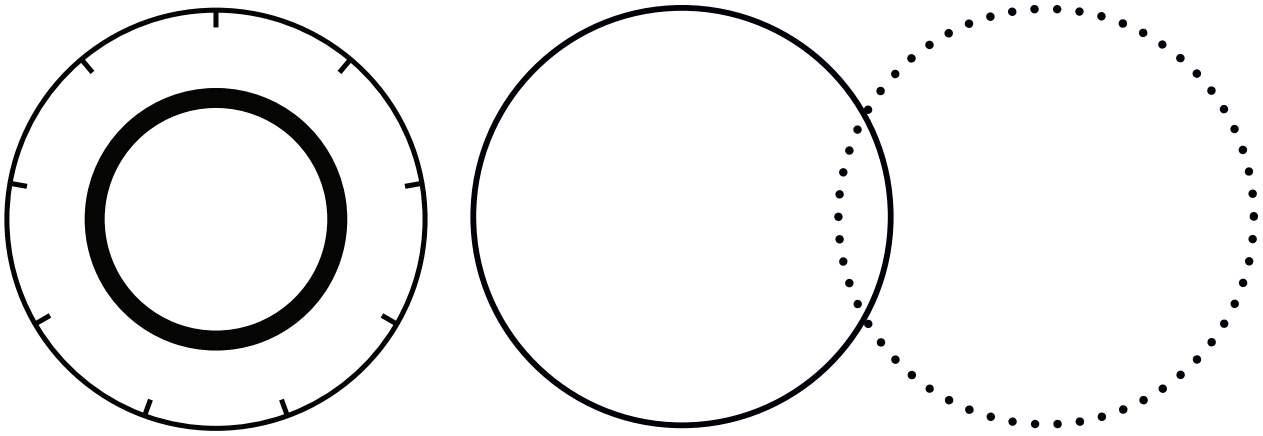
FieldMax Touch Meter

Operator’s Manual



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FieldMax Touch/Touch Pro Meter™

Operator's Manual

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1 Introduction

This *Operator's Manual* introduces the FieldMax Touch Meter.

1.1 Signal Words and Symbols

This section provides information about signal words and safety symbols that you need to know before you begin.

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

Anyone using the FieldMax Touch Meter with lasers, meters, and sensors must first read and understand how safety information is presented prior to beginning any tasks.



NOTICE
User information reported in this manual is in compliance with the following standards for Light-Emitting Products EN/IEC 60825-1 *"Safety of laser products – Part 1: Equipment classification and requirements"* 21 CFR Title 21 Chapter 1, Sub-chapter J, Part 1040 *"Performance standards for light-emitting products"*.

1.1.1 Signal Words

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

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

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

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

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

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

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

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

1.1.2 Symbols

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



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



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



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



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



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



This symbol is intended to alert the operator to the danger of crushing injury.



This symbol is intended to alert the operator to the danger of a lifting hazard.

1.2 Preface

This manual contains user information for the product.



NOTICE

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



DANGER!

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

1.3 Export Control Laws and Compliance

It is the policy of Coherent® to comply strictly with export control laws of the United States of America (USA).

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 (ITAR).

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 laws in the USA, clarification must be obtained from Coherent or an appropriate agency of the U.S. Government.

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

Declaration of Conformity certificates are available upon request.

1.4 The Operator's Manual

This Operator Manual is designed to familiarize the user with the FieldMax Touch Meter and its designated use. It contains important information on how to install, operate, and troubleshoot the meter with a laser system safely, properly, and most efficiently. Observing these instructions helps to avoid danger, reduce repair costs, and downtimes and increase the reliability and lifetime of laser systems.

The screenshots in this manual are only examples and may show configurations or parameter settings which do not apply to the laser system. Changing parameter settings to correspond with screenshots may reduce laser performance or even damage the laser system!

---

2 Description and Specifications

2.1 Introduction

The Coherent FieldMax Touch Meters represent the latest generation of compact high-performance instrumentation for laser power and energy measurement. The meter is designed to support the most demanding measurement applications in the lab while also offering reliability in the field.

These meters provide full compatibility with the full Coherent catalog of laser power and energy sensors.

- The standard FieldMax Touch Meter samples up to 10 Hz with thermopile, optical and PowerMax-Pro sensors.
- The FieldMax Touch Pro Meter model adds support for Pyroelectric energy sensors, sampling with rep rate up to 1000 Hz. (The meter is not compatible with 10 kHz Coherent sensors.).

The touchscreen interface provides easy access to measurement data and analytics including live display, statistics, trending, tuning, and beam position information.

This chapter introduces the FieldMax Touch Meters, shown in Figure 2-1. It describes the components and features of the hardware and its connectivity, the dimensions and specifications.



Figure 2-1. FieldMax Touch Pro Meter

2.2 Features

The FieldMax Touch Meter offers several key features and performance factors:

- 1000 Hz maximum laser repetition rate or pulse rate, with pyroelectric sensors (FieldMax Touch Pro only)
- Sampling up to 10Hz with PowerMax-Pro thermoelectric sensors
- 5-inch capacitive touchscreen LCD with LED backlight and wide viewing angles
- USB 2.0 and Ethernet PC interfaces
- USB flash drive port
- Analog output and external trigger input
- Compatible with Coherent Meter Connection PC software
- Windows 10, 11 compatible (32-bit and 64-bit)
- ISO 17025 accredited

Other features of the FieldMax Touch Meter include:

- A rugged enclosure with an anti-slip grip and a removable screen protector flap
- A bumper on the edges of the case to provide shock/vibration protection
- A built-in heat sink for thermal protection

The remainder of this section provides a 'tour' of the FieldMax Touch Meter.

For information about Parts and Accessories - see 'Parts and Accessories' (p. 175)

Coherent Meter Connection PC Software and User Manuals are available for download from Coherent website: www.coherent.com/resources

2.2.1 Models Available

There are two models available for the FieldMax Touch Meter:

- **FieldMax Touch Pro Meter** — P/N 2339784
  - Supports EnergyMax Pyro sensors
  - Has external trigger input
  - Supports Alarms
  - Sampling of PowerMax-Pro measurement channel up to 10 Hz
- **FieldMax Touch Meter (standard model)** — P/N 2339785

Each meter is shipped with AC power adapter, power cord, USB cable, 3.5mm AUX to BNC Analog-output/Trigger-input cable and certificate of calibration.

The Cat5 Ethernet cable must be supplied by the customer.

2.2.2 Applications

The FieldMax Touch Meter supports numerous applications, including:

- R&D and Laboratory
- Scientific
- Industrial and Manufacturing Quality Assurance
- Field Service Diagnostics

2.2.3 Compatibility

The FieldMax Touch Meters are compatible with a variety of sensors.

The regular FieldMax Touch is a power-only meter compatible with power sensors including semiconductor, thermopile/calorimeter, and Power-Max-Pro sensors.

The FieldMax Touch Pro supports both power and energy measurement and adds compatibility with pyroelectric energy sensors.

Table 2-1 shows the compatible sensors and sample rates:

Table 2-1. Compatible Sensors

Type	Compatibility	Sample Rates
Pyroelectric	EnergyMax DB-25 **pyroelectric** sensors	• Repetition Rate: 1000 Hz • Every pulse
Thermopile	LabMax and PowerMax **thermopile** models (such as LabMax-10 and PowerMax-10)	• Supports quadrant beam position data when using LabMax-model thermo-piles • Sample Rate: 10 Hz
Transverse Thermoelectric	PowerMax-Pro **transverse** thermo-electric models	• Sample Rate: 10 Hz
Optical	LM-model and OP-model optical sensors (e.g. LM-2, OP-2)	• Sample Rate: 10 Hz

2.2.3.1 Shipped with the Meter

The FieldMax Touch Meter comes with the cables and accessories shown in Figure 2-2.



Figure 2-2. Shipped with the Meter

More details are given about these cables later in this section:

- USB A-to-USB B Mini cable (P/N 1108906)

- Trigger-Input and Analog Output cable (P/N 2237381)
- The Power Supply (P/N 1256370)
- Carrying Case

2.3 Product Description

The FieldMax Touch Meter can be viewed as follows:

- Front panel:
  - Functional control buttons
  - Display
- Back panel:
  - Battery
  - Meter stand
- Top of case — Communication and input/output ports
- Edge of case — Sensor port

2.3.1 Front Panel

The front panel of the FieldMax Touch Meter is shown in Figure 2-3:

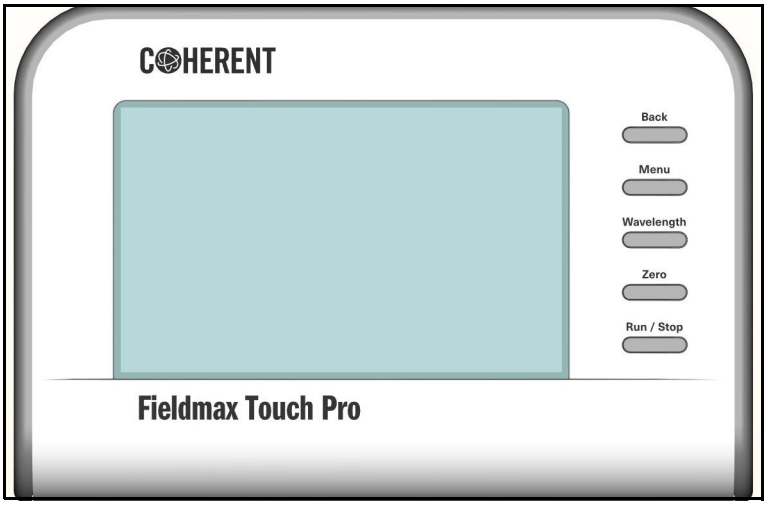

Figure 2-3. FieldMax Touch Meter – Front Panel

2.3.1.1 Functional Control Buttons

The functional buttons on the front panel of the case for the FieldMax Touch Meter are described in Table 2-2. Also see 'Touchscreen User Interface' (p. 39) for details about how the user interface changes when these buttons are pressed.

Table 2-2. Functional Buttons on the Case

Button	Description
Back	Provides a quick way to cancel an operation, close a window and return to the previous view without accepting any changes
Menu	Displays the top-level menu with icons for the different function windows on the touchscreen.
Wavelength	Displays the wavelength selection dialog.
Zero	Cancels out any measurement offset caused by stray light, temperature, or sensor variations.
Run/Stop	Press RUN to begin capturing data into the trend buffer. Press STOP to stop capturing data to the buffer.

2.3.1.2 LCD Display

The front panel includes a display touchscreen with the following features:

- 800 x 480 pixel color TFT LCD
- Active area 5-in. diagonal, capacitive touch-screen interface
- LED backlight level is user adjustable



CAUTION!
Take necessary precautions or shielding to protect the display from electrostatic discharge to prevent damage or degradation of performance.

See 'Touchscreen User Interface' (p. 39) for details about the layout and functions of the user interface.

2.3.1.3 Care and Handling of the Touchscreen

The display on the touchscreen is made of glass. Use normal precautions when handling. Do not drop or apply excessive force on the glass.

If the display becomes dirty or contaminated, gently wipe with a clean, dry, soft cloth that will not scratch the surface. If the display remains dirty or contaminated, moisten the cloth with a small amount of either isopropyl alcohol or ethyl alcohol. Using water or any solvent other than those can contaminate the display; in particular, do not use Ketone or any aromatic solvents.

When storing the FieldMax Touch Meter, do not leave in direct sunlight or prolong exposure to fluorescent lights.

2.3.2 Back Panel

The back of the FieldMax Touch Pro Meter is shown in Figure 2-4:

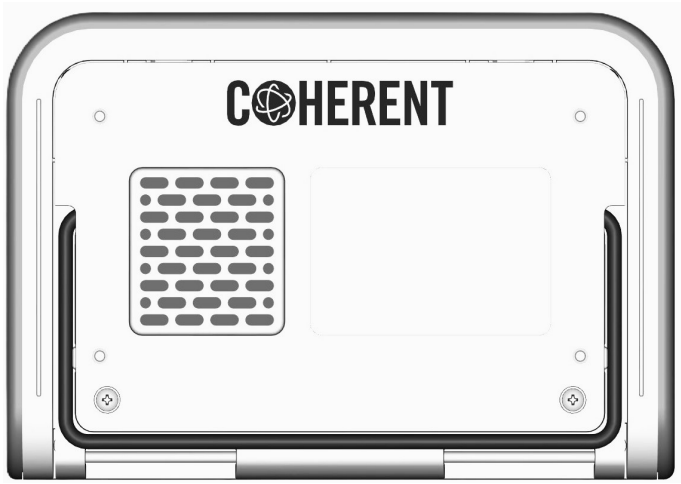

Figure 2-4. FieldMax Touch Meter – Back Panel

Note that there is a door over the battery compartment and air vents to provide thermal protection for the meter.



NOTICE

Do not block the air flow over the vents on the back panel. This results in overheating and can distort measurements!

2.3.2.1 Kickstand

The case for the FieldMax Touch Meter includes a kickstand that can be rotated and used to adjust viewing angles, as shown in Figure 2-5. It also includes a removable rubberized screen cover/flap.



Figure 2-5. Kickstand for the FieldMax Touch Meter

2.3.2.2 Battery

The battery in the FieldMax Touch Meter is shipped with at least an hour of battery life, depending on the amount of charge already in the battery, time held in stock, calibration time, and shipping time. Connecting power to the meter automatically begins to charge the battery; see 'Apply Power to the Meter' (p. 29).

The FieldMax Touch Meter includes a 7.4V 3000mAh Lithium Polymer battery, shown in Figure 2-6. It charges to full capacity while connected to power.



Figure 2-6. Lithium-poly Battery

The dimensions are shown in Figure 2-7:

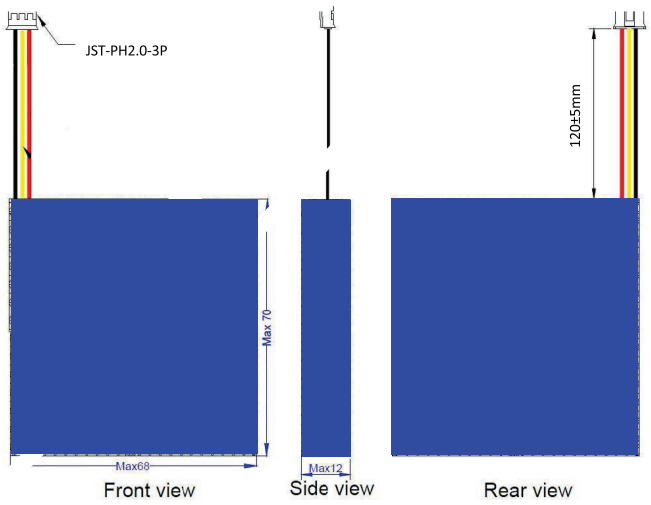

Figure 2-7. Battery Dimensions (mm)

The battery life depends on the brightness of the touchscreen. When the backlight brightness is set at the following levels, the battery charge time and discharge times are shown in the table.

