in progress
6	00000040	Trend data collection is in progress
7	00000080	Meter power is on (will always be 1)
8	00000100	Future use
9	00000200	Data logging to flash active
10	00000400	Data logging to in-memory FIFO active
11	00000800	Remote mode enabled
12	00001000	Host file copy in progress

Unspecified bits are reserved and will be zero.

Command: None

Query: SYSTem:STATus?

Reply: <status>

As an example, if the battery is low and the sensor damage temperature has been exceeded, the system status query will return:

00000003 (Battery is low, sensor damage temperature exceeded)

## **Backlight Control**

### **On/Off State**

This command controls the backlight on/off state. The backlight automatically turns off at the expiration of the backlight auto-off timer, if the backlight auto-off is enabled.

Command: DISPlay:BACKlight {DEFault|ON|OFF}

Default: ON

Query: DISPlay:BACKlight?

Reply: ON|OFF

### **Auto-Off Mode**

The meter can be configured to automatically turn off the backlight after the specified front panel idle period. The backlight timeout value is expressed in minutes, rounded to the nearest integer. Specifying OFF disables the backlight timeout timer.

#### Under AC Power

This command controls the LCD backlight auto-off timeout timer when the meter is under AC power.

Command: SYSTem:OPTion:BACKlight:AOff:ACPower  
{DEFault|OFF|1..60}

Default: OFF

Query: SYSTem:OPTion:BACKlight:AOff:ACPower?

Reply: OFF|1..60

#### Under Battery Power

This command controls the LCD backlight auto-off timer when the meter is under battery power.

Command: SYSTem:OPTion:BACKlight:AOff:BPOwer  
{DEFault|OFF|1..60}

Default: OFF

Query: SYSTem:OPTion:BACKlight:AOff:BPOwer?

Reply: OFF|1..60

## Power Auto-Off

This command sets the power auto-off timeout when the meter is under battery power. The power auto-off timeout value is expressed in minutes rounded to the nearest integer. The meter can be configured to automatically power off after the specified front panel idle period when the meter is under battery power. Setting the timeout to OFF will disable the power auto-off function.

Command: SYSTem:OPTion:POWer:AOFF  
{DEFault|OFF|1..60}  
Default is OFF

Query: SYSTem:OPTion:POWer:AOFF?  
Reply: OFF|1..60

## Meter Configuration Management

Meter configurations are stored as named files. If the software implementation requires a file extension for internal configuration file storage, the file extension is not used as part of the configuration file name.

The following rules apply to naming configuration files:

- The configuration name may use space characters, dash characters, and all alphabet and number characters
- The configuration name length will not exceed 40 characters
- The first character of the configuration name is not a space character
- Configuration name matching for comparison purposes is case-insensitive
- A configuration name containing the string “Factory Settings” is considered an invalid name

An attempt to specify an invalid configuration name in a command will raise error 101.

## Catalog

This query gets the list of stored configuration files that was saved by the user. Note that the length of the meter response is limited to the maximum message size.

Command: None

Query: MEMory:STATe:CATalog?  
Reply: <comma separated list of quoted configuration names>

**Save**

This command stores the current configuration to the named configuration file. The named configuration file is overwritten if the configuration name matches an existing configuration file. An attempt to save to the “Factory Settings” configuration raises error 101.

Command:

MEMory:STATe:SAVE <quoted configuration name>

Default: not applicable.

Query: None

**Recall**

This command loads and activates the configuration held in the named configuration file. An attempt to recall a non-existent configuration raises error 101.

Command: MEMory:STATe:RECall <quoted configuration name>

Default: not applicable.

Query: None

**Delete**

This command deletes the named configuration file. An attempt to delete a non-existent configuration raises error 101. An attempt to delete the “Factory Settings” configuration raises error 101.

Command: MEMory:STATe:DELeTe <quoted configuration name>

Default: not applicable.

Query: None

**Rename**

This command renames the named configuration file. Error 101 is raised if the source configuration does not exist. This Error 101 is raised if the destination configuration exists.

Command: MEMory:STATe:REName <quoted source configuration name>,<quoted destination configuration name>

Default: not applicable.

Query: None

**Communications**

Communications parameters may be changed remotely. Any changes to the communications settings take effect immediately after the command is processed and the handshaking response, if any, is transmitted.

## Interface Select

This command selects the interface for host communication.

Command: SYSTem:COMMunicate:INTerface  
{DEFault|RS232|USB}  
Default: USB

Query: SYSTem:COMMunicate:INTerface?  
Reply: RS232|USB

## Message Handshaking

This command selects the state of SCPI message round trip handshaking.

Command: SYSTem:COMMunicate:HANDshaking  
{ON|OFF}

Reply: OK if ON is selected; otherwise no reply is sent

Query: SYSTem:COMMunicate:HANDshaking?  
Reply: ON|OFF

If handshaking is ON:

- Empty commands (commands with only whitespace characters) reply with “OK\r\n”
- Valid commands with valid data reply with “OK\r\n”
- Valid queries with valid data reply as explicitly defined elsewhere in this section, followed by “OK\r\n”
- Valid commands or queries which result in an error reply with “ERR<n>\r\n” where <n> is the error code number Available data is either measurement data records (see “Sample Measurement Data Collection” on page 141) or error records (see “Error Record Reporting and Collection” on page 114).
- Unrecognized commands or queries reply with “ERR100\r\n”
- Error queuing occurs as explicitly defined elsewhere in this section

If handshaking is OFF:

- All command and query response behavior is explicitly defined elsewhere in this section

## Serial Port-Specific

### Baud Rate

This command selects the transmit and receive baud rates together.

Command: SYSTem:COMMunicate:SERial:BAUD  
{DEFault|9600|19200|38400|57600|115200}  
Default: 19200

Query: SYSTem:COMMunicate:SERial:BAUD?  
Reply: 9600|19200|38400|57600|115200

### **Parity**

This command selects the parity bit setting.

Command: SYSTem:COMMunicate:SERial:PARity  
{DEFault|EVEN|ODD|NONE}  
Default: NONE

Query: SYSTem:COMMunicate:SERial:PARity?  
Reply: EVEN|ODD|NONE

### **Stop Bits**

This command selects the number of stop bits used.

Command: SYSTem:COMMunicate:SERial:SBITs  
{DEFault|1|2}  
Default: 1

Query: SYSTem:COMMunicate:SERial:SBITs?  
Reply: 1|2

### **Flow Control**

This command selects the flow control method for meter to host communication. XON represents the XON/XOFF pacing method (see“Data Flow Control” on page 96).

Command: SYSTem:COMMunicate:SERial:PACE  
{DEFault|XON|NONE}  
Default: NONE

Query: SYSTem:COMMunicate:SERial:PACE?  
Reply: XON| NONE

### **Service Request**

This command selects the state of the service request marker feature (see“Service Request” on page 96).

Command: SYSTem:COMMunicate:SERial:SERVice  
{DEFault|OFF|ON}  
Default: OFF

Query: SYSTem:COMMunicate:SERial:SERVice?  
Reply: OFF|ON

**USB Port-Specific****Binary Streaming Data**

This command enables the transmission of binary streaming data on the USB interface.

Command: SYSTem:COMMunicate:USB:STREam  
 {DEFault|ON|OFF}  
 Default: OFF

Query: SYSTem:COMMunicate:USB:STREam?  
 Reply: ON|OFF

**Error Record Reporting and Collection**

Programming and system errors will occasionally occur while testing or debugging remote programs and during measurement. Error strings will follow the SCPI Standard for error record definition:

<error code>,<quoted error string><CR><LF>

The host queries for errors in two steps. First, the host queries for the number of error records available (N) and second, the host queries N times for the error records. Errors are stacked up to 20 deep. In the case of error overflow, the last error in the error list is an indication of error overflow.

The possible error strings are shown in Table 10.

**Table 10. Error Codes and Description Strings (Sheet 1 of 2)**

ERROR CODE NUMBER	QUOTED ERROR STRING	ERROR DESCRIPTION
-350	"Queue overflow"	Error queue is full
-321	"Out of memory"	Meter internal memory is exhausted
-310	"System error"	Unexpected/unrecoverable hardware or software fault
-254	"Media full"	No more storage available on the mass storage volume
-200	"Execution error"	Command is out of order
0	"No error"	No error
100	"Unrecognized command/query"	The command or query is not recognized
101	"Invalid parameter"	The command or query parameter is invalid
200	"Directory does not exist"	The specified directory does not exist
201	"File does not exist"	The specified file does not exist



**Table 10. Error Codes and Description Strings (Sheet 2 of 2)**

ERROR CODE NUMBER	QUOTED ERROR STRING	ERROR DESCRIPTION
202	“Directory already exists”	The specified directory already exists
203	“File already exists”	The specified file already exists
204	“Directory is not empty”	The specified directory is not empty
205	“File query is not possible”	The file query is not possible because the file is not opened
206	“File to open not named”	The file open is not possible because the named file has not been named

Error -350 is raised when the error queue becomes full. Non-“Queue overflow” errors are replaced by “Queue overflow” errors when there is exactly one available storage location available in the error queue. No additional errors are added to the error queue if the error queue is full.

Error -321 is raised when there is an internal memory allocation error. This error typically happens when malloc(), calloc(), or strdup() fails and usually leads to an unrecoverable meter firmware condition.

Error -310 is raised when the meter firmware detects an unexpected or unrecoverable error. This error condition includes unrecoverable hardware faults.

Error -254 is raised when an attempt to write a trend data file to the local or USB mass storage volumes exceeds the storage limit of the volume. When a mass storage volume becomes full, the growing file that caused the error is immediately closed and error -254 is raised.