Table 2-3. Battery Life

Condition	Charge Time (min)	Discharge Time (min)
Pyroelectric measurement, 70% brightness	90	215
Pyroelectric measurement, 100% brightness	100	167
Idle, 20% brightness	93	380

The time for operation between charges varies, as power consumption is dependent on what is in operation and if the unit is charging or not.

2.3.3 Side Panels and Ports

The left side panel of the FieldMax Touch Meter provides connectivity to a sensor. The left side panel is shown in Figure 2-8. The left side panel has no connectors.

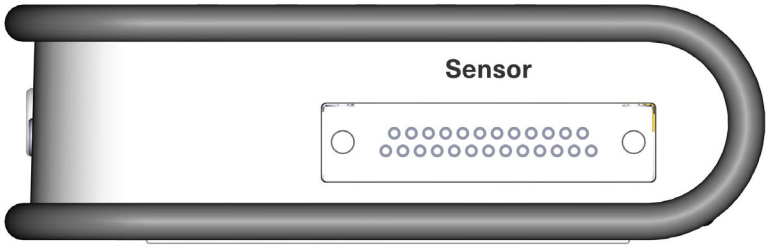

Figure 2-8. Connector Port – Side Panel

The DB25 connector on the side of the FieldMax Touch Meter is for connection to DB25 Coherent sensors and no other devices.

Triggering is done with either an external trigger input or a user-adjustable internal trigger. See 'Trigger States' (p. 83) for details.

There is also an internal trigger for pyroelectric sensors:

- 0 to 9.99% with 0.01% resolution
- 10 to 99.9% with 0.1% resolution
- Total range is 0 to 100%

The cable that can be used for trigger input or analog output is shown in Figure 2-9:



Figure 2-9. Trigger In/Analog Out Cable

2.3.3.1 Top Panel and Connectors

The connector ports on the top panel of the FieldMax Touch Meter are shown in Figure 2-10:

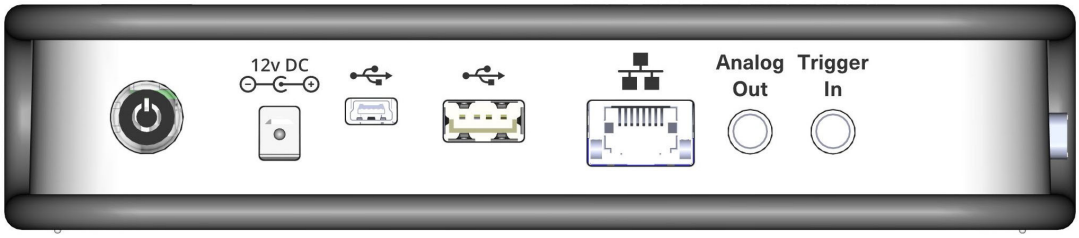

Figure 2-10. Connector Ports - Top

The various top panel connectors and interface are described in Table 2-4:

Table 2-4. Top Panel Interface Descriptions

Port	Notes
Power button	Toggles power ON and OFF. Displays when set to ON.
Power Supply Input	Connects a 12 VDC power supply (P/N 1256370).
Ethernet RJ-45	Allows remote access through a network.
USB 2.0 Mini-B	Miniature USB PC Interface port. Allows user to configure, send, and receive data for operation with the FieldMax Touch Meter.
USB 2.0 Type A	Allows access to an external USB flash drive for data logging or software upgrades. It can also be used to operate the meter with a computer mouse. Note that it is recommended that USB flash drive format is FAT32, for compatibility.
External Trigger Input Port	Trigger Input (3.5mm AUX Socket) TTL Compatible, 2-6 V @ 0.4 mA
Analog Output	0.02 to 1, 2, or 4 VDC (user selectable, 3.5mm AUX Socket) • 0.03% resolution • ±0.2% (of reading) ±0.3% (of full scale) accuracy • 50 ohms impedance

The Power button is located at the end of the connector panel on top of the meter. This button sets the meter ON and OFF, and displays in green when set to ON, as shown in Figure 2-11:



Figure 2-11. Power Button on the Meter

See 'Installation' (p. 25) for details about use of the Power button either with dedicated power (the power supply plugged in) with the battery.

2.3.3.2 Power and Status LED Indicator

The LED within the power button on the FieldMax Touch Meter displays the current status of the system and the battery.

There are three (3) colors that the Power button displays, depending on whether the device is powered on or off:

- **GREEN**: Power is ON (either from the battery or when plugged in).
- **BLUE**: The battery is fully charged and a power supply is attached.
- **RED**: Failed to charge or a fault condition exists.

Table 2-5 lists the different LED states:

Table 2-5. LED Status

LED	State	
	ON	OFF
Charging	Green	N/A
Fully Charged	Green	Blue
Fault Condition	Red	Red

One other cable that can be used with the FieldMax Touch Meter are customer supplied and not included with the product. Contact your local vendor to purchase.

- CAT5 Ethernet cable

See ’Parts and Accessories’ (p. 175) for additional information and part numbers for items associated with the FieldMax Touch Meter.

2.4 Dimensions

Both models of the FieldMax Touch Meter are the same size. The additional features and functions of the FieldMax Touch Pro Meter version are accessed through the software.

2.4.1 Front and Back Panel Dimensions

The dimensions for the front and back panels are shown in Figure 2-12:

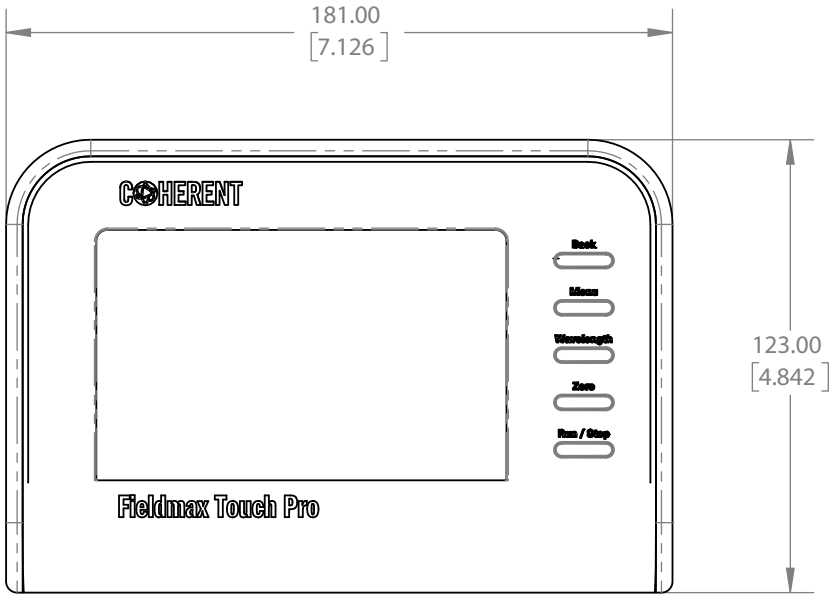

Figure 2-12. Dimensions — Front and Back Panel

2.4.2 Side Panel Dimensions

The dimensions for the side panels are shown in Figure 2-13, Values are in millimeters and inches (in brackets)

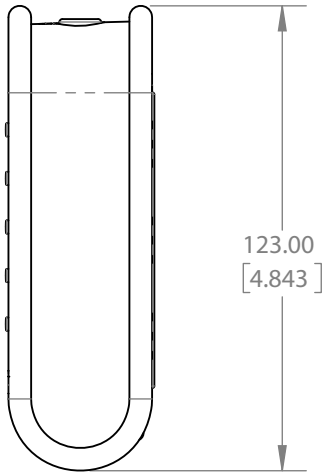

Figure 2-13. Dimensions — Side Panels

2.4.3 End Panel Dimensions

The dimensions for the end panels are shown in Figure 2-14. Values are in millimeters, and inches (in brackets)

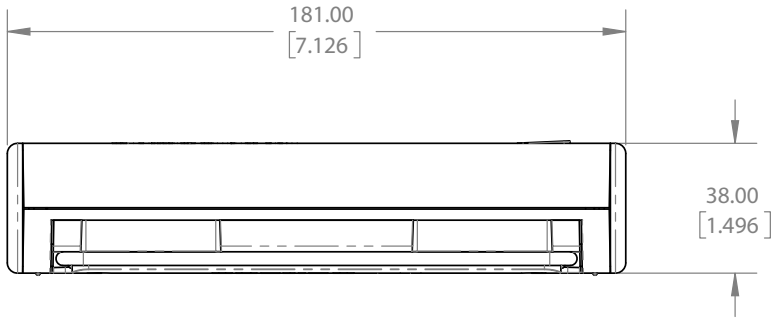

Figure 2-14. Dimensions — End Panels

2.5 Specifications

This section describes basic specifications for the FieldMax Touch Meter, including:

- Physical Characteristics
- Temperature and Humidity
- Measurement Ranges and Accuracy

For a complete list of technical specifications, refer to the FieldMax Touch / Touch Pro datasheet, available at:

www.coherent.com/resources.

2.5.1 Physical Characteristics

Table 2-6 shows the ranges and accuracy for measurements taken with the FieldMax Touch Meter.

Table 2-6. Physical Characteristics

Measurement	Notes
LCD Display	800 x 480 pixel color TFT LCD, 5-in. diagonal, capacitive touchscreen, LED backlight
Computer Interface	Ethernet, USB

Table 2-6. Physical Characteristics

Measurement	Notes
Dimensions	18.1 cm x 12.3 cm x 3.8 cm (7.13 in. x 4.85 in. x 1.5 inches)
Weight	771 g (1.70 lbs)
Compliance	CE, UKCA, RoHS, WEEE, ISO 17025 (refer to 'Compliance' (p. 187))

2.5.2 Temperature and Humidity

Table 2-7 shows the temperature and humidity ranges for operation and storage of the FieldMax Touch Meter.

Table 2-7. Temperature and Humidity

Operations	Temperature	Humidity
Battery Operating Temperature Range	0 to 40°C	0 to 95% RH, non-condensing
Power Adapter Operating Temperature Range	0 to 50°C	0 to 95% RH, non-condensing
Storage	-20 to 60°C	0 to 95% RH, non-condensing

2.5.3 Measurement Ranges and Accuracy

Table 2-8 shows the ranges and accuracy for measurements taken with the FieldMax Touch Meters.

Table 2-8. Measurement Ranges

Measurement	Values and Descriptions
Meter Accuracy	±1%
System Accuracy	Meter accuracy + sensor accuracy
Analog Output Accuracy	±0.2% (of reading) ±0.3% (of full scale)

Table 2-8. Measurement Ranges (Continued)

Measurement	Values and Descriptions
Analog Output Update Rate	FieldMax Touch Meter: 10 Hz FieldMax Touch Pro Meter: 500 Hz
Calibration Uncertainty	±1%
Measurement Resolution	0.1% of full-scale
Frequency Measurement	• 0-1000 Hz -0.1% Accuracy and 1 Hz resolution
Measurement Range	• 1 uW to 30 kW, with 100 nW resolution in the lowest range using corresponding thermopiles. • 100 pW to 5 W with 10 pW resolution in the lowest range using corresponding optical sensors. • 10 nJ to 100 J with 1 nJ resolution in the lowest range using corresponding pyroelectric detectors (FieldMax Touch Pro only). • 1 mW to 3 kW, with 100 µW resolution in the lowest range using corresponding transverse thermoelectric sensors
Measurement Analysis	FieldMax Touch Meter: Tuning, data logging to flash drive, statistics (min., max., mean, range, std. deviation) FieldMax Touch Pro Meter: FieldMax Touch features + pulse energy measurements to 1 kHz
Thermopile Channel Sampling Rate (Hz)	10 Hz
Optical Channel Sampling Rate (Hz)	10 Hz
Pyroelectric Chanel Laser Maximum Pulse Rate (Hz)	1,000 Hz (FieldMax Touch Pro only)
PowerMax Pro Channel Sampling Rate (Hz)	10 Hz
Analog Output (VDC)	0.02 to 1, 2, or 4 VDC (selectable)
Analog Output Resolution (mV)	0.1 mV

3 Installation

This section provides instructions about how to set up and connect the FieldMax Touch Meter. It also shows how to install the measurement software.

Optionally, to put the meter in a fixed location, the meter can be mounted on DIN rails; see 'Put Meter on a Mount' (p. 30).



CAUTION!
Before connecting devices, follow all laser safety procedures; see 'Safety' (p. 177). The laser must be blocked or switched OFF before starting any activity involving laser measurement.

3.1 Connect the Meter

Refer to 'Safety' (p. 177) for required safety precautions when using lasers.



CAUTION!
Take precautions to avoid Electrostatic Discharge (ESD) when setting up equipment.

To set up the FieldMax Touch Meter:

- Connect a sensor to the FieldMax Touch Meter
- (Optional) Connect the FieldMax Touch Meter to a PC
- Connect the power supply to the FieldMax Touch Meter
- Set the power to the meter to ON

Each of these steps are described in the subsections that follow.

3.1.1 Connect to a Sensor

To connect the meter to a sensor:

1. Rotate the cover flap away from the screen and set the meter up with the kickstand, as necessary.
2. Attach a Coherent sensor to the FieldMax Touch Meter with the DB-25 connector. Refer to Figure 3-2:



Figure 3-1. Connect the Meter to a Sensor

- If no sensor is present, then the default view will be the MAIN MENU view after power is applied to the meter.
- Any time the meter is set to ON and no sensor is detected, a warning message is displayed. See the section, 'Trouble-shooting' (p. 173), for information about errors displayed.
- If a sensor is connected, the meter defaults to the last mode used with that sensor type (thermopile, optical, pyroelectric,or PowerMax Pro). The modes used include MEASURE, TUNE, STATISTICS, and BEAM POSITION.

3. If there is not sufficient battery power, or as necessary, attach the external power supply to the sensor.



Figure 3-2. Meter Connected to a Sensor and Power Supply

Wavelength settings persist rather than being changed when a new sensor is attached. If the wavelength is out of range, it will switch to the calibration wavelength for that sensor.

3.1.2 External Input Device

A mouse can be used to change the controls, when connected to the USB connector. A left-click becomes the new finger touch. A right-click opens a pop-up menu that has five buttons. Refer to Figure 3-3. The on-screen buttons provide the same functions as the actual physical buttons on the meter.

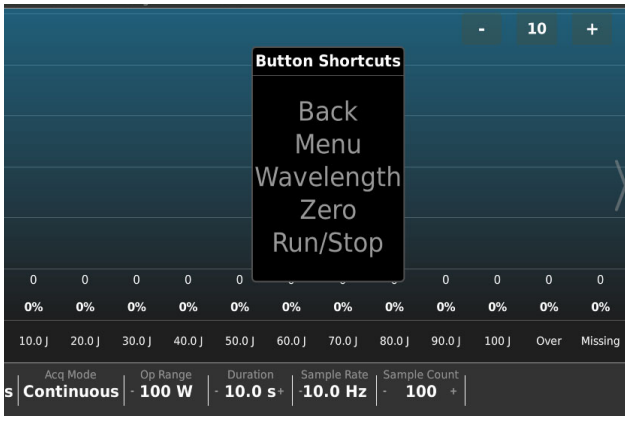

Figure 3-3. Use Mouse for Button Controls

3.1.3 Connect to a PC

To use remote commands with the FieldMax Touch Meter, connect the meter to a personal computer (PC) or laptop. This is an optional step when using host commands. Remote communications must be enabled on the meter. Refer to 'Bottom Main Window Information Bar' (p. 42).



NOTICE

When connecting the FieldMax Touch Meter to a PC, wait to apply power to the meter.

1. Attach a USB 2.0 cable from the meter's high-speed mini-B port to the PC, as shown in Figure 3-4.

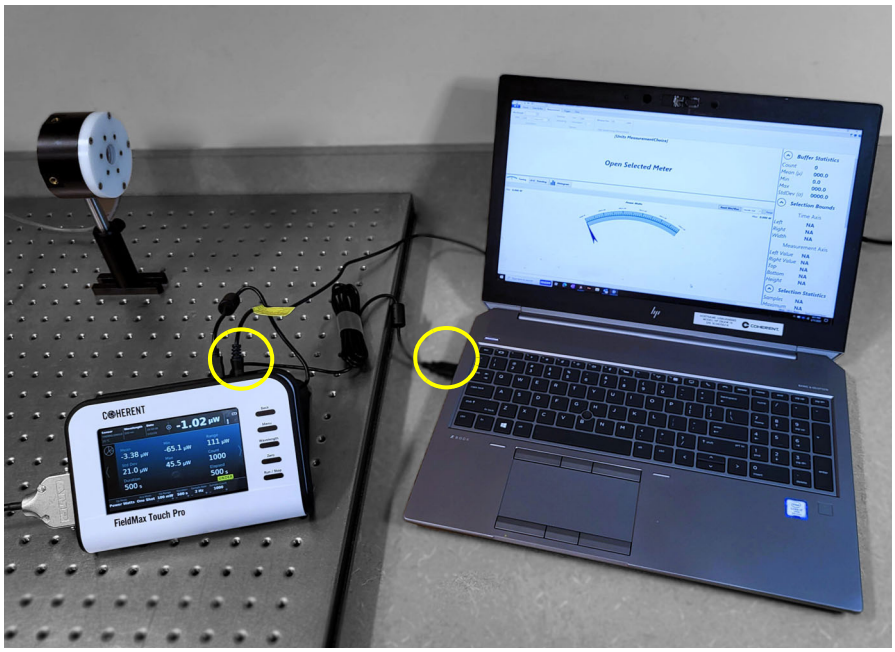

Figure 3-4. Connect the Meter to a PC

2. Press the Enable Remote Communications button on the Communications App (displayed in the Main Menu). Refer to 'Bottom Main Window Information Bar' (p. 42). Note that the default setting for Remote Communications is Enabled (On).

3.1.4 Apply Power to the Meter

To connect the power supply to the FieldMax Touch Meter:

1. Attach the power supply to the meter, and the power cord to the power supply.
2. Plug the power cord into an electrical outlet. This applies power to the meter, and sets it to ON. It also automatically begins charging the battery.

The Power button is located at the end of the connector panel on top of the meter. It illuminates in **green**, as shown in Figure 3-5:



Figure 3-5. Power Button on the Meter

- A start-up screen displays for 20 seconds that shows the Coherent logo.
- To set **Power OFF**: Press and hold 2-3 seconds; the Power button color changes. When no external power is connected, there is no light.
- When external power (12VDC) is plugged into the meter, it automatically turns ON. There is no need to press the ON/OFF button.
- When used with battery power, the ON/OFF button must be pressed to set the meter to ON or OFF.

3.2 Put Meter on a Mount

The FieldMax Touch Meter can be mounted so that it is in position in an easily-accessible location. For example, you might want to put the meter on a DIN rail above a workbench in a lab where measurements are typically taken to save space, or to set up the display panel at eye level.

To mount the meter, the **Meter Mounting Accessory Kit** (P/N 2269910) is needed, which can be ordered on the Shop.coherent.com website.

SHOP COHERENT

Shop.coherent is the official e-commerce website for Coherent lasers, energy meters and sensors, fiber optics, and accessories. This e-commerce service offers product-specific filtering, fast-and-easy checkout, and prompt shipping confirmations.

As shown in Figure 3-6, the kit includes:

- Two mounting brackets (quantity 2)

- Screws (quantity 4, 2 for each bracket) to attach the FieldMax Touch Meter

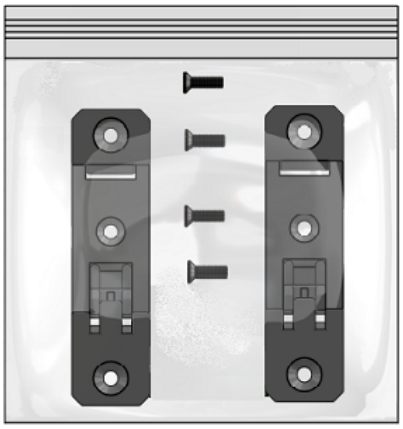

Figure 3-6. Meter Mount Accessory Kit

The customer must provide the DIN rail (not included in the Kit). The mounting brackets for the FieldMax Touch Meter fit a standard 35 mm x 7.5 mm DIN rail. The DIN rail can be secured to the wall or other support in any way preferred, using the slots in the middle of the rail.

The dimensions for the mounting brackets are shown in Figure 3-7:

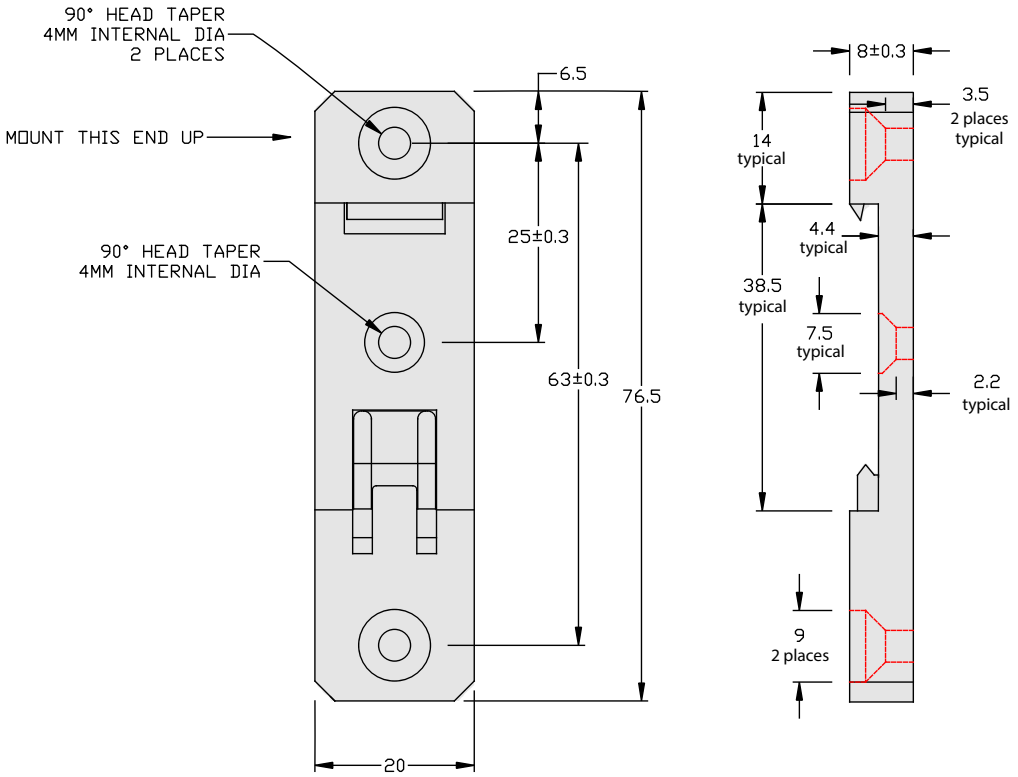

Figure 3-7. Dimensions for the Mounting Brackets

Figure 3-8 shows the location of the mount holes for the brackets on the meter:

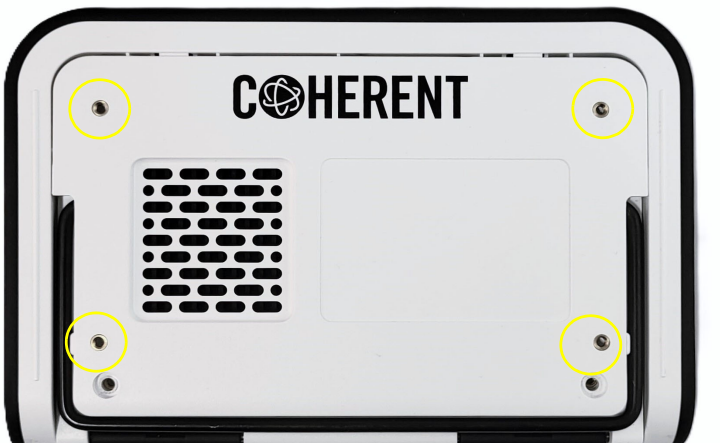

Figure 3-8. Holes for Brackets to Mount Meter

To mount the meter:

1. Put the FieldMax Touch Meter face down on a solid surface. Be sure to first clear the surface so that no objects can scratch the display on meter.
2. Attach the two brackets to the meter with two screws each. Figure 3-9 shows the location of the holes on the back of the meter where attach the screws are attached.

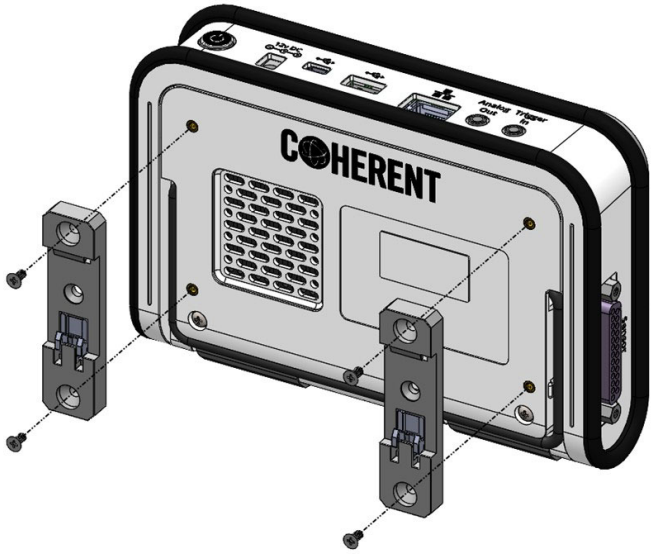

Figure 3-9. Mount Brackets Installed

3. Tighten the screws until snug, then tighten an additional 1/4 turn.
4. Identify the necessary facility location to mount the meter. Securely attach the DIN rail to the desired location to attach the meter.

   The polyurethane cover can be removed when the meter is installed on DIN Rails.
5. To remove polyurethane cover, unscrew the battery cover and then remove the cover. Then tighten the battery cover screws again to make it secure.

6. To install, slide the lower edge of the brackets onto the lower edge of the DIN rail, and snap the meter up to engage the top of the brackets, as shown in Figure 3-10.

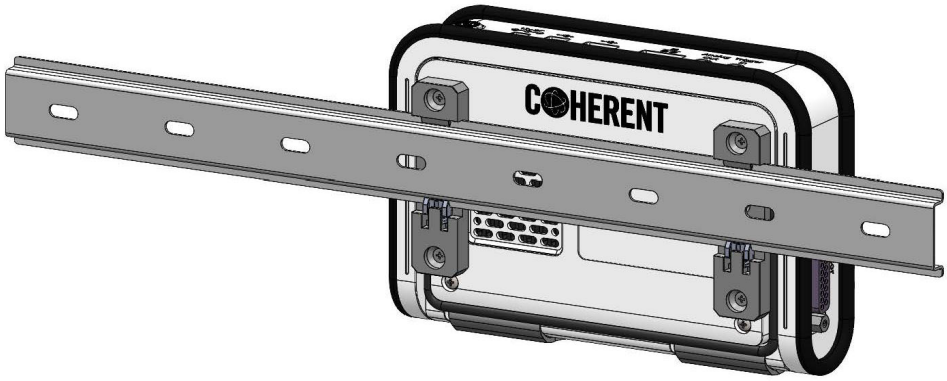

Figure 3-10. Attach the Mount Brackets to DIN Rails

NOTICE

Because the touchscreen will be accessed frequently, remember to occasionally make sure that the meter is tightly clipped to the DIN rail.

3.3 Install PC Software

This section introduces the Coherent Meter Connection (CMC) software and describes how to install the application on a personal computer (PC) or laptop.

For information about the features and functions of the software, see the *Coherent Meter Connection User Manual* (P/N 1343658).

3.3.1 Software Features

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

- Trending with Time and Power cursors
- Energy integration
- Tuning

- Data logging
- Statistics

3.3.2 System Requirements

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

- Windows v10 or v11 (32- and 64-bit) operating system
- 4 GB of RAM
- 100 MB of available hard disk space
- 2.5 GHz or faster processor
- 1024x768 screen resolution
- Microsoft .NET Framework 4.0 or higher. If no version (or an older version) is found on the workstation, then the installation program installs a version of Microsoft .NET Framework.

3.3.3 Software Installation

Before work is started, remember to save any data and close all other applications. The installation displays the message shown in Figure 3-11.



Figure 3-11. Install CMC Software First

1. Download the software and the *Coherent Meter Connection User Manual* (Part Number 1343658) from the Coherent website.

   Coherent product information and related software is available in one easily accessible location on the Coherent website:

   https://www.coherent.com/resources



NOTICE

The Coherent Meter Connection software is available in English only.

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

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

3. Refer to the *Coherent Meter Connection User Manual* for detailed installation instructions

When installation completes and the software is started, the following splash screen displays. Refer to the *FieldMax Touch/Touch Pro User Manual* to learn about the features and functions related to use of the meter.



Figure 3-12. Startup Splash Screen

3.4 Next Steps

Go to the next chapter to learn more about the touchscreen user interface and settings.

Go to 'Operation - Coherent Meter Connection' (p. 101) to learn about the PC Software User Interface and to perform measurement tasks.