Error -200 is raised when a file name/open/close sequence happens out of order.

Error 100 is raised when the meter receives an unrecognized command or query.

Error 101 is raised when the meter receives a command or query with one or more invalid data parameters.

The remaining errors are raised for specific mass storage operational errors described elsewhere in this section.

### **Error Count Query**

This query gets the number of error records in the error queue at the time of the query.

Command: none

Query: SYSTem:ERRor:COUNT?

Reply: <count of error records stored in integer format>

## Error Query

This query gets the next error record(s) in the error queue. More than one error record may be queried using the optional <error record count> parameter, which must be an integer value. A single error record is returned if <error record count> is not specified. No reply is transmitted if no error records are available.

As the meter transmits each error record:

- The error record is permanently removed from the error queue
- The queued error record count decrements by one

Command: none

Query: SYSTem:ERRor:NEXT? [<error record count>]

Default: not applicable.

Reply: <next available error record(s)>

## All Error Query

This query gets all error records in the error queue at the time of the query. No reply is transmitted if no error records are available.

After the completion of the reply transmission:

- The error queue is empty
- The queued error record count is zero

Command: none

Query: SYSTem:ERRor:ALL?

Reply: <all available error record(s)>

**All Error Clear**

This command clears all error records in the error queue.

Command: SYSTem:ERRor:CLEar

Query: none

**Measurement Setup and Control**

The meter may be configured to measure data through the host interface or the front panel. Many of the setup commands have an identical corresponding host command.

**Measurement Mode Select**

This command sets the meter measurement mode to select either power (Watts) or energy (Joules) measurement mode.

Command: CONFigure:MEASure {DEFAult|J|W}

Default: W (Watts) mode when a thermopile or optical sensor is attached.

Query: CONFigure:MEASure?

Reply: J|W

The command is ignored when an optical sensor is attached or if a valid sensor is not attached.

**Power Measurement Units Select**

This command sets the display measurement units for power measurements (Watts or dBm).

Command: CONFigure:PUNits {DEFAult|W|DBM}

Default: W (Watts)

Query: CONFigure:PUNits?

Reply: W|DBM

**Display Mode Select**

This command sets the display mode.

Command: CONFigure:DISPlay:PRImary

Command: CONFigure:DISPlay:STATistics

Command: CONFigure:DISPlay:PSTability

Command: CONFigure:DISPlay:TUNE

Command: CONFigure:DISPlay:TREND

Query: None

The position stability display mode command (CONF:DISP:PST) is ignored if an LM sensor is not attached.

The command header that follows CONFigure:DISPlay: has the function shown in Table 11.

**Table 11. Display Mode Headers**

HEADER	DISPLAY MODE
PRImary	Non-statistics
STATistics	Statistics
PSTability	Position stability
TUNE	Tune
TREND	Trend

### Display View Mode Select

#### Position Stability View Mode

This command sets the position stability view mode to be used when position stability display mode is active.

Command: CONFigure:PSTability:VMode  
{DEfault|SCRoll|FTScreen}  
Default: SCRroll

Query: CONFigure:PSTability:VMode?  
Reply: SCR|FTSC

#### Tune View Mode

This command sets the tune view mode to be used when tune display mode is active.

Command: CONFigure:TUNE:VMode  
{DEfault|SCHart|BCHart}  
Default: SCHart

Query: CONFigure:TUNE:VMode?  
Reply: SCH|BCH

#### Trend Chart View Mode

This command sets the trend chart view mode to be used when trend display mode and trend chart display sub mode are active.

Command: CONFigure:TREND:VMode  
{DEfault|SCRroll|FTScreen}  
Default: SCRroll

Query: CONFigure:TREND:VMode?  
Reply: SCR|FTSC

## **Area Correction**

### **Enable/Disable State**

This command enables or disables area correction.

Command: CONFigure:AREA:CORRection  
{DEFault|ON|OFF}  
Default: OFF

Query: CONFigure:AREA:CORRection?  
Reply: ON|OFF

### **Aperture Area**

This command sets the aperture area expressed in square centimeters (cm<sup>2</sup>).

Command: CONFigure:AREA:APERture  
{DEFault|0.01..500.00}  
Default: 1.0

Query: CONFigure:AREA:APERture?  
Reply: 0.01..500.00

## **Analog Output Full Scale Voltage**

This command selects the full scale output voltage at the analog output connector.

Command: CONFigure:AOUT:FSCale {DEFAult|1|2|4}  
Default: 2

Query: CONFigure:AOUT:FSCale?  
Reply: 1|2|4

## **Speedup**

### **Host Data Output**

This command selects the speedup mode for the host interface data output.

Command: CONFigure:SPEedup:HOST  
{DEFAult|OFF|ON}  
Default: ON

Query: CONFigure:SPEedup:HOST?  
Reply: OFF|ON

### **Analog Output**

This command selects the speedup mode for the analog output.

Command: CONFigure:SPEedup:AOUT  
{DEFAult|OFF|ON}  
Default: ON

Query: CONFigure:SPEedup:AOUT?  
Reply: OFF|ON

### **Panel Numeric Display**

This command selects the speedup mode for the panel numeric display.

Command: CONFigure:SPEedup:DISPlay  
{DEFAult|OFF|ON}  
Default: ON

Query: CONFigure:SPEedup:DISPlay?  
Reply: OFF|ON

### **Tune Display**

This command selects the speedup mode for the panel tune display.

Command: CONFigure:SPEedup:TUNE  
{DEFAult|OFF|ON}  
Default: ON

Query: CONFigure:SPEEdup: TUNE?  
 Reply: OFF|ON

## Display Data Smoothing

Display data smoothing is controlled differently, depending on the type of sensor attached.

### Time

This command sets the display data smoothing window size expressed in seconds rounded to the nearest integer. This command applies only when a thermopile or optical sensor is attached in Watts mode.

Command: CONFigure:AVERage:TIME  
 {DEFault|OFF|AUTO|1..60}  
 Default: AUTO

Query: CONFigure:AVERage:TIME?  
 Reply: OFF|AUTO|1..60

## Wavelength Correction

### Enable/Disable State

This command enables or disables wavelength correction.

Command: CONFigure:WAVElength:CORRection  
 {DEFault|OFF|ON}  
 Default: OFF

Query: CONFigure:WAVElength:CORRection?  
 Reply: OFF|ON

### Operational Wavelength

This command sets the operational wavelength expressed in units of nm rounded to the nearest integer. When MIN is specified, the minimum allowable wavelength for the attached sensor is used. When MAX is specified, the maximum allowable wavelength for the attached sensor is used. Otherwise, the range of wavelengths permitted for this command is controlled by MIN and MAX.

Command: CONFigure:WAVElength:WAVElength  
 {MIN|MAX|1..99999}  
 Default: not applicable.

Query: CONFigure:WAVElength:WAVElength?  
 [MAXimum|MINimum]  
 Reply: 1..99999

Using the optional MAX and MIN parameters results in the maximum or minimum wavelengths that can be used for the currently connected sensor. If there is no sensor attached, the maximum is 99999 nm and the minimum is 1 nm.

The numerically-specified wavelength must be one of the wavelengths in the wavelength table for the attached sensor type. Error 101 is raised if the numerically specified wavelength is not one of the wavelengths in the wavelength table for the attached sensor type. If no sensor is attached, any numerically-specified wavelength within the range stated above is accepted.

### **Wavelength Table Definition**

This command sets the wavelength table entries for the meter. The old list is replaced by the list of wavelengths specified in the command. Each wavelength is expressed in units of nm rounded to the nearest integer. Each wavelength ranges from 1 to 99999. Error 101 is raised if the list length exceeds 100 entries. Note that the list returned by the query will always include the calibration wavelength of the current sensor.

Command: CONFigure:WAVElength:LIST

<comma separated list of wavelengths>

Default: not applicable.

Query: CONFigure:WAVElength:LIST?

Reply: <comma separated list of wavelengths>

## **Gain Compensation**

### **Enable/Disable State**

This command enables or disables gain compensation.

Command: CONFigure:GAIN:COMPensation

{DEFAULT|OFF|ON}

Default: OFF

Query: CONFigure:GAIN:COMPensation?

Reply: OFF|ON

### **Factor**

This command sets the gain compensation factor. The gain compensation factor has no units.

Command: CONFigure:GAIN:FACTOR

{DEFAULT|0.001..100000.0}

Default: 1.0

Query: CONFigure:GAIN:FACTOR?

Reply: <gain compensation factor>



**Probe Zero**

This command sets the current sensor input voltage as the zero base-line voltage. Using this command will result in no internal action taken if a valid sensor is not attached.

Command: CONFigure:ZERO

The zero query returns the offset in Watts used to generate the zeroed output if a valid thermopile or optical sensor is attached. Otherwise, 0 is returned.

Query: CONFigure:ZERO?

Reply: <zero offset in Watts>

**Range Select****Range Value Select**

This command selects the meter measurement range expressed in the units defined under the current measurement mode (Joules or Watts). The measurement range is selected by expressing the maximum expected measurement, which must be greater than 0.0. The <granted full scale range> value is the lowest available full-scale range that can measure the <maximum expected measurement>. For example, if the list of available ranges is 3 mW, 30 mW and 300 mW, and the maximum expected measurement is 10 mW, the granted range is 30 mW. The <granted full scale range> is the top range available if the <maximum expected measurement> exceeds the top range value.

Command: CONFigure:RANGe:SElect

<maximum expected measurement>

Default: not applicable.