Go to 'External Computer Control Host Commands' (p. 117) to learn about host commands.



CAUTION!

Before devices are connected, follow all laser safety procedures; see ’Safety’ (p. 177). A laser must be blocked or switched OFF before starting any activity involving laser measurement.

4 Touchscreen User Interface

This section gives the procedures for how to set up and use controls in the User Interface for the FieldMax Touch Meter screen.

The User Interface for the FieldMax Touch Meter supports a 5-inch, full-color touchscreen.

4.1 User Interface Description

An example of the Main screen for the FieldMax Touch Meter is shown in Figure 4-1:

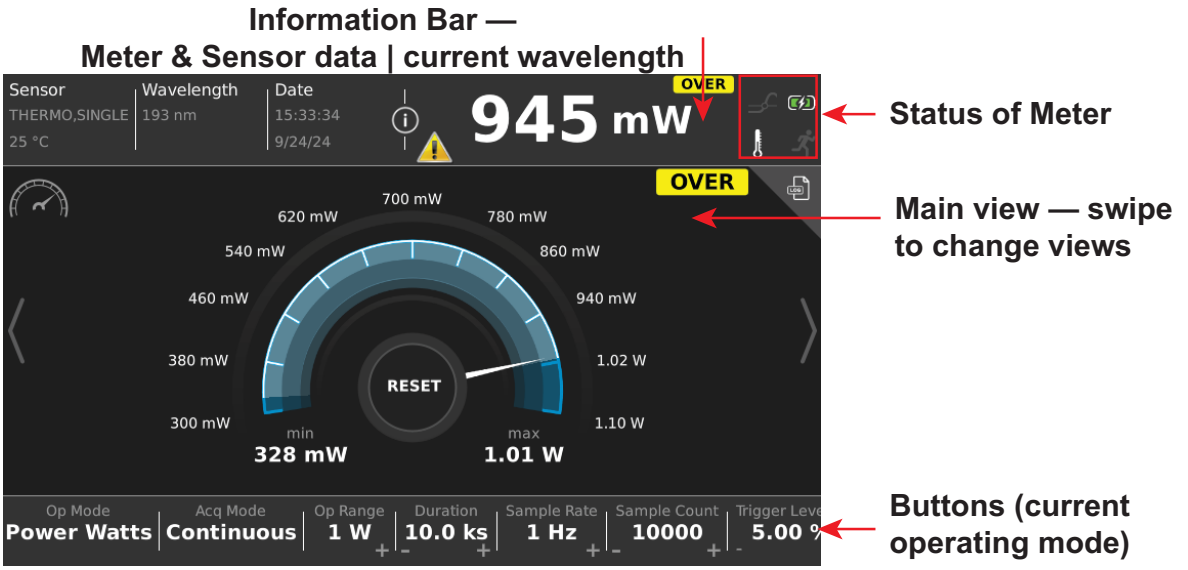

Figure 4-1. Touch Meter Main Screen— Example

The screen includes these functions:

- Information bar
- Status indicators
- Main view — Swipe to switch between major views.
- Button bar for operating mode configuration— options relevant to the current operating mode. Press to toggle ON/OFF, use (+/-) to increase/decrease settings, or press and hold to pop up settings.

To change the view, simply swipe the touchscreen to the left or to the right. This slides the next view to the main window, as shown in Figure 4-1:

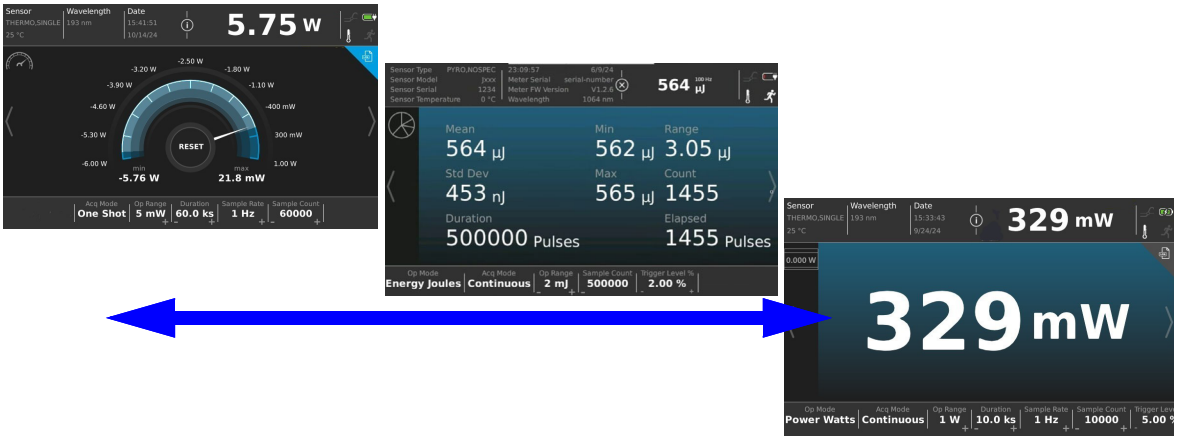

Figure 4-2. Touchscreen — Swipe to Change Views

4.1.1 Top Information Bar

At the top of the window, the information bar shown in Figure 4-3 displays important sensor and meter information, along with the selected wavelength.



Figure 4-3. Top Information Bar — Meter/Sensor Information (collapsed)

The information in the top left panel can be expanded and collapsed to show more or less details. Click the 'i' icon to expand. Refer to Figure 4-4.

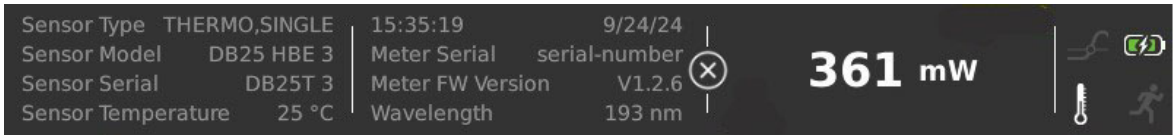

Figure 4-4. Top Information Bar — Meter/Sensor Information (expanded)

The space in the information bar shown in Figure 4-5 that displays a live measurement value. This value is updated several times per second, and is useful to check the current reading of the sensor even when the meter is not in operation.

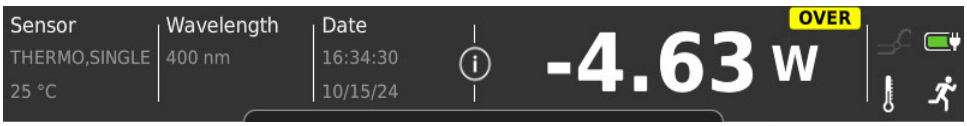

Figure 4-5. Top Information Bar — Live Measurement Value

The box shown in Figure 4-6 in the right top corner of the display shows additional information about the meter.

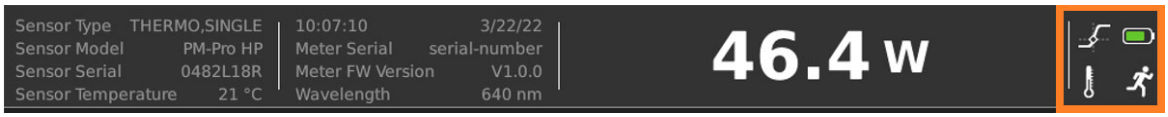

Figure 4-6. Top Information Bar — Status Information

These icons for the status of the meter are described briefly in Table 4-1:

Table 4-1. Status Indicator Icons

Icon	Name	Description
	Trigger indicator	Identifies whether a trigger threshold has been crossed or a trigger has been received.
	Battery	The charge status of the battery.
	Temperature Alarm	Reports when the sensor is too hot.
	Run/Stop	The 'running person' icon is: • Highlighted when data is being captured to the buffer. • Grayed out when data is not being captured to the buffer.

4.1.1.1 Trigger Indicator Details

Certain operating modes rely on triggers. Triggers cause data acquisition to wait until measurements meeting certain criteria occur.

Triggers and their indicators only apply to certain EnergyMax pyroelectric sensors.

The indicator reflects the state of acquisition hardware, via the Trigger Status Indicator. The Trigger Indicator can display four possible states. Refer to Table 4-2:

Table 4-2. Trigger Status Icons

Trigger Icon	Status Description
	Triggers are not available or not in use.
	Triggers are in use and the acquisition hardware has recently seen at least one occur
	Indicates hardware is actively waiting for a trigger and that a force trigger is allowed. For higher sampling rates, force-trigger is activated by tapping anywhere in the indicator region of the title bar
	A forced trigger is in use and the acquisition hardware is actively waiting for one to occur. Sometimes, the meter waits indefinitely in this state, because there is no signal or if trigger levels or other parameters are set incorrectly.

4.1.2 Bottom Main Window Information Bar

The information bar at the bottom of the main window, shown in Figure 4-7, shows information related to the current operating mode. These touch-sensitive buttons can be configured. What is displayed and available changes based on the type of sensor used and the measurement being performed.



Figure 4-7. Main Window — Bottom Information Bar Example

Tapping or holding the various buttons allows changes to the different configuration parameters. The buttons that are visible change depending on factors such as the selected Operating Mode or the attached sensor.

Some of these on-screen buttons act as toggle switches to switch between two different options such as the Operating Mode and the Acquisitions Mode buttons.

Other buttons allow changes to the settings by clicking:

- (**-**) at left side of the button to decrease the value of the parameter.
- (**+**) at right side to increase the value of the parameter.

Holding these configurable buttons displays a configuration dial used to speed up the value selection by spinning the dial, as shown in the example in Figure 4-8:

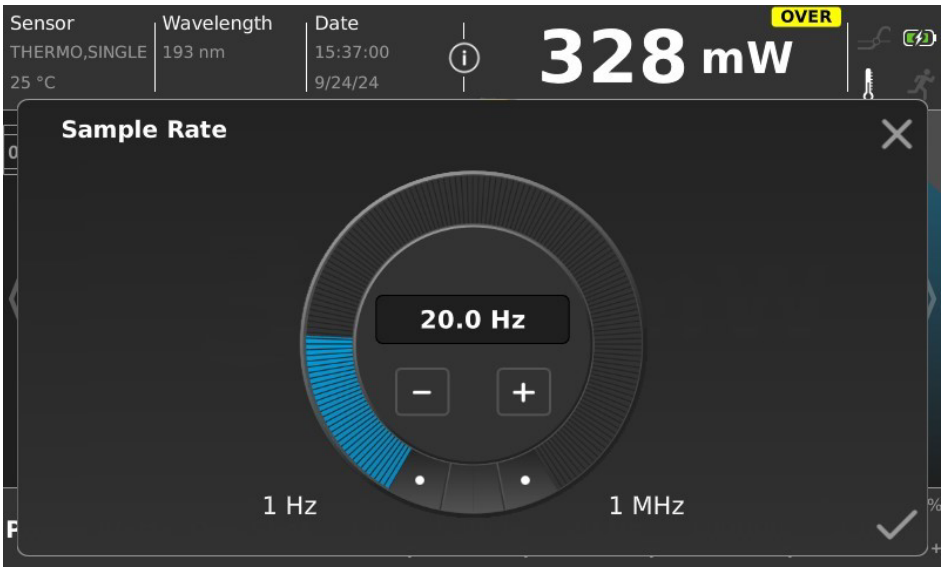

Figure 4-8. Configure Sample Rate - Dial

The value field in the middle of the dial can be tapped to display a keypad to type in the necessary value. Refer to Figure 4-9:

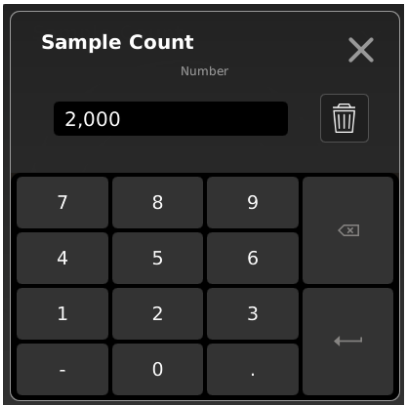

Figure 4-9. Configure Sample Rate - Keypad

The less common configuration parameters can be accessed through the Acquisition Settings dialog. Press the Menu button to the right of the LCD display.

4.2 Configure Settings

Many of the operating settings are restored at start-up from settings saved for the type of sensor attached the last time the attached sensor was used. However, note the following:

- The selections in the information button bar (at the bottom of the touchscreen), in the settings menus, and tables can change, depending on the type of sensor being used.

Pressing the physical MENU function button displays the Settings menu. This Settings screen displays several categories of settings (shown in Figure 4-10 and Figure 4-11) to configure the FieldMax Touch Meter.

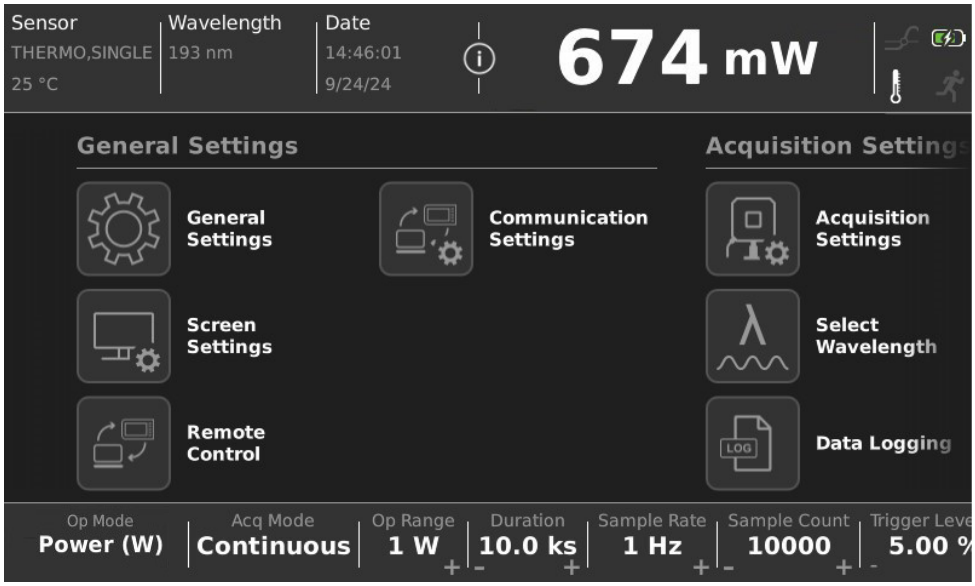

Figure 4-10. Configure General, Acquisition Settings



Figure 4-11. Configure Analysis Settings, System Utilities

Each group can be accessed by swiping to the left or right in the window, and then tapping the name of the necessary group. Some functions are also selectable by pressing and holding the associated icon in the quick menu. Refer to ’Bottom Main Window Information Bar’ (p. 42).