Query: CONFigure:RANGe:SElect? [MAXimum|MINimum]

Reply: <granted full scale range>

Using the optional MAX and MIN parameters will result in the maximum or minimum available range, respectively. It is possible that the range returned from the query will not be the same as the range selected, if auto ranging is active.

**Auto Range Enable/Disable State**

This command enables or disables automatic selection of the meter measurement range. The meter hunts for the best measurement range for the current sensor and laser conditions when auto ranging is active. The hunt procedure may require several samples to arrive at the best range.

Command: CONFigure:RANGe:AUTO

{DEFault|ON|OFF}

Default: OFF

Query: CONFigure:RANGe:AUTO?

Reply: ON|OFF

## Statistics Mode Control

Sets statistics calculation parameters to be used in the statistics operating mode.

### Display Item Select

This command selects the statistics display items, which takes effect at the end of the current statistical batch. The data argument is a comma-separated list of one or more tokens shown below. At least one token must be specified. The tokens may be specified in any order. Duplicated tokens are ignored. Error 101 is raised if the list length exceeds 10 entries.

One or more display items may be selected but only the first six list items are displayed. The query returns all selected tokens—including non-displayed tokens—following the order stated in the reply list below.

### Batch Size

#### Time

This command sets the statistics batch size, which takes effect at the end of the current statistical batch. The batch size includes 0 to 999 days and is expressed in units of days:hours:minutes:seconds. Each numeric component of hours:minutes:seconds must be an integer. Days must range from 0 to 999. Hours must range from 0 to 24. Minutes must range from 0 to 59. Seconds must range from 0 to 59. This command applies only when a thermopile or optical sensor is attached in Watts mode.

Command: CONFigure:STATistics:BSIZE:TIME

{DEfault|00:00:01..24:00:00}

Default: 00:01:00

Query: CONFigure:STATistics:BSIZE:TIME?

Reply: 00:00:01..24:00:00

### Sampling Rate

#### Time Based Measurements

This command sets the statistics sampling rate, which takes effect at the end of the current statistical batch. The sampling interval rate is expressed in units of samples per second. This command applies only when a thermopile or optical sensor is attached and is in Watts mode.

The sampling rate is 1, 2, 5, or 10 (max.) samples/sec. The true sampling rate is integer submultiples of 10 samples/sec as the internal sensor sampling rate is fixed at exactly 10 samples/sec.

Command: CONFigure:STATistics:RATE:FREQuency  
{DEFAult|1.157E-5..1.0E1}  
Default: 1.0E1

Query: CONFigure:STATistics:RATE:FREQuency?  
Reply: 1.157E-5..1.0E1

### **Restart Mode**

This command selects the action to be taken at the end of a statistical batch. AUTomatic begins a new batch immediately upon logging the data from the previous batch. MANual requires the start signal (see “Start a New Batch” on page 125).

Command: CONFigure:STATistics:RMOde  
{DEFAult|MANual|AUTomatic}  
Default: MANual

Query: CONFigure:STATistics:RMOde?  
Reply: MAN|AUT

### **Batch Initiation and Termination**

#### Start a New Batch

This command terminates the current statistical batch and starts a new one.

Command: CONFigure:STATistics:STARt

Query: None

The command is ignored if statistics display mode is not active.

#### Stop a Batch

This command terminates the current statistical batch if a batch is in progress.

Command: CONFigure:STATistics:STOP

Query: None

The command is ignored if statistics display mode is not active or a batch is not in progress.

## Position Stability Mode Control

### Cycle Duration

This command sets the position stability cycle time, which takes effect at the end of the current position stability cycle. The position stability cycle time is expressed in units of hours:minutes:seconds. Each numeric component of hours:minutes:seconds must be an integer. Hours must range from 0 to 24. Minutes must range from 0 to 59. Seconds must range from 0 to 59. This command applies only when a quad thermopile sensor is attached in one of the position stability display modes.

Command: CONFigure:PSTability:DURation  
{DEfault|00:00:01..24:00:00}  
Default: 00:01:00

Query: CONFigure:PSTability:DURation?  
Reply: 00:00:01..24:00:00

### Cycle Initiation and Termination

#### Start a New Cycle

This command terminates the current position stability display cycle and starts a new one.

Command: CONFigure:PSTability:STARt

Query: None

The command is ignored if position stability display mode is not active.

#### Stop a Cycle

This command terminates the current position stability display cycle if a position stability display cycle is in progress.

Command: CONFigure:PSTability:STOP

Query: None

The command is ignored if position stability display mode is not active or a position stability display cycle is not in progress.

## Tune Mode Control

### Zoom Level

#### Strip Chart

##### Vertical

This command sets the vertical zoom mode when the tune strip chart display mode is active. The vertical zoom mode value is unit-less.

Command: CONFigure:TUNE:SCHart:ZOOM:VERTical  
 {DEfault|AUTO|1|2|5|10|20}  
 Default: AUTO

Query: CONFigure:TUNE:SCHart:ZOOM:VERTical?  
 Reply: AUTO|1|2|5|10|20

#### Horizontal

This command sets the horizontal zoom mode when the tune strip chart display mode is active. The horizontal zoom mode value is unit-less.

Command: CONFigure:TUNE:SCHart:ZOOM:HORizontal  
 {DEfault|1|2|5|10|20}  
 Default: 1

Query: CONFigure:TUNE:SCHart:ZOOM:HORizontal?  
 Reply: 1|2|5|10|20

#### **Clear**

This command clears the tune strip chart display.

Command: CONFigure:TUNE:CLEar

Query: None

### **Trend Mode Control**

The trend mode is controllable from the CONFigure and MMEMory command nodes from the host interface. The CONFigure commands provide all host configuration of the trend mode operation. The MMEMory commands provide all data file management and data file transfer commands and queries for data generated when trend display mode is active.

#### **Operational Control**

##### Cycle Initiation and Termination

##### Start a New Cycle

This command terminates the current trend cycle and starts a new one. An optional, fully-qualified filename may be included to specify the location where the trend data will be stored. (Fully-qualified filenames are defined under the heading, “Data Storage” on page 129.) If a filename is not specified, the data will be buffered internally and may be saved at a later time using mass memory commands.

Command:  
 CONFigure:TRENd:STARt [<quoted fully qualified filename>]

Query: None

The command is ignored if trend display mode is not active.

### Stop a Cycle

This command terminates the current trend cycle if a cycle is in progress.

Command: CONFigure:TREND:STOP

Query: None

The command is ignored if trend display mode is not active or a trend cycle is not in progress.

### Cycle Parameters

#### Cycle Duration

##### *Time*

This command sets the trend cycle duration, which takes effect at the end of the current trend cycle. The trend cycle duration is expressed in units of hours:minutes:seconds. Hours must range from 0 to 24. Minutes must range from 0 to 59. Seconds must range from 0 to 59. This command applies only when a thermopile or optical sensors is attached in Watts mode.

Command: CONFigure:TREND:BSIZE:TIME

{Default|00:00:01..24:00:00}

Default: 00:01:00

Query: CONFigure:TREND:BSIZE:TIME?

Reply: 00:00:01..24:00:00

### Sampling Rate

#### *Time Based Measurements*

This command sets the trend sampling rate, which takes effect at the end of the current trend cycle. The sampling interval rate is expressed in units of samples per seconds. This command applies only when a thermopile or optical sensor is attached in Watts mode.

The sampling rate is 1, 2, 5, or 10 (max.) samples/sec. The true sampling rate is integer sub-multiples of 10 samples/sec as the internal sensor sampling rate is fixed at exactly 10 samples/sec.

Command: CONFigure:TREND:RATE:FREQuency

{Default|1.157E-5..1.0E1}

Default: 1.0E1

Query: CONFigure:TREND:RATE:FREQuency?

Reply: 1.157E-5..1.0E1

## Data Storage

Trend mode data storage (also known as mass memory) is in USB and/or internal flash memory. Data is stored in files within a hierarchical directory-based file system.

The full file format is \<volume>[\<directory>[\<directory>]...]. Files and directories are not limited to the 8.3 format. A fully-qualified combined directory path and file name will not exceed 260 characters in length. Valid directory and file name characters are ASCII characters 0x20-0x7E, except for the characters '<', '>', ':', '"' (double quote), '/' (forward slash), '\' (backward slash), and '|'.

The file name will not end with a trailing space or period. (Note that the graphical interface of the meter may only allow user entry of a subset of the file name characters supported by the host interface.) The only file names considered valid for trend data storage purposes are Comma Separated Value (CSV) files, and in all cases the “.csv” file name extension are appended to valid trend data file names.

There are two mass storage volumes: removable USB flash memory and local flash memory. The string “usb” identifies USB flash memory volume. The string “loc” identifies local flash memory volume.

Volume name, directory name, and file name matching is case-sensitive for comparison and file storage purposes. The case is preserved at all times.

Forward slashes (/) and backward slashes (\) separating <directory> and <volume> entries in the full file and directory formats are accepted interchangeably on input. Backward slashes are always used on full file and directory format outputs. The full file string format is a quoted concatenation of the full directory path, followed by a slash separator, which is followed by the file name.

A file or directory may be specified as a relative name (non-absolute path, starting with the conventional “.” and “..” relative symbols), or a fully-qualified absolute name in command arguments. Relative names are relative to the current working directory (see “Change Directory” on page 130). Files and directories returned in replies are absolute names.

## Directory and File Manipulation

### Directory List

Note: SCPI specifies using the term “catalog” in lieu of the term “directory” as the header to request a list of files contained in a directory. In that context, catalog and directory are synonymous.

This query gets trend data file mass storage information and a list of trend data files stored in the current working directory. The reply to the query returns data in comma-separated list format. The first list item is the estimated number of allocated trend data storage bytes used on the current volume. The second list item is the estimated number of allocated trend data storage bytes remaining for new trend data storage. All remaining list items are file entries. Each file entry is a trio of data items. Each trio is identified by position only. The first item in a file entry trio is the quoted file name. The second item is the file type, with ASC always representing ASCII file type. The third item is the file size in bytes (an estimated value in the case of active open files).

For example, a valid reply might be:

10012321,392323,"file1.csv",ASC,1250,"file2.csv",ASC,3250

The reply string indicates the following:

- 10012321 bytes of storage allocated for trend files are in use
- 392323 bytes of storage allocated for trend files are available for new trend data file storage
- There are two files in the current working directory: file1.csv and file2.csv
- file1.csv is an ASCII file containing 1250 bytes
- file2.csv is an ASCII file containing 3250 bytes

Note that the length of the meter response is limited to the maximum message size.

Command: None

Query: MMEMory:CATalog?

Reply: <bytes used>,<bytes available>,<comma separated list of file entries>

### Change Directory

This command sets the current working directory. The command argument is a quoted string indicating the directory. An attempt to set the current working directory to a non-existent directory will raise error 200. The query gets the quoted current working directory. The current working directory is the root directory of the internal data storage directory tree after a power off/on cycle.

Command:

MMEMory:CDIRectory <quoted directory name>

Default: not applicable.

Query: MMEMory:CDIRectory?

Reply: <quoted current working directory name>



Create Directory

This command creates a new directory. The command argument is a quoted string indicating the directory. An attempt to create an existing directory will raise error 202. An attempt to create a directory using the name of an existing file will raise error 202. An attempt to create a new directory when the storage volume is full will raise error -254.

Command:

MMEMory:MDIRectory <quoted directory name>

Default: not applicable.

Query: None

Delete File

This command deletes a file. The command argument is a quoted string indicating the file, including the “.csv” file name extension. An attempt to delete a non-existent file will raise error 201. An attempt to delete a file being populated by the currently active trend cycle will raise error 101. An attempt to delete a file open for file transfer will raise error 101.

Command: MMEMory:DELeTe <quoted file name>

Default: not applicable.

Query: None

Remove Directory

This command removes a directory. An attempt to remove a directory that does not exist will raise error 200. An attempt to remove a directory that contains files or subdirectories will raise error 204.

Command:

MMEMory:RDIRectory <quoted directory name>

Default: not applicable.

Query: None

Rename File or Directory

This command renames a file or directory. Only directories and “.csv” files may be renamed using this command. Renaming a file requires that the “.csv” file name extension be specified for both the original file name and the new file name. An attempt to rename a file or directory that does not exist will raise error 201. An attempt to rename a file or directory to a file or directory that already exists will raise error 202 or 203, depending if the original file is a directory or a file. An attempt to rename a file being populated by the currently-active trend cycle will raise error 101. An attempt to

rename a file open for file transfer will raise error 101. An attempt to rename a file or directory when the storage media is full will raise error -254.

Command: MMEemory:REName <quoted original file or directory name>,<quoted new file or directory name>

Default: not applicable.

Query: None

### Copy File

This command copies a source file to a destination. The <quoted source> parameter indicates a relative or absolute source path to an existing file. The <quoted destination> parameter may indicate a relative or absolute path to a new non-existent destination file or an existing destination directory. The current working directory is assumed if the directory component of either source or destination path is omitted. A duplicate of the source file is created with the destination file name in the specified directory, if the destination parameter represents a file. A duplicate of the source file is created with the same source file name in the specified directory, if the destination parameter represents a directory. Copying a file requires that the “.CST” file name extension be specified for source files and destination file names (not destination directories). An attempt to copy a file that does not exist will raise error 201. An attempt to copy a file to a destination file that already exists will raise error 202 or 203, depending if the destination is a directory or a file. An attempt to copy a file when the storage media is full will raise error -254. An attempt to copy a source file that is currently in use will raise error 101.

Note that file copies may be lengthy operations and, for this reason, they are performed in the background. The result code returned by this command represents a “good faith” effort at predicting the results of the subsequent copy operation. If the background copy ultimately fails, error -200 is raised after the initial reply to this command has been returned. The system status word contains a bit to indicate that a host file copy is in progress. The host may check this bit to see if any copies are in progress.

Command:

MMEemory:COPY <quoted source>,<quoted destination>

Default: not applicable.

Query: None

### Store Data to File

This command stores data generated from the last completed and unnamed trend cycle since the last power off/on cycle to a trend data file in mass storage. This command is ignored if a trend cycle is in

progress. This command is ignored if no trend cycle has completed since the last power off/on cycle. An attempt to operate on a file being populated by the currently-active trend cycle will raise error 101. An attempt to store to a file open for file transfer will raise error 101.

Command: MMEMemory:STORe <quoted file name>

Default: not applicable.

Query: None

#### File Transfer to Host

The host interface provides facility for transferring a trend data file in meter mass storage to the host computer via the host interface. The model for the facility will be:

1. Set file name
2. Open file
3. Fetch data record(s)
4. Close file

Only one file will be open at any time. Failing to follow the above order for file data access will raise error -200. The open/close state of a file will not persist across after a power off/on cycle. All files will be closed after a power off/on cycle.

Data records are defined as a single ASCII line in a comma-separated values data file. Data records are fetched in start-to-finish sequential order. Each data record is removed from the open file data stream as it is transmitted, until all data records have been read from the data stream.

#### Name File to Open

This command sets the name of the file that will apply when the next open command is sent. An attempt to set the name of a file while a previously opened file remains open will raise error 101

Command: MMEMemory:NAME <quoted file name>

Default: not applicable.

Query: None

#### Open Named File

The command opens the previously-named file for transmission by placing all data records contained in the file in the record transmit queue. An attempt to open a file that has not been named will raise error 206. An attempt to open a file that does not exist will raise error 201. An attempt to open a file being populated by the currently active trend cycle will raise error 101.

Command: MMEMory:OPEN

Query: None

File Record Count Query

This query gets the number of unread data records available from the data stream of the currently-open trend data file. An attempt to issue this query while a file is not open will raise error 205.

Command: None

Query: MMEMory:FETCh:NRECORDs?

Reply: <count of records available>

Fetch Next Available Record(s)

The query gets the next unread and available data record(s) of the currently-open trend data file. An attempt to issue this query while a file is not open will raise error 205. An attempt to fetch more data records than are available will result in the exact number of data records available being transmitted.

As the meter transmits each data record:

- The data record is permanently removed from the record transmit queue
- The queued data record count decrements by one

Command: None

Query: MMEMory:FETCh:NEXT? [<record count>]

Reply: <next available record(s)>

Fetch All Available Records

This query gets all unread and available data records of the currently open trend data file.

After the completion of the reply transmission:

- The record transmit queue will be empty
- The queued data record count will be zero

Command: None

Query: MMEMory:FETCh:ALL?

Reply: <all available records>

Close Named File

This command closes the currently-open file. This command is ignored if a file is not open.

Command: MMEMory:CLOSE

Query: None

## Measurement Data Format

The data format commands are used to configure the form in which the meter sends measurement data and statistical data to the host. Data records are sent to the host in ASCII text form. A data record is a set of one or more comma-delimited data values generated at the same instant, ending in "<CR><LF>".

The selected meter measurement mode controls the type of measurement data that is sent over the host interface. The user receives energy readings from the host interface if the measurement mode is J. The user receives power readings from the host interface if the measurement mode is W. Watts or Joules are expressed as units per square centimeter, if area correction is active.

Two types of data records are available to the host: Sample and Statistics. *Sample* data records that represent data from a single measurement pulse or sample are available anytime the meter has acquired data and sample data logging has been initialized. *Statistic* data records are available when statistics mode is active, and when one or more statistical batches have been completed and statistics data logging has been initialized.

### Sample Data Record Format

The following information is available with each data record:

- Measurement value in "%.4E" format (for all sensor types)
- Quad Sensor X distance in MM in "%.1f" format (data is 0 if quad sensor is not used)
- Quad Sensor Y distance in MM in "%.1f" format (data is 0 if quad sensor is not used)
- Coded format ID indicating the exact format string used for meter measurement display (refer to Table 12, "Measurement Data Value Selections," on page 137 for coded format ID definitions)
- Coded engineering units scale multiplier ID (refer to Table 12, "Measurement Data Value Selections," on page 137 for coded scale multiplier ID definitions)
- Encoded Units ID byte.
  - Bit 7 indicates the measurement value units, SET indicates Watts, CLEAR indicates Joules
  - Bit 6 indicates if units represent area, SET indicates units are in CM<sup>2</sup>, CLEAR indicates no area
  - Bits 5-0 represent the following units:
    - Femto

- Pico
  - Nano
  - Micro
  - Milli
  - Fundamental
  - Kilo
  - Mega
  - Giga
- Flags (defined in Table 13, “FLAG Bit Definitions,” on page 138)
  - Sequence number

The meter internally generates a data record according to the following rules:

- With every pulse when a thermopile sensor is attached and Joules mode is selected
- 10 times per second when a thermopile or optical sensor is attached and Watts mode is selected

Since thermopile and optical power measurements are continuous in nature, the delivery of this data may be configured as a stream of sampled points or simply the last point recorded (see “Continuous Data Delivery Mode” on page 140).