The next sections describe the configuration settings in more detail.

4.2.1 General Settings

General settings are accessed from the first group in the Settings Menu. Refer to Figure 4-12.

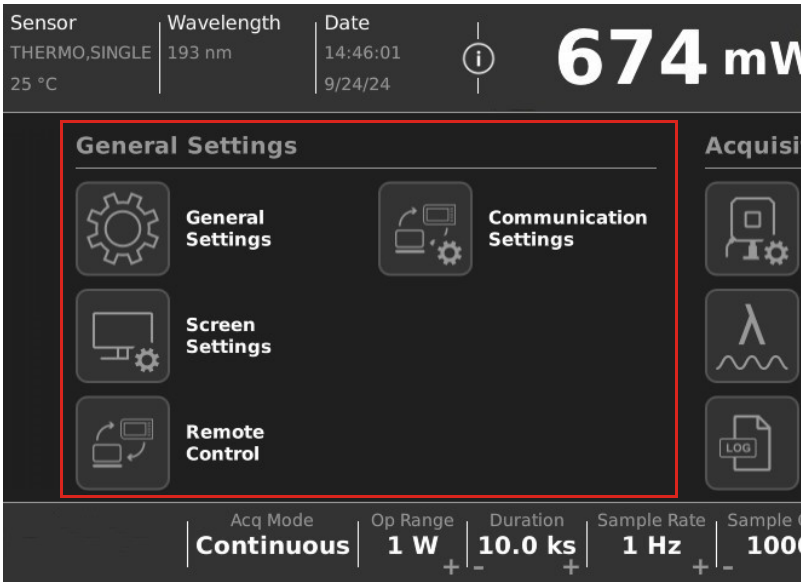

Figure 4-12. Configure General Settings Group

Figure 4-13 shows the options that can be configured for General settings, by pressing the General Settings button in the General Settings group.

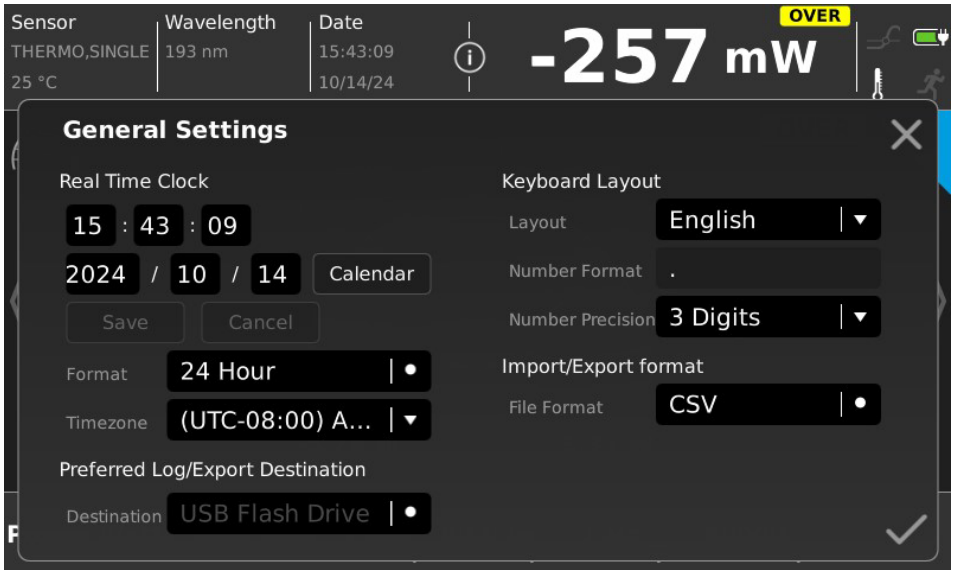

Figure 4-13. Configure General Settings

4.2.2 Remote Control Settings

The Remote Control settings allow users to set configurable options settings for remote communication via a PC. When a user presses the **Remote Control** button in the General Settings group (Figure 4-12), a popup displays. Refer to Figure 4-14. A user can select whether to enable or disable the Ethernet, or USB device.

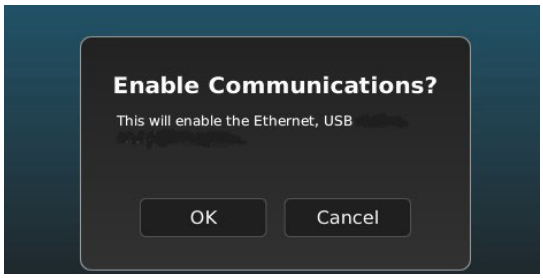

Figure 4-14. Configure Remote Communications

4.2.3 Communication Settings

Figure 4-15 shows the tab for configurable settings for remote communication via a PC for Ethernet. Note that remote communication is enabled/disabled with the Remote Control settings button.

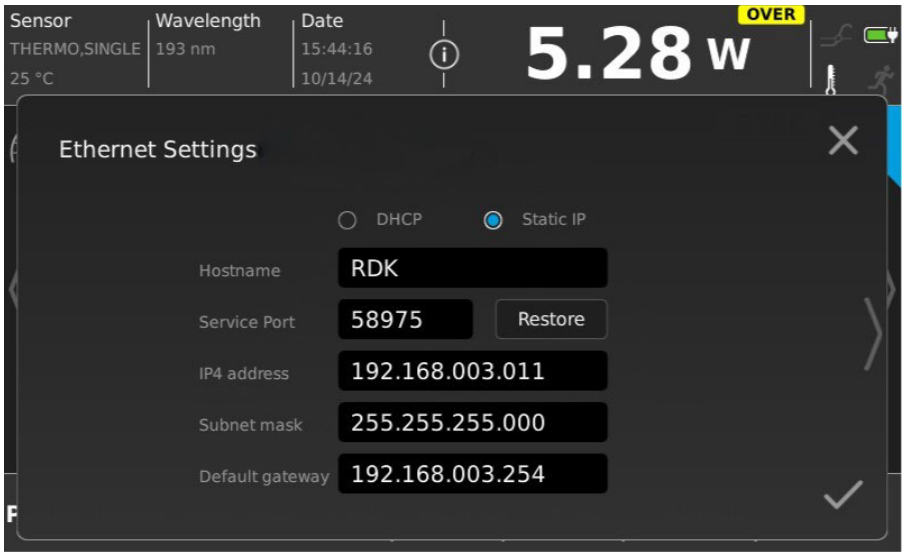

Figure 4-15. Configure Communication Settings - Ethernet

4.2.4 Acquisition Settings

The Acquisition Settings options can be accessed from another group the main Settings Menu.

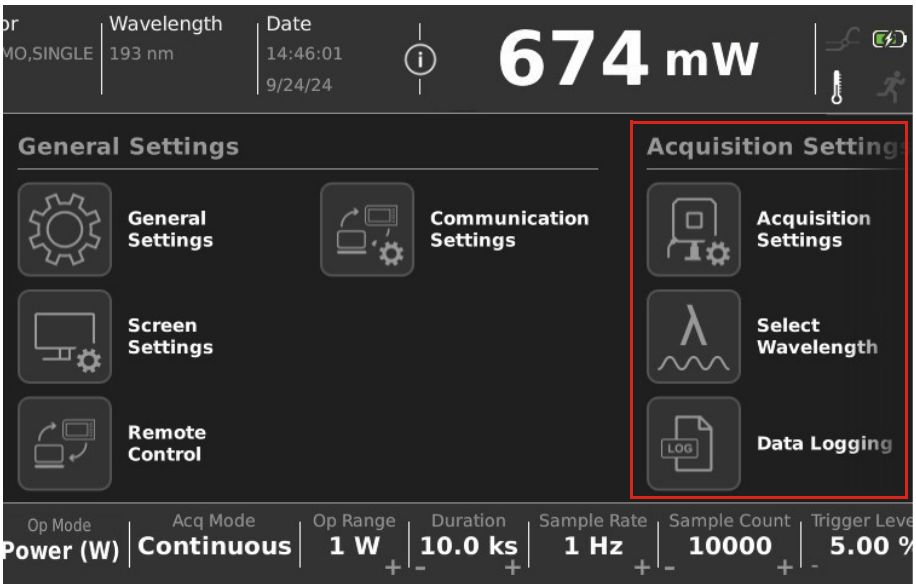

Figure 4-16. Configure Acquisition Settings

It includes:

- 'Acquisition Settings Menu' (p. 48) submenu
- 'Select Wavelength' (p. 53) submenu
- 'Data Logging' (p. 55) submenu

4.2.4.1 Acquisition Settings Menu

There are three sub-tabs, or sub-menus, that are accessed by scrolling left and right on the touchscreen in the Acquisition Settings submenu: General Acquisition, Trigger, and Measurement settings.

4.2.4.1.1 Acquisition Settings - Acquisition Tab

From this dialog, change and adjust the acquisition parameters, as necessary. Figure 4-17 shows the configurable options for general Acquisition settings in Power Watts mode:

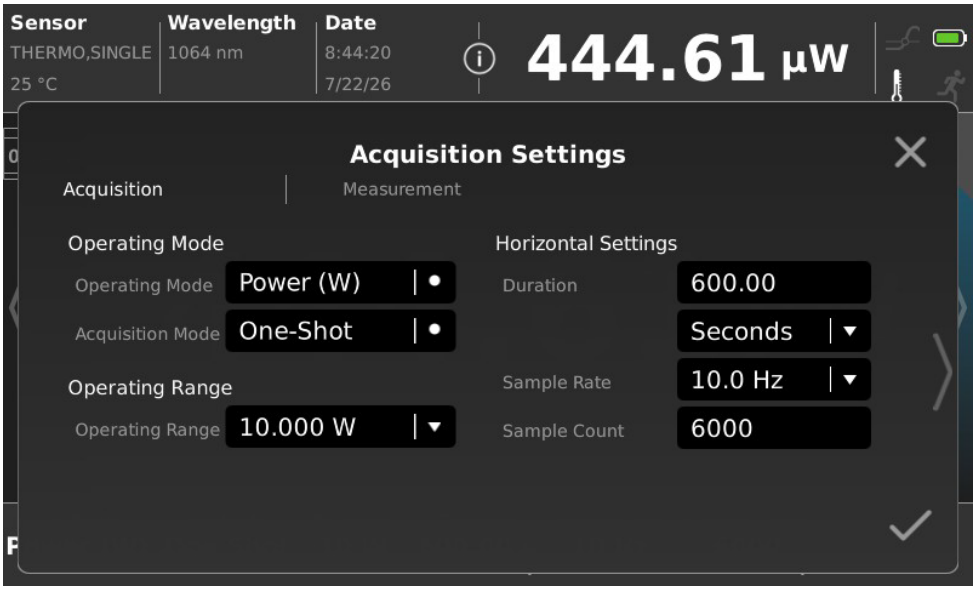

Figure 4-17. Configure General Acquisition Settings

NOTICE

What is displayed and available changes based on the type of sensor used and the measurement being performed.

Operating Mode Group

Operating Mode

Power Watts: Collects and displays measurements in power units.

- For PowerMax/PowerMax Pro sensors, this is a direct power measurement.
- For EnergyMax sensors, this is calculated using the measured pulse energy and the measured pulse repetition rate.

Energy Joules: Collects and displays measurements in energy units.

- For PowerMax thermopile sensors, this activates Long Pulse Joules mode.
- For FieldMax Touch Pro with PowerMax Pro sensors, this activates pulse acquisition and analysis mode.
- For EnergyMax sensors, this measures pulse energy and pulse repetition rate.

Acquisition Mode

Continuous: The meter keeps collecting measurements even when the user-specified buffer capacity is filled, operating as FIFO.

One Shot: Once the user-specified buffer capacity is reached, acquisition stops.

Operating Range Group

Operating Range

Sets the desired operating range for the sensor.

Horizontal Settings Group

The fields are used to set the buffer capacity. The user sets 2 of the 3 settings and the other is calculated based on these.

4.2.4.1.2 Acquisitions Settings - Trigger Tab

NOTICE

This functionality only applies to the FieldMax Touch Pro model with an EnergyMax sensor connected.

Press the **Trigger** tab to display Trigger settings sub-menu. Refer to Figure 4-18.

Trigger Level %: Sets the trigger level as a % of the current range setting.

Trigger Source: Toggle the trigger source between internal auto trigger using the % trigger level, or external trigger.

Trigger Edge: Toggle between rising edge or falling edge trigger logic.

Trigger Delay: Sets the delay between trigger input signal and measurement acquisition. External trigger only.

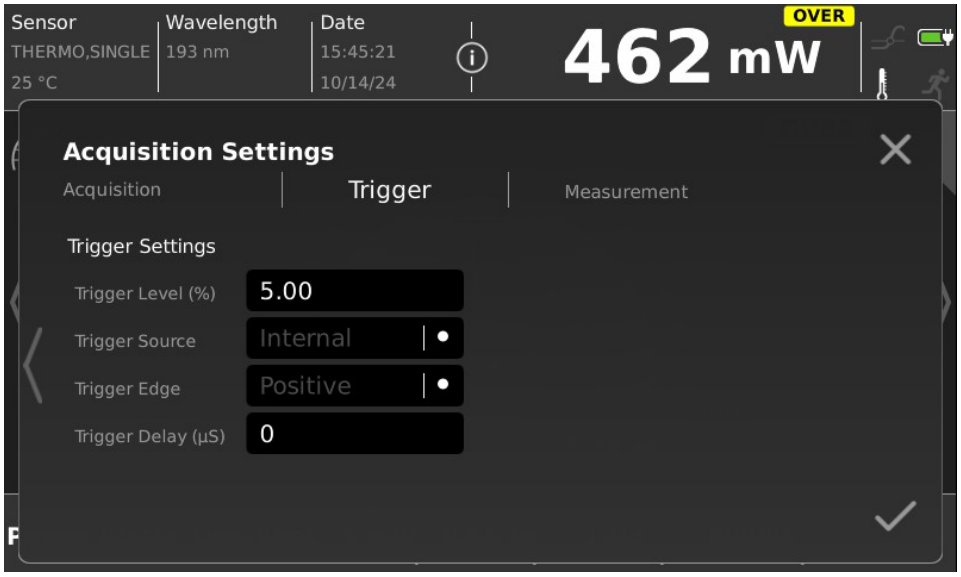

Figure 4-18. Acquisition Settings - Trigger

4.2.4.1.3 Acquisition Settings - Measurement Tab

Figure 4-19 shows the Measurement tab with options to configure acquisition in Energy (Joules) mode.

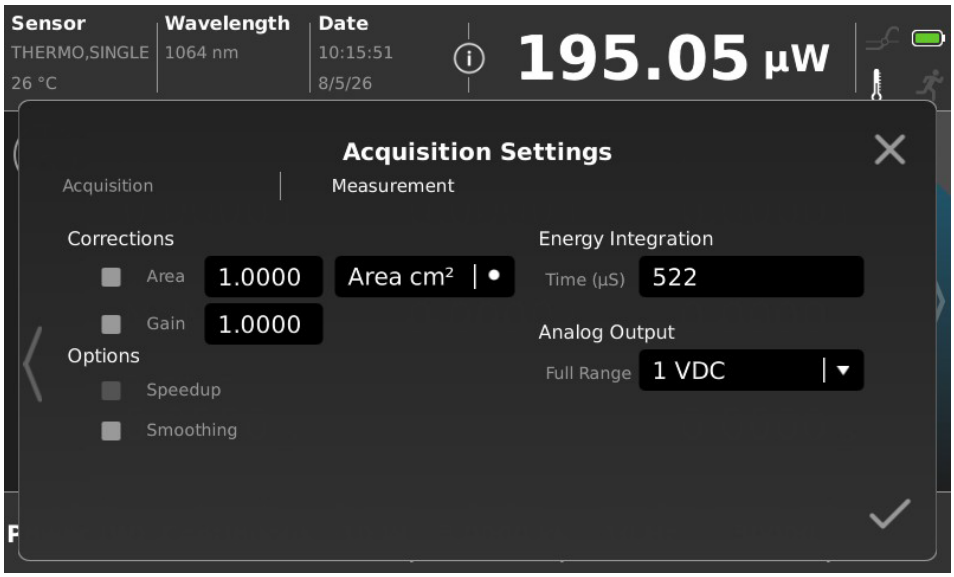

Figure 4-19. Configure Acquisition Settings for Measurement

Corrections Group

Area - Changes the displayed units from Power/Energy to Power Density / Energy Density. Input your known beam area into the field after enabling this setting.

Gain - Adjusts the displayed measurement values by a specified gain factor. Input the factor for the measurement to be multiplied by.

Options Group

Speedup - Activates the Speedup algorithm. This provides a faster response for Thermopile power sensors. Note - this can cause some small amount of overshoot on the power reading before stabilization.

Smoothing - suppresses large and rapid variations in the output reading. This is implemented by performing an average of every 32 samples. Used in the following conditions:

- A PowerMax/PowerMax Pro sensor is connected and Watts mode is selected
- A pyroelectric sensor is connected and Joules mode is selected

Analog Output

Full range - Changes the full scale value of the analog output signal. Default is 2 VDC, options are 1, 2 and 4 VDC.

4.2.4.2 Select Wavelength

Figure 4-20 shows the options to select a different wavelength when the physical WAVELENGTH button is pressed or when Select Wavelength is pressed in the Settings menu:

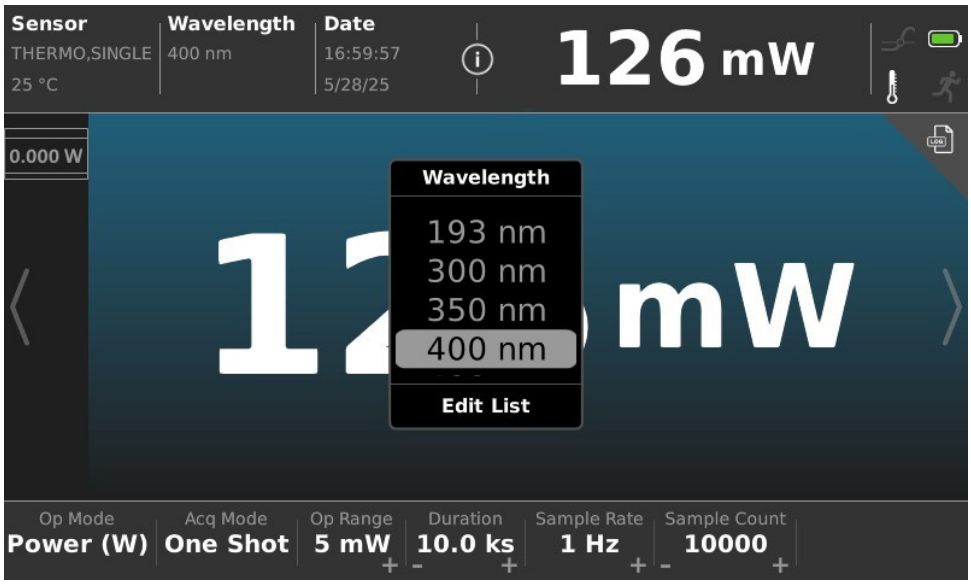

Figure 4-20. Select a Different Wavelength

Users can also press Edit List in the Wavelength selection menu to edit the list of available wavelength selections.

Figure 4-21 shows the submenu option to add a Wavelength:

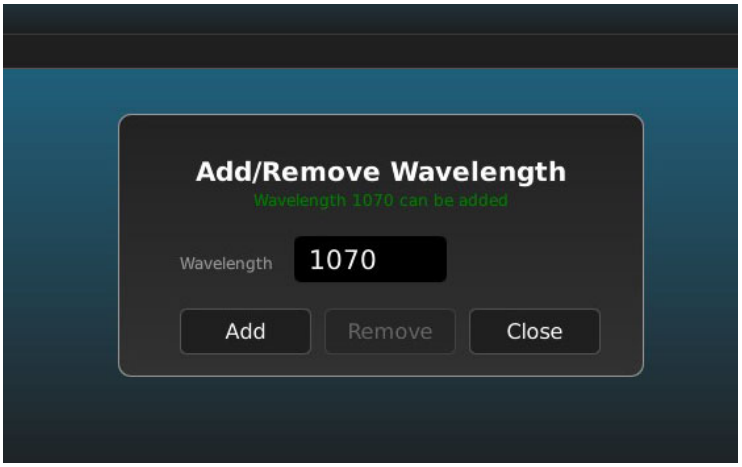

Figure 4-21. Configure – Add a New Wavelength

Figure 4-22 shows the submenu option to remove a Wavelength:



Figure 4-22. Configure – Remove a Wavelength

4.2.4.3 Data Logging

Figure 4-23 shows the options to identify a destination in the Data Logging submenu, on the Destination tab:

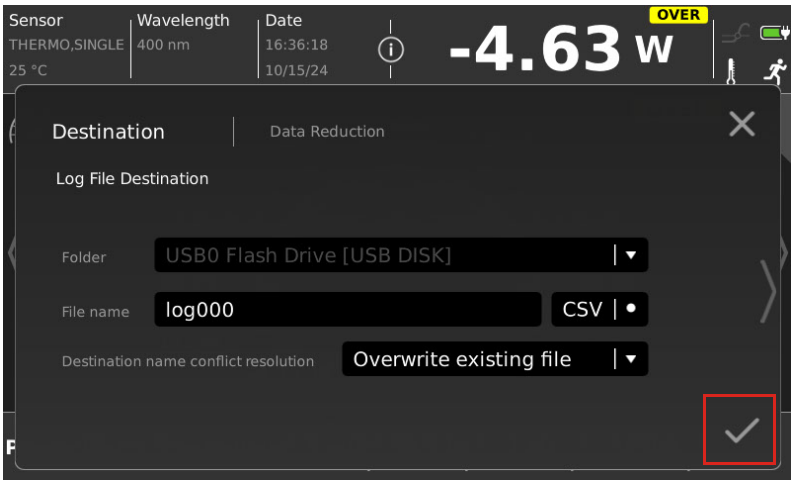

Figure 4-23. Configure Data Logging

Enabling data logging requires a USB flash drive inserted into the USB-A port on the top of the meter.

In the Destination tab, use the **Folder** and **Filename** fields to name the log file and choose the save destination.

Press the Data Reduction tab to change how many samples are preserved in the log. The default is All Samples.

Once settings are completed, press the check mark (highlighted, Figure 4-23) to enable data logging. Press the Run/Stop physical button to start data acquisition and begin writing the log file to the USB flash drive.

To save a log file to a USB flash drive, refer to ’Export Capture Data to File’ (p. 99).

4.2.4.4 Alarms and Limits Settings

NOTICE
This functionality only applies to the FieldMax Touch Pro model.

Alarms and Limits allows the option to set a Pass/Fail window based on minimum/maximum measurement values accepted by the user.

When measurement values are recorded that fall outside of this window, Fault Actions can be assigned. This can either stop Acquisition of data, highlight where the out of range data falls, or both.

Figure 4-24 shows the configurable options settings for Alarms and Limits.

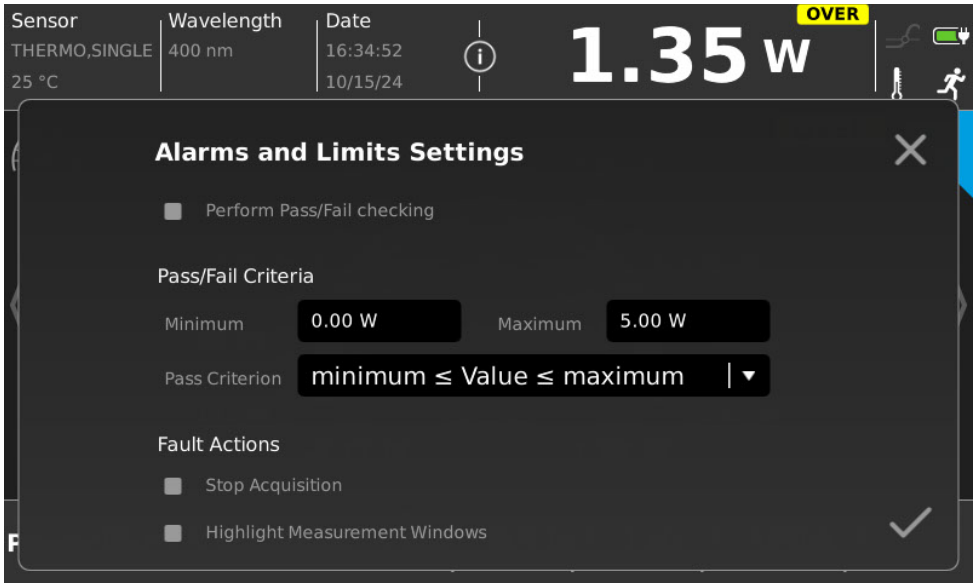

Figure 4-24. Configure Alarms and Limits

4.2.5 Import/Export Utilities

Each of the system utilities settings in the Import/Export group are described next:

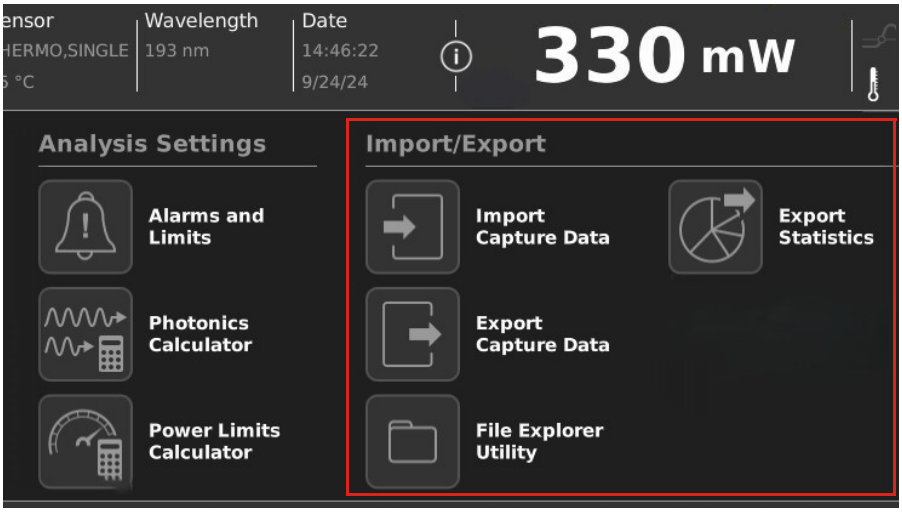

Figure 4-25. Configure Analysis Settings

- 'Import Capture Data' (p. 58)
- 'Export Capture Data' (p. 59)
- 'File Explorer Utility' (p. 60)
- 'Export Statistics Analysis' (p. 59)

4.2.5.1 Import Capture Data

Figure 4-26 shows the options to configure settings for Import Capture Data:

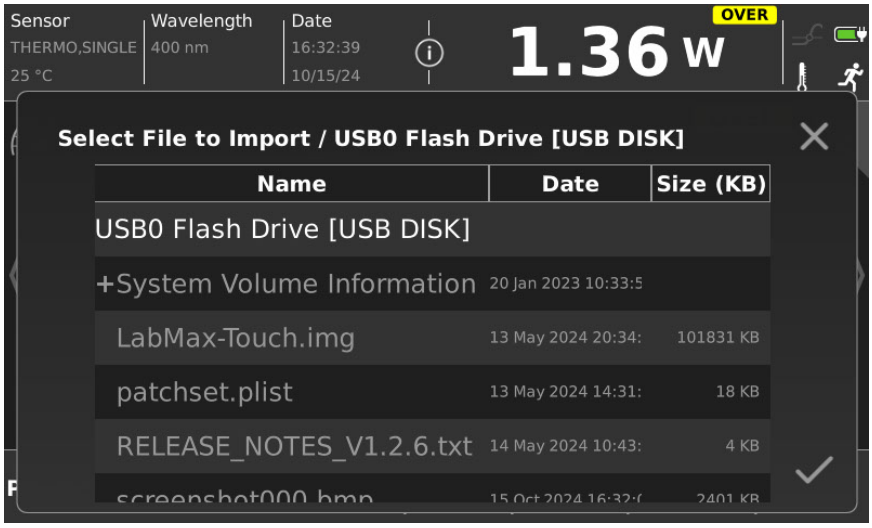

Figure 4-26. Configure Data Import Capture (example)

The data captured by the meter and stored in the data buffer can be exported to a .csv or .tsv file. That same data can be imported again.

With the FieldMax Touch Meter, users can do things like view the statistics of that data set. Users can also view the positional data of the laser beam, if the data was captured with a LabMax sensor.