The host may configure the presentation of data in a record. Data ID tags and content are configurable. The host may control the expression of data ID tags that precede each data item in a batch record. The host may control the data contents and the expression of data ID tags that precede each data item (see “Sample Data Value Set Send” on page 137 and “Data Value Headers” on page 139).

### Sample Data Value Set Send

This command—which takes effect at the next data measurement taken (but not already queued)—selects which values are sent when sample data are reported over the host interface. One or more of the selections from Table 12 may be selected.

**Table 12. Measurement Data Value Selections**

TOKENS	DATA DESCRIPTION	EXPRESSED IN
PRI	Primary data value (includes Watts or Joules)	Scientific notation (for example, “2.88E-3”)
QUAD	Quad distance X/Y data in mm (valid only when an LM sensor is attached)	Two floating point values in X,Y order (for example, “-1.2,+1.5”)
FMT	Primary data value display format	<p>Coded print format ID followed by a “/” followed by a coded engineering units scale multiplier (for example, 5/3 represents a %6.2f print format string and a 1.0E-9 engineering units scale multiplier). Coded IDs are as follows:</p> <p style="text-align: center;"><u>Coded Print Format IDs</u></p> <ol style="list-style-type: none"> <li>1. “%4.0f”</li> <li>2. “%5.1f”</li> <li>3. “%5.2f”</li> <li>4. “%6.1f”</li> <li>5. “%6.2f”</li> <li>6. “%6.3f”</li> <li>7. “%7.2f”</li> <li>8. “%7.3f”</li> <li>9. “%7.4f”</li> <li>10. “%8.3f”</li> <li>11. “%8.4f”</li> <li>12. “%8.5f”</li> </ol> <p style="text-align: center;"><u>Coded Scale Multiplier IDs</u></p> <ol style="list-style-type: none"> <li>1. 1.0E-15</li> <li>2. 1.0E-12</li> <li>3. 1.0E-9</li> <li>4. 1.0E-6</li> <li>5. 1.0E-3</li> <li>6. 1.0</li> <li>7. 1.0E+3</li> <li>8. 1.0E+6</li> <li>9. 1.0E+9</li> <li>10. 1.0E+12</li> <li>11. 1.0E+15</li> </ol>
UNIT	Primary data value display units	String format (for example, “mW/cm2”)
PER	Pulse period in microseconds	32-bit unsigned integer form
FLAG	Flags	8-bit hexadecimal integer form
SEQ	Sequence ID	32-bit unsigned integer form

The data argument is a comma-separated list of one or more tokens shown below and in Table 12. At least one token must be specified. The tokens may be specified in any order. Duplicated tokens will be ignored. Error 101 will be raised if the list length exceeds 7 entries.

The presentation of the data items in a data record is: PRI, QUAD, FMT, UNIT, PER, FLAG, then SEQ order, depending on which tokens were specified.

The labels in the former list also serve as data header strings (see “Data Value Headers” on page 139).

The query returns all selected tokens following the order stated in the reply list below.

Command: CONFIgure:READings:SEND  
 {DEFault|PRI,QUAD,FMT,UNIT,PER,FLAG,SEQ}  
 Default: PRI

Query: CONFIgure:READings:SEND?  
 Reply: PRI,QUAD,FMT,UNIT,PER,FLAG,SEQ

The FLAG data item may be used so that accompanying qualification information is reported with each data record. Qualification information includes various error conditions. The flag word is reported in the ASCII form of an 8-bit, uppercase hexadecimal number. Each bit has a qualification meaning as described in Table 13.

**Table 13. FLAG Bit Definitions**

BIT POSITION	HEX BIT MASK	QUALIFICATION MEANING	DATA ERROR STRING
0	01	Minimum baseline error	BCLIP
1	02	Overrange error	OVR
2	04	Pulse sampled data	(none)
3	08	Negative power	(none)
6	40	Measurement is sped up	(none)
7	80	Sample included in TREND	(none)

Unspecified bits are reserved and will be 0.

The appropriate data error string indicated above will replace the PRI measurement value if a data record is generated with a data error. In situations where more than one flag condition is set, the lowest bit position condition will be indicated in the PRI measurement value.



As an example, indicating to send PRI and FLAG, the host interface could send the following data records:

PRI=1.449E-03,FLAG=00 (*this record shows a data value of 1.449 mJ and no flag bits set*)

PRI=OVR,FLAG=02 (*this record shows an invalid data value with the overrange bit set*)

### Statistics Data Record Format

If statistics mode is active, the following data is available in a single data record at the completion of collection of a batch:

- AVG (mean of all pulses in batch, formatted as %.4E for all sensor types)
- DEV (standard deviation of the batch, formatted as %.3E)
- MIN (minimum measurement of the batch)
- MAX (maximum measurement of the batch, formatted as %.4E for all sensor types)
- SEQ (batch sequence number, incremented once for each new set of batch results and formatted as a decimal integer)

The delivery of these data records may be configured as a buffered stream of batch results or simply the last batch result recorded see “Continuous Data Delivery Mode” on page 140).

The host may configure Data ID tags to be prepended to each data value in a record (see “Sample Data Value Set Send” on page 137 and “Data Value Headers” on page 139).

The presentation of the data items in a statistics data record is fixed in the following order: AVG, DEV, MIN, MAX, DOSE, MISSED, SEQ.

The labels in the former list will also serve as data header strings (see “Data Value Headers” on page 139).

If an error (Over range, Baseline clip, etc.) occurs while a batch measurement sample is being taken, the batch may not be valid. This situation is indicated by a returned average value of 9.99E99.

### Data Value Headers

This command selects whether or not data value identification strings will prefix data values reported over the host interface. Headers are in the form of “<header>=<value>”. The <header> is literally one of the ID tag strings used in the data value send command.

Command: CONFigure:READings:HEADers  
{DEFAult|ON|OFF}  
Default: OFF

Query: CONFigure:READings:HEADers?  
Reply: ON|OFF

For example, if headers is ON, a data record could look like “PRI=1.449E-03”. If headers is OFF, a data record could look like “1.449E-03”.

### Continuous Data Delivery Mode

This command will select if measurement sample data records and statistical data records are buffered as a continuous stream of sampled data records or simply the last available data record. When this mode is set to LAST, each data record placed into the buffer will overwrite the previous data record.



---

**If this command is issued while data collection is enabled, the setting will not take effect until data collection mode is ABORTed and INITiated again (see “Data Gating” on page 141).**

---

Command: CONFigure:READings:CONTInuous  
{DEFAult|LAST|STREAm}  
Default: LAST

Query: CONFigure:READings:CONTInuous?  
Reply: LAST|STREAm

### Numeric Display Resolution

Front panel numeric display resolution is configurable from among the following set of display digit counts: 3, 4, and 5.

#### Thermopile

This command sets the number of display digits used when a thermopile sensor is attached.

Command: CONFigure:RESolution:THERmopile  
{DEFAult|3|4|5}  
Default: 3

Query: CONFigure:RESolution:THERmopile?  
Reply: 3|4|5

## Optical

This command sets the number of display digits used when an optical sensor is attached.

Command: CONFigure:RESolution:OPTical

{DEFault|3|4|5}

Default: 3

Query: CONFigure:RESolution:OPTical?

Reply: 3|4|5

## Sample Measurement Data Collection

Measurement data records is placed in the measurement data transmission queue as the meter generates measurement data while data collection is enabled. The queue storage capacity is 200,000 records. A missing data count increments by one for every data record that is generated but not added to the queue due to a full queue condition.

## Data Gating

The host has control over when measurement data is queued for reading from the host interface. Data collection is enabled and disabled using the INITiate and ABORt commands, respectively. Data collection is enabled after an INITiate command. Data collection is disabled after an ABORt command. Measurement data records are queued for transmission as the meter generates measurement data while data collection is enabled.




---

**For more information, refer to “Continuous Data Delivery Mode” on page 140.**

---

The host gating commands does not affect front panel operation.

### Initiate Command

This command enables measurement data collection. It automatically resets the measurement data buffer to empty and clears the missing data count. This command is ignored if data collection is enabled.

Command: INITiate

Query: none

### Abort Command

This command disables measurement data collection. This command is ignored if data collection is disabled.

Command: ABORt

Query: none

## Data Query

The host must query for measurement data in two steps. First, query for the number of data records available (N) and second, query N times for the data records (see “Measurement Data Format” on page 135).

Data record queries are destructive reads. The data record count decrements by one automatically as the host reads each data record.

### Fetch Available Record Count

This query gets the number of unread data records available at the time of the query.

Command: none

Query: FETCh:NRECORDs?

Reply: <count of records available>

### Fetch Next Available Record(s)

The query gets the next unread available measurement data record(s) at the time of the query. More than one data record may be queried using the optional <record count> parameter, which must be an integer value. If <record count> is not specified, a single data record is returned. No reply is transmitted if there are no measurement data records available.

Command: none

Query: FETCh:NEXT? [<record count>]

Default: not applicable

Reply: <next available record(s)>

### Fetch All Available Records

This query gets all unread available measurement data records at the time of the query. No reply is transmitted if there are no measurement data records available.

Command: none

Query: FETCh:ALL?

Reply: <all available records>

### Fetch Missing Data Count

This query gets the missing data count due to a measurement data transmission queue full condition.

Command: none

Query: FETCh:MISSing?

Reply: <integer count of missing data records>

## Statistics Data Collection

### Statistics Data Gating

The host has control over when statistics data is queued for reading from the host interface. Statistical data collection is available only when statistics is active on the meter, at which time statistics data collection can be enabled or disabled using the STATistics:INITiate and STATistics:ABORt commands, respectively. Data collection is enabled after a STATistics:INITiate command. Data collection is disabled after a STATistics:ABORt command. Statistical data records are queued for transmission as the meter generates statistics data while statistics is active and data collection is enabled.