4.2.5.2 Export Capture Data

Figure 4-27 shows the Export Capture Data dialog to configure and to export log file data to a USB drive:

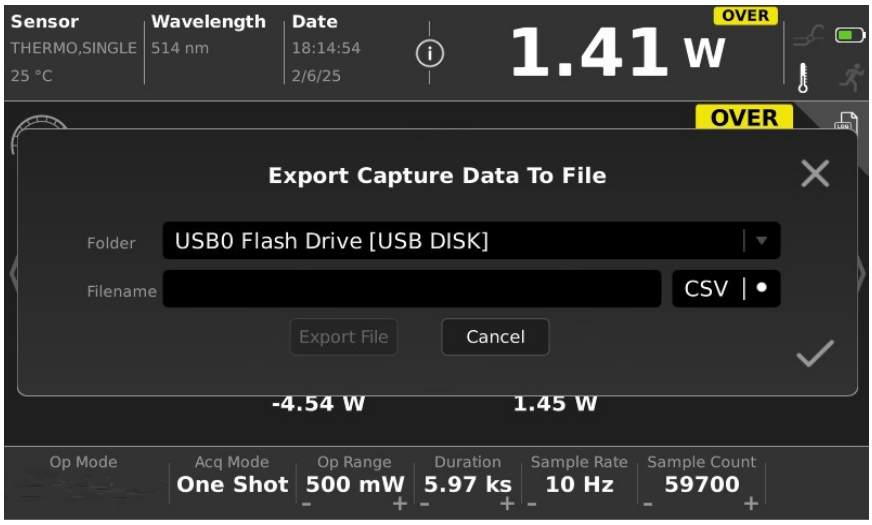

Figure 4-27. Configure Export Capture

4.2.5.3 Export Statistics Analysis

Figure 4-28 shows the Export Statistics Analysis dialog to configure and export statistics calculations to a USB drive.

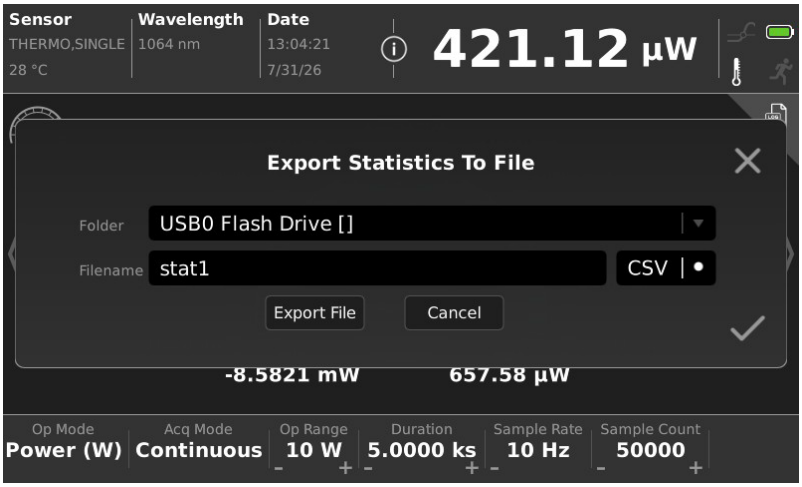

Figure 4-28. Export Statistical Analysis

4.2.5.4 File Explorer Utility

Figure 4-29 shows the view in the File Explorer Utility:

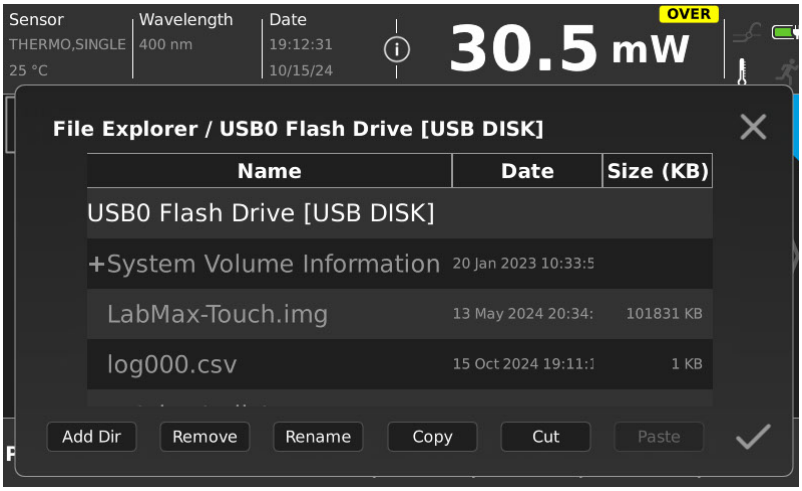

Figure 4-29. Configure File Explorer

4.2.6 View-Specific Settings

The view-specific settings that can be configured include:

- 'Tuning View Settings' (p. 61)
- 'Statistics Settings' (p. 62)

- ’System Utilities’ (p. 62)

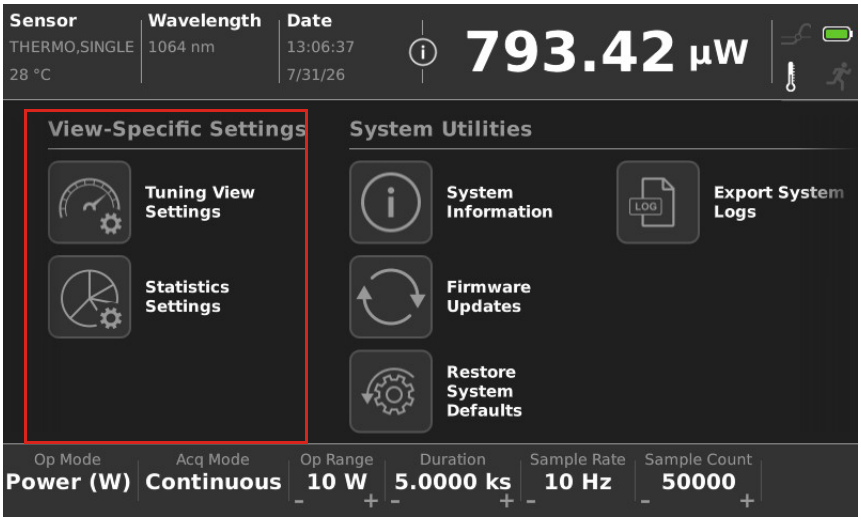

Figure 4-30. View-Specific Settings

Each of these are described in the sections that follow.

4.2.6.1 Tuning View Settings

Figure 4-31 shows the window for the Tuning view settings. The settings can also be adjusted, in Tuning view, by clicking the **Tuning Settings** button in the upper left.

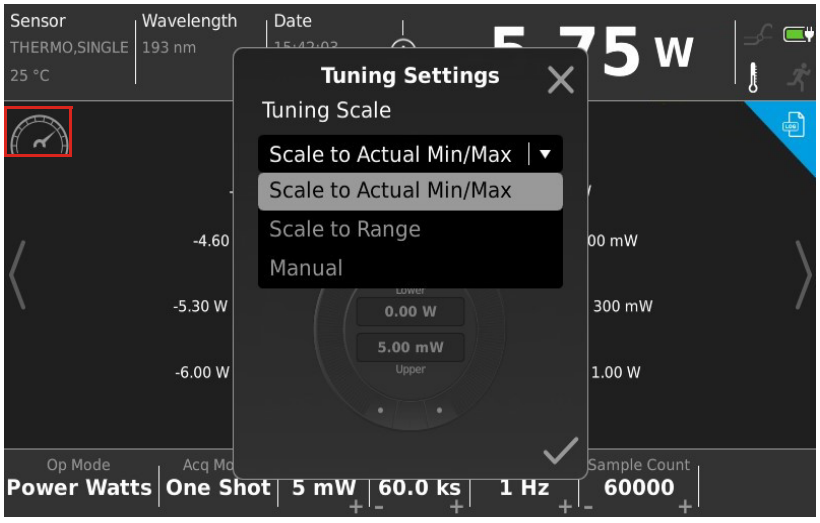

Figure 4-31. Tuning View Settings

4.2.6.2 Statistics Settings

Figure 4-32 shows the options that can be configured for Statistics to display. The settings can also be adjusted, in Statistics view, by clicking the Statistics Selection button in the upper left (refer to Figure 5-1).

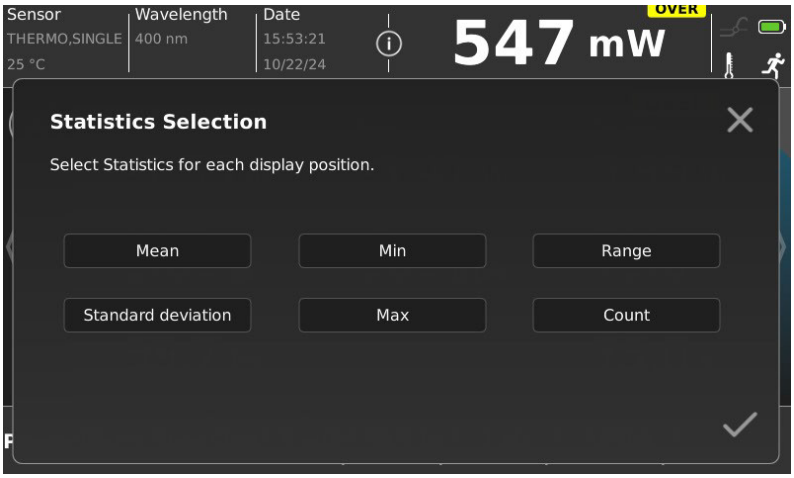

Figure 4-32. Configure Statistics Settings

4.2.7 System Utilities

System information and update utilities include:

- 'Photonics Calculator' (p. 63)
- 'Power Limits Calculator' (p. 63)
- 'System Information' (p. 64)
- 'Firmware Update' (p. 65)
- 'Restore Default Settings' (p. 68)

Each of these are described in the sections that follow.

4.2.7.1 Photonics Calculator

The Photonics (Laser) Calculator functionality is shown in Figure 4-36. It has tabs for units converter and for standard laser-related parameters. It provides common units conversions for laser parameters.

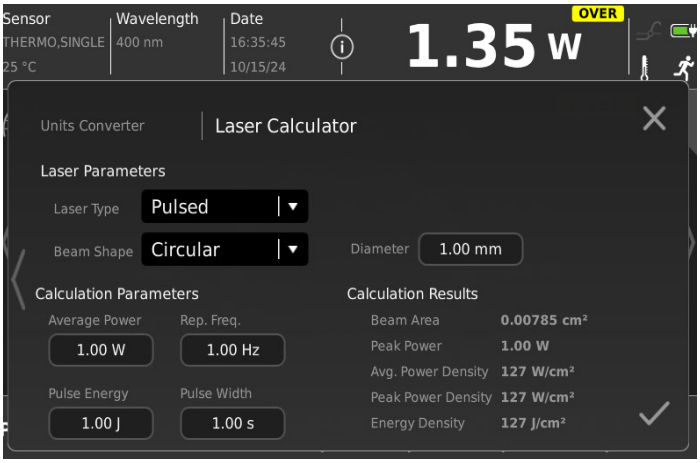

Figure 4-33. Photonics Calculator Screens

4.2.7.2 Power Limits Calculator

The Power Limits Calculator functionality is shown in Figure 4-36.

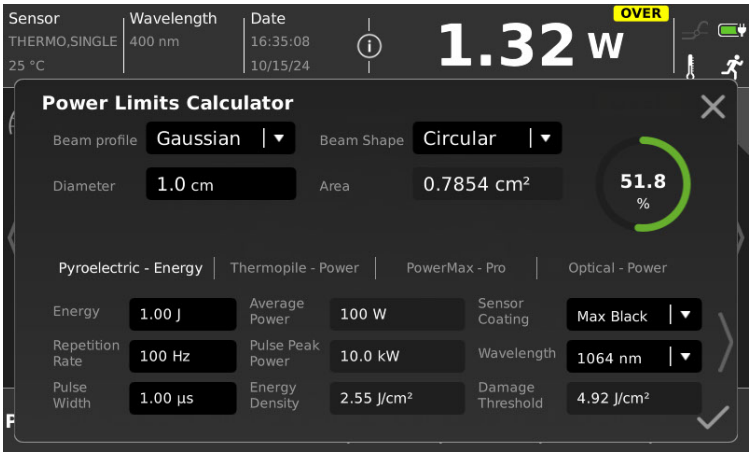

Figure 4-34. Power Limits Calculator Screen

The Power Limit Calculator is associated with Coherent sensors. The top section of the window allows entry of the characteristics of the laser beam. The bottom section of the window let's you select the type of sensor you are using, the laser power, and the coating of the sensor (Coherent sensors). The circular representation, at the top right corner, with the percentage value in the middle, indicates if the sensor can handle the power or energy of the laser beam. It is the percentage of the maximum power allowed for that sensor/coating, for example. If the laser power exceed the maximum, then the circle will turn red.

4.2.7.3 System Information

Information about the meter and operating system displays when System Information is pressed in the System Utilities group in the Settings menu.

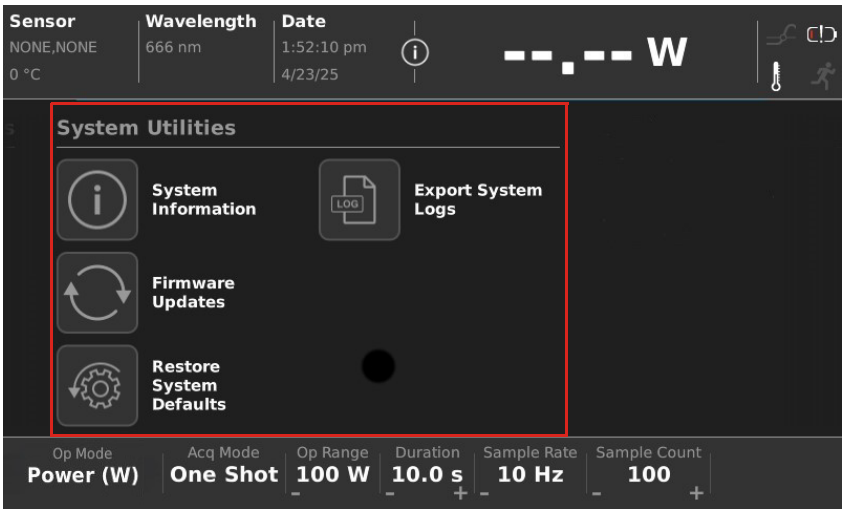

Figure 4-35. System Utilities

An example About FieldMax Touch is shown in Figure 4-36.

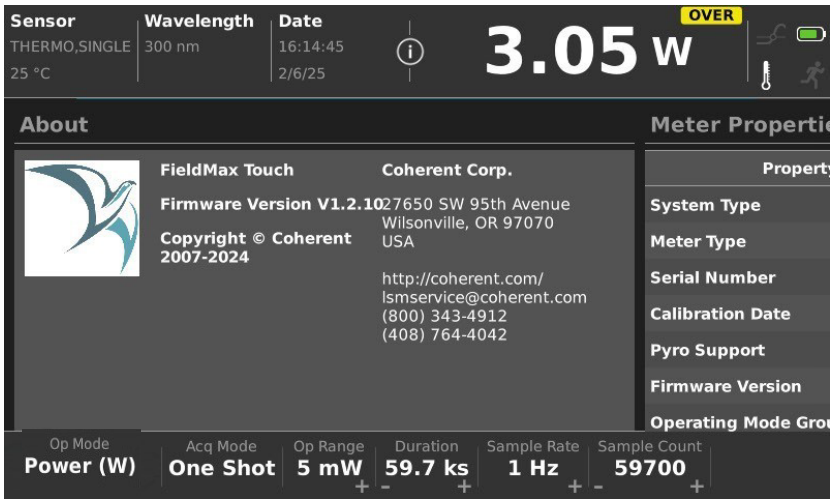

Figure 4-36. About Screen

Figure 4-37 shows system information, including properties for the meter and any connected sensor. Swipe to the right or left to reveal more information.