---

**For more information, refer to “Continuous Data Delivery Mode” on page 140.**

---

The host gating commands do not affect front panel operation.

### Statistics Initiate Command

This command enables statistical data collection. It automatically resets the statistics data buffer to empty and clears the missing data count. This command is ignored if statistics data collection is already enabled. Note that this command only enables queuing of statistical results for transmission to the host; it does not enable statistics mode on the meter.

Command: STATistics:INITiate

Query: none

### Statistics Abort Command

This command disables statistics data collection. This command is ignored if statistics data collection is disabled. Note that this command disables queuing of statistical results for transmission to the host; it does not disable statistics mode on the meter.

Command: STATistics:ABORt

Query: none

## Statistics Data Query

The host must query for statistics data in two steps. First, query for the number of statistics data records available (N) and second, query N statistics data records. See “Statistics Data Record Format” on page 139 for detailed information on the definition of statistics data records.

Statistics data record queries are destructive reads. The statistics data record count automatically decrements by one as the host reads each data record.

### Fetch Available Statistics Record Count

This query gets the number of unread statistics data records available at the time of the query.

Command: none

Query: STATistics:FETCh:NRECORDs?

Reply: <count of records available>

### Fetch Next Available Statistics Record(s)

The query gets the next unread available statistics data record(s) at the time of the query. More than one data record may be queried using the optional <record count> parameter, which must be an integer value. If <record count> is not specified, a single statistics data record is returned. No reply is transmitted if there are no statistics data records available.

Command: none

Query: STATistics:FETCh:NEXT? [<record count>]

Reply: <next available record(s)>

### Fetch All Available Statistics Records

This query gets all unread available statistics data records at the time of the query. No reply is transmitted if there are no statistics data records available.

Command: none

Query: STATistics:FETCh:ALL?

Reply: <all available records>

### Fetch Missing Statistics Data Count

This query is the missing record count due to a statistics data transmission queue full condition.

Command: none

Query: STATistics:FETCh:MISSing?

Reply: <integer count of missing statistics records>

## Display

### Contrast

This command sets the display contrast between no contrast and maximum contrast as displayed. The parameter ranges in value from 0.00 to 1.00. 0.00 indicates no contrast and 1.00 indicates maximum contrast. On input the contrast value is rounded to two decimal places.

Command: DISPlay:CONTRast {DEFault|0.00..1.00}

Default: 0.50

Query: DISPlay:CONTRast?

Reply: <contrast value>

### Display Text

This command sets the display text in the measurement display area. When text is displayed through the host interface, it remains until it is cleared from the front panel, changed again from the host interface, or until a display clear (DISP:CLE) is sent. The string is displayed centered. Oversized strings are left and right truncated. All text within the quoted string is displayed.

The characters acceptable for the <quoted display text> are from the set of all 7-bit ASCII characters, starting with and including the space character (20 hex), and up to and including the tilde character (7E hex), except for the double quote character (22 hex). The double quote character is reserved to close the quote of the <quoted display text>. Any characters that follow the closing double quote are not displayed and are discarded.

Command: DISPlay:TEXT <quoted display text>

Query: none

### Text Clear

This command clears the display text and enables measurement data to be displayed live. This command should also be used to clear dismissible error displays on the LCD.

Command: DISPlay:CLEar

Query: none

## Meter and Sensor Device Information

The meter and any compatible sensors can be queried for device information for the purposes of unit identification and quality control.

## Meter

### Date and Time

#### Current Time

The command sets the time maintained within the meter. The query gets the time maintained within the meter.

Command: SYSTem:TIME <hour>,<minute>,<second>

Default: not applicable.

Query: SYSTem:TIME?

Reply: <hour>,<minute>,<second>

<hour> ranges from 0 to 23. <minute> ranges from 0 to 59.  
<second> ranges from 0 to 59.

#### Current Date

The command sets the date maintained within the meter. The query gets the date maintained within the meter.

Command: SYSTem:DATE <year>,<month>,<day>

Default: not applicable.

Query: SYSTem:DATE?

Reply: <year>,<month>,<day>

<year> is indicated by the four-digit year number. <month> ranges from 1 to 12. <day> ranges from 1 to 31.

#### Date Format

This command sets the panel display date format used by the meter.

Command: SYSTem:DATE:FORMat

{DEFault|MDY|DMY}

Default: MDY

Query: SYSTem:DATE:FORMat?

Reply: MDY|DMY

MDY indicates month-day-year format. DMY indicates day-month-year format.

### Serial Number

This query gets the meter serial number.

Command: none

Query: SYSTem:INFormation:INSTrument:SNUMber?

Reply: <quoted meter serial number>

### Calibration Date

This query gets the calibration date of the meter.



Command: none

Query: SYSTem:INFormation:INSTrument:CDATe?

Reply: <quoted meter calibration date>

## **Sensor**

### **Type**

This query gets the currently-connected sensor type.

Command: none

Query: SYSTem:INFormation:PROBe:TYPE?

Reply: <type>,<qualifier>

<type> is one of NONE, THERMO, or OPT.

<qualifier> is one of NONE, SINGLE, QUAD, or NOSPEC.

NONE,NONE is returned when a valid sensor is not attached. THERMO,QUAD or THERMO,SINGLE is returned when a valid thermopile sensor is attached. OPT,NOSPEC is returned when a valid optical sensor is attached.

### **Model**

This query gets the currently-connected sensor model.

Command: none

Query: SYSTem:INFormation:PROBe:MODEl?

Reply: <probe model string>

The sensor model string is the name string of the attached sensor. The sensor model string is the generic name of the attached sensor if the string does not exist. The reply string is not quoted.

The following naming rules apply in order:

1. An empty string if a valid sensor is not attached
2. The sensor model string stored within the sensor EEPROM, if a sensor model string exists
3. "LM" if a valid LM style sensor is attached and a sensor model string does not exist
4. "PM" if a valid PM-style sensor is attached and a sensor model string does not exist
5. "Unknown" in all other cases

### **Serial Number**

This query gets the serial number of the sensor.

Command: none

Query: SYSTem:INFormation:PROBe:SNUMber?

Reply: <sensor serial number>

An empty string is returned if a valid sensor is not attached.

### **Responsivity**

This query gets the currently-connected sensor calibration responsivity. Responsivity units depend on the sensor type.

Query: SYSTem:INFormation:PROBe:RESPonsivity?

Reply: <responsivity>

0.0 is returned if a valid sensor is not attached.

### **Calibration Date**

This query gets the calibration date of the sensor.

Command: none

Query: SYSTem:INFormation:PROBe:CDATE?

Reply: <probe calibration date>

The date is expressed using the ASCII string format of “<3 character month name> <day of the month> <year>”. An empty string is returned if a valid sensor is not attached.

### **Head Temperature**

This query gets the head temperature of the sensor.

Command: none

Query: SYSTem:INFormation:PROBe:TEMPerature?

Reply: <sensor head temperature in degrees Celsius in integer format>

The literal string “NA” (quotes not included) is returned if a valid sensor is not attached or the attached sensor does not have a temperature measurement device.

### **Diameter**

This query gets the sensor diameter.

Command: none

Query: SYSTem:INFormation:PROBe:DIAMeter?

Reply: <probe diameter in mm>

The literal string "NA" (quotes not included) is returned if a valid sensor is not attached or the attached sensor diameter value is not known.

## Host Interface Glossary

**Power off/on cycle** - The action of turning off the meter using the panel Power button and then turning it back on again using the same button. The state of the meter electronics is sleep mode at a significantly reduced level of power consumption between the power off and power on events. The power off/on cycle transitions across this sleep mode.

**Valid probe** - A sensor attached to the meter with all of the following characteristics:

- Either a fully-functional Molelectron PowerMAX sensor, Molelectron SmartProbe, or Coherent LM sensor all having an EEPROM for sensor calibration data storage
- Valid EEPROM checksum(s) that validates the data stored within

**Front panel idle period** - The period of time during which neither front panel button press/release events or data wheel movement events have happened. The following events are not included as events that will end a front panel idle period:

- Sensor attach and remove events
- USB flash drive attach and remove events
- Host port cable attach and remove events
- Host interface commands and queries
- Any data measurement events

**Dose** - The sum of pulse energies of all pulses contained within a batch of pulses.

**Minimum baseline error** - A pulse measurement error condition during which the meter and sensor system is in a state which is driving the analog-to-digital converter to a voltage less than it can measure. Also known as *baseline clipping error*.

**Baseline clipping error** - See *Minimum baseline error*.

**Overrange error** - A measurement error condition during which the measurement exceeds the full scale range setting.

**Pulse sampling** - A measurement situation in which pulse energy measurements are subsampled (every Nth pulse,  $N > 1$ ) due to meter pulse processing capacity limits.

**Sequence ID** - The identification number used to synchronize data from multiple meters that share the same trigger signal. The sequence ID increments by one and accompanies each measurement data record transmitted. It is unique in a stream of data transmissions until it wraps around from 2147483647 to 0 or until it is set by the TRIG:SEQ command.

**Ignored command /query** - A defined meter response for commands or queries in which no internal or external action is taken and the command or query is dropped. The meter responds to ignored commands/queries as if the command/query was never sent.

**Directory** - The pathname component of the fully qualified filename. For example, “greenbuster” is one of three directories in the fully qualified filename “usb:\data\greenbuster\config\file.txt”. The other directories are “data” and “config”.

**Dirty batch** - A batch that contains indeterminate data. Indeterminate data is characterized as having errors associated with it (for example: overranged, baseline clipped, or missing data). Batch results from a dirty batch cannot be computed due to the indeterminate data it contains.

# **CALIBRATION AND WARRANTY**

This section discusses:

- Calibration (this page)
- Coherent calibration facilities and capabilities (this page)
- Limited warranty (page 152)
- Extended lifetime warranty (page 152)
- Warranty limitations (page 153)
- Obtaining service (page 153)
- Product shipping instructions (page 154)

## **Calibration**

Coherent laser power and energy meters are precision instruments, capable of delivering very accurate measurements, as well as providing many years of useful service. To maintain this high level of performance, it is important to have your measurement system serviced and recalibrated once a year.

## **Coherent Calibration Facilities and Capabilities**

As the largest laser manufacturer in the world, Coherent has been able to build state-of-the-art calibration facilities containing the widest possible range of laser types and technologies. This enables us to perform instrument and sensor calibration under virtually any combination of wavelength, power, and operating characteristics. Sensors are calibrated against NIST-traceable working standard sensors which are, in turn, calibrated against NIST-calibrated golden standard sensors. These working and golden standards are maintained with the utmost care, recalibrated annually, and verified even more regularly. We maintain multiple NIST-calibrated standards at many laser wavelengths to support the growing calibration needs of our customers. Optical calibration is a core competency at Coherent and we strive to continually improve our methods, precision, and repeatability. Additionally, most of the calibrations are performed with highly automated systems, thus reducing the possibility of human error to nearly zero. Strict quality inspections during many stages of calibration and testing assure a precise and accurate instrument that is NIST traceable and CE marked. The benefit to our customers is that instruments calibrated by Coherent will consis-

tently perform as expected under their actual use conditions. We are a registered ISO 9001:2000 company, our products are NIST traceable, and our calibration labs are fully ANSI Z540 compliant.

In addition to the technological advantage, we also strive to deliver the best service in the industry, with a knowledgeable and responsive staff, and rapid turnaround.

## **Limited Warranty**

Coherent, Inc. (the “Company”) warrants its laser power and energy meters and sensors products (“Products”) to the original purchaser (the “Customer”) that the product is free from defects in materials and workmanship and complies with all specifications, active at the time of purchase, for a period of twelve (12) months.

Coherent, Inc. will, at its option, repair or replace any product or component found to be defective during the warranty period. This warranty applies only to the original purchaser and is not transferable.

## **Extended Lifetime Warranty**

Coherent, Inc. (the “Company”) offers original purchasers (the “Customer”) purchasing laser power and energy meters and sensors products (“Products”) an extended, lifetime warranty program, which includes all parts and labor. In order to qualify for this warranty, a Customer must return the Product to the Company for recalibration and recertification (traceable to NIST and MIL-STD-45662A) within one year from the date of purchase, and annually thereafter. The Company will recertify the Product, provide software upgrades, and perform any needed repairs, for a fixed service fee (as established by the Company from time to time and in effect at the time of service).

If the Product fails and is returned to the Company within one year following the date of recalibration service, the Company will, at its option, repair or replace the Product or any component found to be defective. This warranty applies only to the original purchaser and is not transferable.

If the Product is not returned for recalibration or service prior to the one-year anniversary, the lifetime warranty program expires. The lifetime warranty program may be reinstated, at Coherent's option, after completion of a fee-based product evaluation and repair, and subsequent recalibration and recertification service.

## **Warranty Limitations**

The foregoing warranties shall not apply, and Coherent reserves the right to refuse warranty service, should malfunction or failure result from:

- Damage caused by improper installation, handling, or use.
- Laser damage (including sensor elements damaged beyond repair).
- Failure to follow recommended maintenance procedures.
- Unauthorized product modification or repair.
- Operation outside the environmental specifications of the product.

Coherent assumes no liability for Customer-supplied material returned with Products for warranty service or recalibration.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, OR IMPLIED. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS PRODUCTS.

## **Obtaining Service**

In order to obtain service under this warranty, Customer must notify the Company of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Company shall, in its sole discretion, determine whether to perform warranty service at the Customer's facility, at the Company's facility or at an authorized repair station.

If Customer is directed by the Company to ship the product to the Company or a repair station, Customer shall package the product (to protect from damage during shipping) and ship it to the address specified by the Company, shipping prepaid. The customer shall pay the cost of shipping the Product back to the Customer in conjunction with annual recalibration and repair; the Company shall pay the cost of shipping the Product back to the Customer in conjunction with product failures within the first twelve months of time of sale or between annual recalibrations.

A Returned Material Authorization number (RMA) assigned by the Company must be included on the outside of all shipping packages and containers. Items returned without an RMA number are subject to return to the sender.

For the latest Customer Service information, refer to our website:  
[www.Coherent.com](http://www.Coherent.com).

Detailed instructions on how to prepare a product for shipping are given under “Product Shipping Instructions,” below.

**Table 14. Coherent Service Centers**

LOCATION	PHONE	FAX	E-MAIL
USA	1.800.343.4912	971.327.2778	info_service@Coherent.com
Europe	+49 (6071) 9680	971.327.2778	info_service@Coherent.com
International	971.327.2700	971.327.2778	info_service@Coherent.com

## **Product Shipping Instructions**

To prepare the product for shipping to Coherent:

1. Contact Coherent Customer Service (refer to Table 14, above) for a Return Material Authorization number.
2. Attach a tag to the product that includes the name and address of the owner, the person to contact, the serial number, and the RMA number you received from Coherent Customer Service.
3. Wrap the product with polyethylene sheeting or equivalent material.
4. If the original packing material and carton are not available, obtain a corrugated cardboard shipping carton with inside dimensions that are at least 6 in. (15 cm) taller, wider, and deeper than the product. The shipping carton must be constructed of cardboard with a minimum of 375 lb. (170 kg) test strength. Cushion the instrument in the shipping carton with packing material or urethane foam on all sides between the carton and the product. Allow 3 in. (7.5 cm) on all sides, top, and bottom.
5. Seal the shipping carton with shipping tape or an industrial stapler.
6. Ship the product to:

Coherent, Inc.  
7470 SW Bridgeport Rd.  
Portland, OR 97224  
Attn: RMA # (add the RMA number you received from  
Coherent Customer Service)



# APPENDIX A: SPECIFICATIONS

This appendix lists specifications for the LabMax meter.

**Table 15. Specifications<sup>A</sup> (Sheet 1 of 2)**

PARAMETER	DESCRIPTION
Maximum Sensor Input Thermopile Sensors (LM models) Thermopile Sensors (PM models) Optical Sensors	2V 2V 20 mA
Minimum Sensor Input Thermopile Sensors (LM models) Thermopile Sensors (PM models) Optical Sensors	50 $\mu$ V 20 $\mu$ V 1 nA
Noise Thermopile Sensors (LM models) Thermopile Sensors (PM models) Optical Sensors	1.2 $\mu$ V 500 nV 4.6 pA
Measurement Resolution (% of full scale)	0.1 <sup>B</sup>
Positional Resolution (mm)	0.1
Repetition Rate Error	< 1%
Maximum Repetition Rate (Hz)	10,000 sampling (1,000 Hz every pulse)
Pulse Triggering	Internal and external (selectable)
External Trigger Pulse Width	1.3 $\mu$ S (min.)
External Trigger Pulse Amplitude	2 to 7V
Power Sampling Rate (Hz)	10
Uncertainty Instrument System Analog Out	$\pm$ 1% of reading meter + sensor $\pm$ 2%
Display	112 x 78 mm backlight graphic LCD 480 x 320 pixels Adjustable contrast and viewing angle

**Table 15. Specifications<sup>A</sup> (Sheet 2 of 2)**

Measurement Analysis	Min., max., mean, range, standard deviation, energy dose, and stability Trend charting, tuning, positional display, and analysis of beam stability
Computer Interface	USB, RS-232
Analog Output (VDC)	0 to 1, 2, or 4 VDC (selectable)
Analog Output Update Rate	10 Hz
Instrument AC Power Adapter (incl.)	100 to 240 VAC, 50/60 Hz Output: + 12 VDC (center-positive), 1.25A, 15W (max.)
Instrument Batteries	4400 mAH Li-ion battery (included) 8800 mAH Li-ion battery (optional)
Battery Life 4400 mAH  8800 mAH	8 hr., backlight off 7 hr., backlight on  16 hr., backlight off 14 hr., backlight on
Temperature Operating Storage	5 to 40°C (41 to 104°F) -20 to 70°C (-4 to 158°F)
Regulations Met Instrument AC Adapter and Cord	CE, RoHS, WEEE PSE and UL
Size (H x W x D)	152 x 229 x 53 mm (6.0 x 9.0 x 2.1 in.)
Weight (including 4400 mAH battery)	1.04 kg (2.3 lb.)
LabMax-TO Meter Part Number	1104619

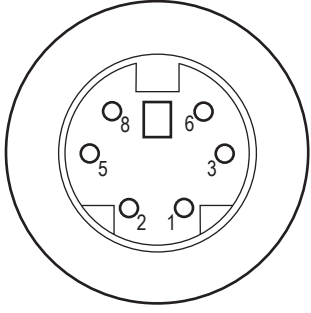
A. Meter supplied with 4400 mAH Li-ion battery, AC power adapter, power cord, 6-ft. USB cable, RS-232 adapter, 256 MB USB flash drive, three RCA-to-BNC adapters, user manual, software and driver CD, soft carrying case, and certificate of calibration.

B. User-selectable display resolution (3, 4, or 5 digits).

**RS-232 Pinouts**

Table 16 shows the LabMax RS-232 connector pinouts.

**Table 16. RS-232 Pinouts**

PIN	ASSIGNMENT	
1	GND	
2	Receive (from computer to LabMax)	
3	Transmit (from LabMax to computer)	
5		
6		
8		

**Persistent Parameters**

Table 17 lists the LabMax persistent parameters.

**Table 17. Persistent Parameters (Sheet 1 of 3)**

PARAMETER DESCRIPTION	DATA ARGUMENT RANGE	FACTORY DEFAULT
Backlight auto off time under AC power	OFF   1..60	OFF
Backlight auto off time under battery power	OFF   1..60	OFF
Meter power auto off time	OFF   1..60	OFF
Selected host interface *	RS232   USB	USB
Host serial port baud rate *	9600   19200   38400   57600   115200	19200
Host serial port parity *	Even   Odd   None	N
Host serial port stop bits *	1   2	1
Host serial port data pacing *	XON   None	None
Display date format	MDY   DMY	MDY
Measurement mode	W	W
Display power units	W   DBM	W
Display mode	Pri   Stat   Pstab   Tune   Trend	Pri
Display sub mode for statistics	Numbers	Numbers

**Table 17. Persistent Parameters (Sheet 2 of 3)**

<b>PARAMETER DESCRIPTION</b>	<b>DATA ARGUMENT RANGE</b>	<b>FACTORY DEFAULT</b>
Display sub mode for trend	Chart	Chart
Display view mode for position stability	Scroll   Fit-to-screen	Scroll
Display view mode for tune	Strip-chart   Bar-chart	Strip-chart
Display view mode for trend	Scroll   Fit-to-screen	Scroll
Area correction state	ON   OFF	OFF
Area correction aperture	0.01..500.00	1.0
Analog output full scale voltage	1   2   5	2
Speedup applied to host data store	OFF   ON	ON
Speedup applied to analog output	OFF   ON	ON
Speedup applied to measure display	OFF   ON	ON
Speedup applied to tune display	OFF   ON	ON
Numeric display smoothing window size for pulses	OFF   AUTO   2..999	AUTO
Numeric display smoothing window size for time	OFF   AUTO   1..60	AUTO
Wavelength correction state *	OFF   ON	ON
Wavelength of operation *	1..99999	193
Wavelength selection list *	Comma-separated list of wavelengths ranging from 1 to 99999 nm	193, 248, 266, 337, 532, 1064, 2100, 10600
Gain compensation state	OFF   ON	OFF
Gain compensation factor	0.001..100000.0	1.0
Selected range	The maximum measurement expected	3.0
Auto ranging state	ON   OFF	ON
Statistics mode display output selection	Comma-separated list of Mean, Min, Max, Stdv, 1sig, 2sig, 3sig, Range, Dose, Missed	Mean, Min, Max, Stdv
Statistics mode batch size for pulses	2..99999	10
Statistics mode batch size for time	00:00:01..24:00:00	00:00:10
Statistics mode sample rate for pulses	1..99999	1
Statistics mode sample rate for time	1.157E-5..1.0E1	1.0
Statistics mode restart mode	Manual   Automatic	Manual

**Table 17. Persistent Parameters (Sheet 3 of 3)**

PARAMETER DESCRIPTION	DATA ARGUMENT RANGE	FACTORY DEFAULT
Position stability mode duration	00:00:01..24:00:00	00:01:00
Tune mode strip chart view vertical zoom level	AUTO   1   2   5   10   20	AUTO
Tune mode strip chart view horizontal zoom level	1   2   5   10   20	1
Tune mode bar chart view zoom level	1   2   5   10   20	1
Trend mode scroll view vertical zoom level	1   2   5   10   20	1
Trend mode batch size for pulses	2..99999	10
Trend mode batch size for time	00:00:01..24:00:00	00:00:10
Trend mode sample rate for pulses	1..99999	1
Trend mode sample rate for time	1.157E-5..1.0E1	1.0
Numeric display resolution for thermopile sensors	3   4   5	3
Numeric display resolution for optical sensors	3   4   5	3
Trigger source	Internal   External	Internal
Trigger level	2..20	5
Trigger slope	Positive   Negative	Positive
Trigger delay	0..1000	0
Trigger bus direction	Host   Guest   Independent	Independent
Display contrast	0.0..1.0	0.5

\* = parameter is not included when restoring the configuration from the last sensor used



## APPENDIX B: ERRORS

### Measurement Errors

WHEN THE METER DETECTS:	MEASUREMENT VALUES ARE REPLACED BY:
An overrange condition	OVER RANGE
A sensor saturation condition (optical sensor only)	SATURATED

Pressing the HELP button when an error is displayed will explain what caused the error and what to do about it.

### Meter and Sensor Errors

*Table 18. Meter and Sensor Errors (Sheet 1 of 2)*

SYMPTOM	CAUSE	CORRECTIVE ACTION
Searching for sensor	Sensor not connected	Connect a sensor to the meter
Sensor over temp	The sensor has overheated	Turn the laser off immediately and let the sensor cool down
NVRAM communication failure	A failure occurred while reading the internal EEPROM	Contact a Coherent Service Center
Sensor checksum error	The sensor internal EEPROM checksum check failed, causing the meter to give non-calibrated readings.	Contact a Coherent Service Center
Sensor communication failure	Sensor and/or meter communication has failed	Disconnect and reconnect the sensor. If problem persists, contact a Coherent Service Center.
Sensor/firmware mismatch	The meter does not recognize the EEPROM format of the sensor	Contact a Coherent Service Center for a firmware upgrade
Sensor NVRAM corrupt	The sensor EEPROM is corrupted	Contact a Coherent Service Center

**Table 18. Meter and Sensor Errors (Sheet 2 of 2)**

<b>SYMPTOM</b>	<b>CAUSE</b>	<b>CORRECTIVE ACTION</b>
Unrecognized sensor	The meter does not recognize this sensor	The sensor is either incompatible, or does not have a functioning EEPROM. If the problem persists, contact a Coherent Service Center.
Fatal initialization error		Contact a Coherent Service Center



## APPENDIX C: ONSCREEN INDICATORS

This section presents a summary of all the onscreen indicators.

**Table 19. Onscreen Indicators (Sheet 1 of 3)**

<b>Battery Life</b>	
Appears on:	All screens when meter is running on battery
Onscreen location:	Upper left corner
Onscreen label:	Icon
Range of values:	5 bars = 81 to 100% of remaining battery life 4 bars = 61 to 80% 3 bars = 41 to 60% 2 bars = 21 to 40% 1 bar = 11-20% 0 bars = 0 to 10%
Behavior:	Displays currently remaining battery life Updates as battery life decreases Blinks when remaining battery life is 10% or less
Edited in:	N/A
<b>Wavelength</b>	
Appears on:	All MEASURE screens
Onscreen location:	Lower left corner
Onscreen label:	Wavelength:
Range of values:	Sensor-dependent
Behavior:	Displays current value
Edited in:	SETUP
<b>Gain</b>	
Appears on:	All MEASURE screens
Onscreen location:	Lower left corner
Onscreen label:	Gain:
Range of values:	OFF, .001 to 999.999
Behavior:	Displays ON or OFF
Edited in:	SETUP
<b>Display Smoothing</b>	
Appears on:	All MEASURE screens
Onscreen location:	Lower right corner
Onscreen label:	Smoothing:
Range of values:	ON/OFF
Behavior:	Displays current value
Edited in:	SETUP

**Table 19. Onscreen Indicators (Sheet 2 of 3)**

<b>Bull's-Eye</b>	
Appears on:	MEASURE POWER
Onscreen location:	Upper right corner
Onscreen label:	Icon
Range of values:	Presence/absence of dot
Behavior:	N/A
Edited in:	N/A
<b>Elapsed</b>	
Appears on:	STATS
Onscreen location:	Upper right corner
Onscreen label:	Elapsed:
Range of values:	N/A
Behavior:	Starts at 0 Begins countup when you press START
Edited in:	STATS & TREND: Setup
<b>Duration</b>	
Appears on:	STATS
Onscreen location:	Upper right corner, below "Elapsed:"
Onscreen label:	Batch:
Range of values:	N/A
Behavior:	Displays the value indicated in the STATS Setup screen
Edited in:	STATS & TREND: Setup
<b>Ready/Calculating for Thermopile Joules</b>	
Appears on:	MEASURE STATS TREND Whenever a thermopile is in use and Joules is selected
Onscreen location:	Upper left above measurement value but below stats and trend "Remaining:" indicator
Onscreen label:	READY CALCULATING
Range of values:	N/A
Behavior:	CALCULATING appears when a pulse is received and is replaced by READY when the measurement value appears
Edited in:	N/A

**Table 19. Onscreen Indicators (Sheet 3 of 3)**

<b>Old Data</b>	
Appears on:	MEASURE STATS TREND Whenever Joules is selected
Onscreen location:	Just to the upper right of the measurement value
Onscreen label:	OLD
Range of values:	N/A
Behavior:	Appears when the measurement value is stale Appears simultaneously with READY (for thermopile sensors) Edited in:N/A
<b>Zero for Optical Sensors</b>	
Appears on:	MEASURE screen when optical sensor is in use
Onscreen location:	Just to the upper right of the measurement value
Onscreen label:	ZERO
Range of values:	N/A
Behavior:	Appears when you press the ZERO button while using an optical sensor
Edited in:	N/A



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