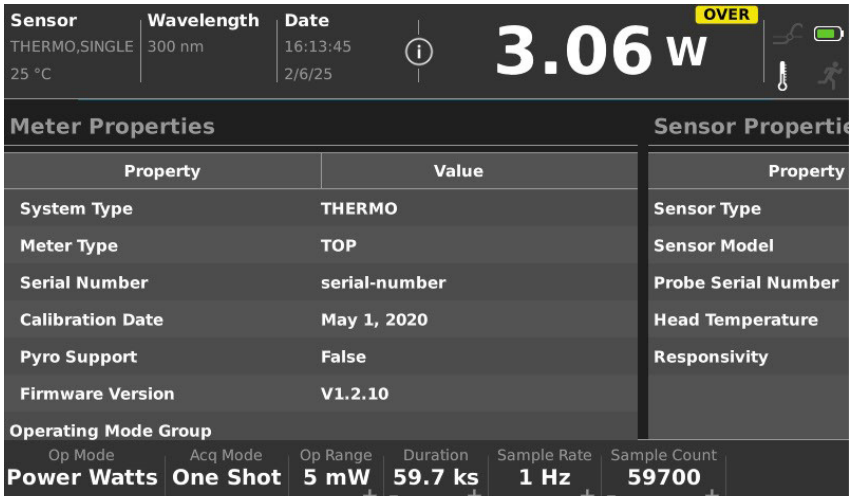

Figure 4-37. System Information Example

4.2.7.4 Firmware Update

A firmware update can be done with a USB flash drive. To install a firmware update, do the following:

1. Download the latest firmware update file from www.Coherent.com. The filename should appear as *FieldMax-Touch.img*.
   NOTE: The firmware download may include multiple image files, including a file for the LabMax Touch meter. The correctly named file for the meter being used must be selected.
2. Put the file, *FieldMax-Touch.img* in the root directory of a USB drive and insert the drive into the USB connector on the FieldMax Touch Meter.



Figure 4-38. USB Drive Installed

3. Make sure that the meter is connected, and given power with the power supply. The firmware update will NOT install when the device is on battery power.
4. Press the MENU button on the FieldMax Touch Meter, and then press the **Firmware Update** button in the Settings menu (refer to Figure 4-36). The Firmware Update dialog displays.



Figure 4-39. Firmware Update Settings

5. Make sure that the FieldMax Touch Meter is connected to power and that it remains plugged in and powered on until the operation completes.
6. Press the **Start Update** button on the Firmware Update screen to begin the update.
7. When the update is done, the FieldMax Touch Meter restarts.
8. Remove the flash drive.

4.2.7.5 Restore Default Settings

The meter can be reset to the default values for the current sensor, to the default values for all sensors, or for the user data to be erased.

1. In the Settings menu, press the **Restore System Defaults** button in the System Utilities group. Refer to Figure 4-36
2. In the Restore Default Settings dialog, press the button for the needed reset type. Refer to Figure 4-40. The reset is immediate, without confirmation.

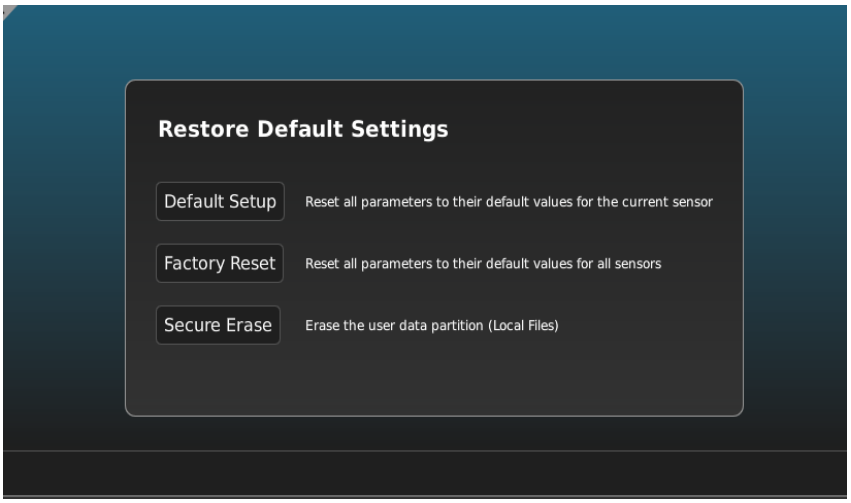

Figure 4-40. Restore Default Settings

Note the following:

- *Default Setup*: Does not change communications settings.
- *Factory Reset*: Resets all communications settings, and sets comm to ON
- *Secure Erase*: Resets all communications settings, and sets communications to ON.

4.2.7.6 Export System Logs

System logs can be collected and saved to an external USB drive. When Export System Logs is pressed from the Settings menu (refer to Figure 4-35), the Export System Logs dialog displays. Refer to Figure 4-41

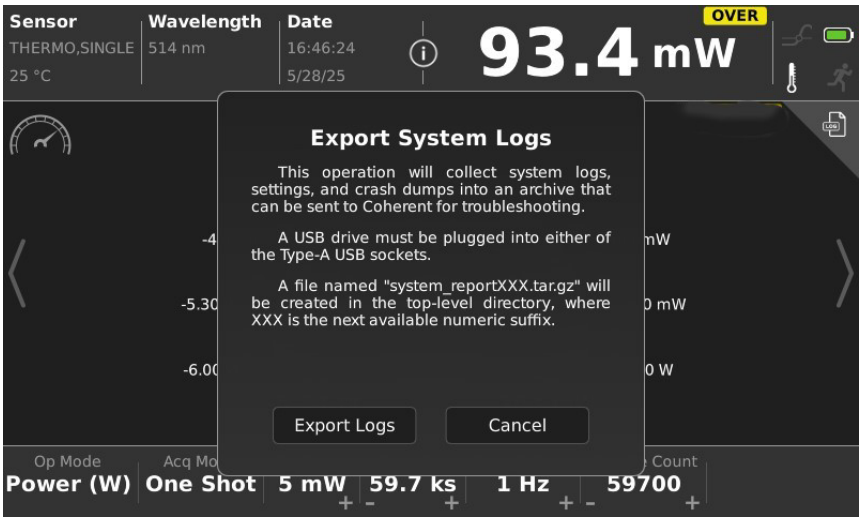

Figure 4-41. Export System Logs

5 Operations Views in Touchscreen

This chapter describes the different functional views available when operating the FieldMax Touch Meter:

- ’Statistics View’ (p. 72)
- ’Tuning View’ (p. 72)
- ’Measurement View’ (p. 73)
- ’Beam Position/Stability View’ (p. 74)
- ’Pyroelectric (Power) Watts Mode’ (p. 75)
- ’Pulsed Thermopile Energy Joules Mode’ (p. 77)

This chapter also describes key operating functions including trigger setting, on-screen indicators, zero setting, and analog output range setting.

5.1 Statistics View

The Statistics Mode view mode is shown in Figure 5-1.

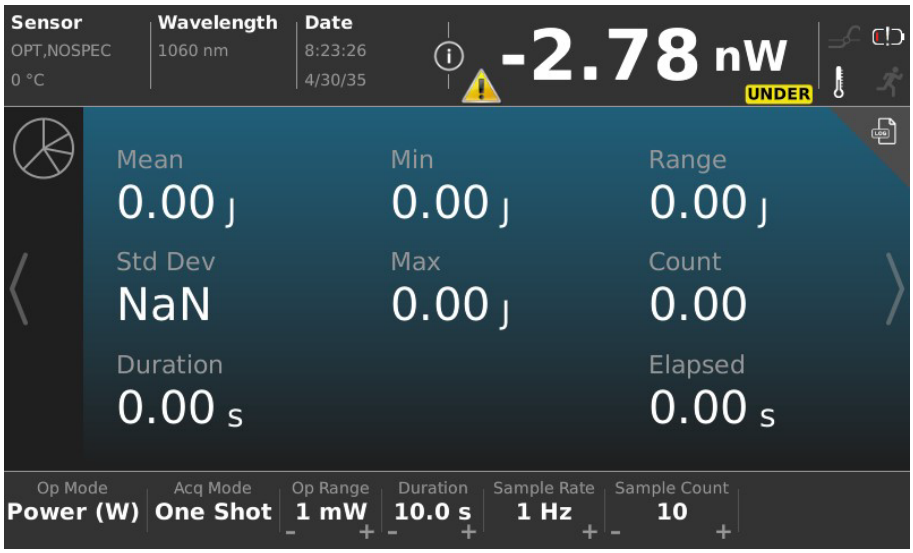

Figure 5-1. Statistics View

5.2 Tuning View

The Tuning View is shown in Figure 5-2.

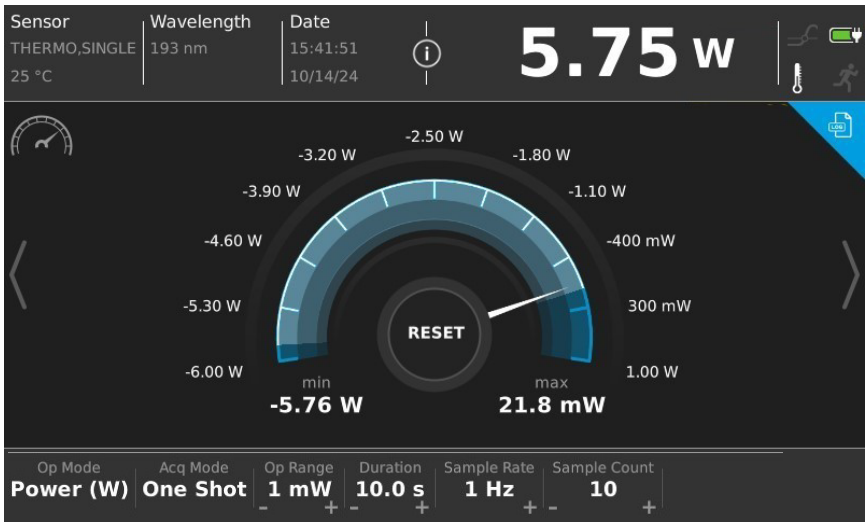

Figure 5-2. Tuning View

When this is over range, the indicator shown in Figure 5-3 displays:

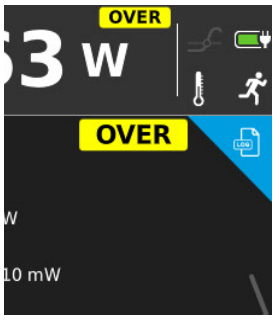

Figure 5-3. Tuning Over Range

5.3 Measurement View

The Power Measurement View with use of standard thermopile is shown in Figure 5-4.

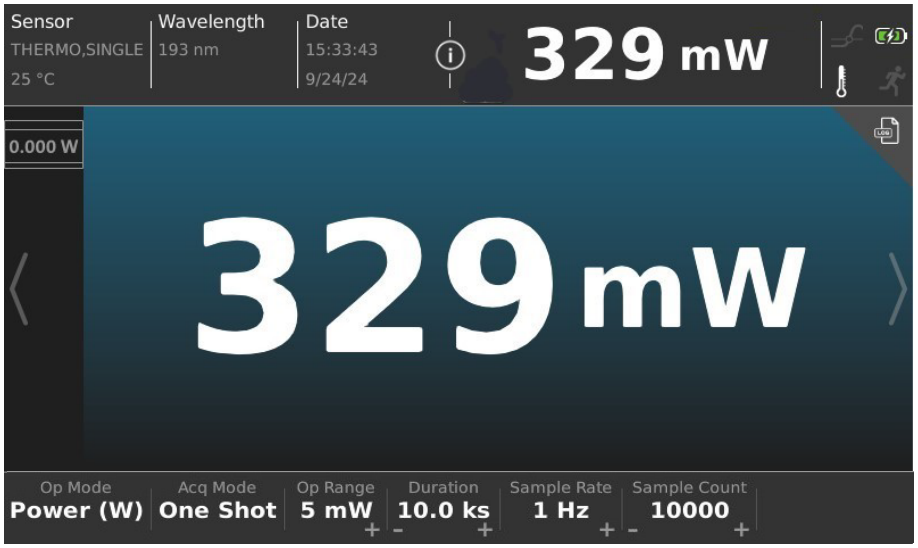

Figure 5-4. Touch Meter Power Measurement View

Measurements with use of pyroelectric sensors also display period measurement data The period can be displayed as a duration of seconds or a frequency in Hertz. Tap the on-screen period value in any view to toggle between frequency, in hertz, and period, in seconds. Refer to examples in Figure 5-5.

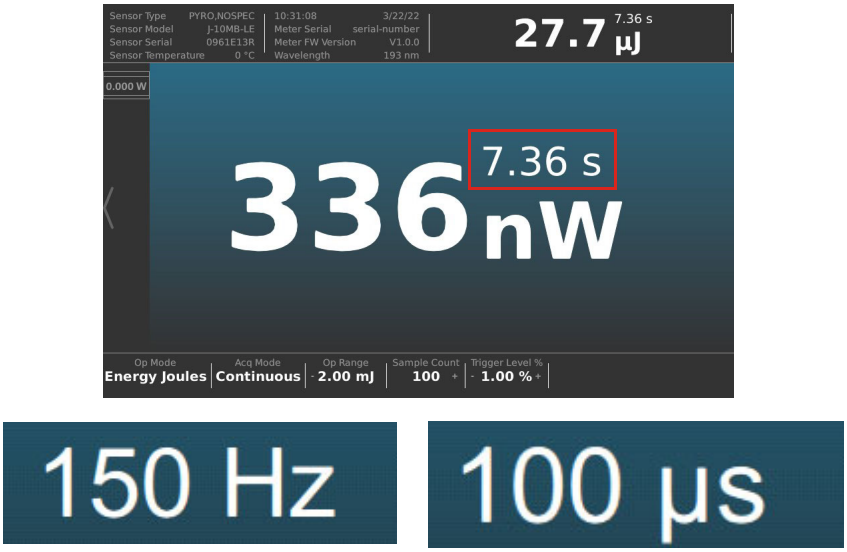

Figure 5-5. Touch Meter Power Measurement View

5.4 Beam Position/Stability View

The Beam Position view is shown in Figure 5-6. For quad sensors, this view shows the position of the laser beam on the sensor disk. Users must first press the RUN button on the meter to display beam position data. Refer to 'Beam Position Data' (p. 75).

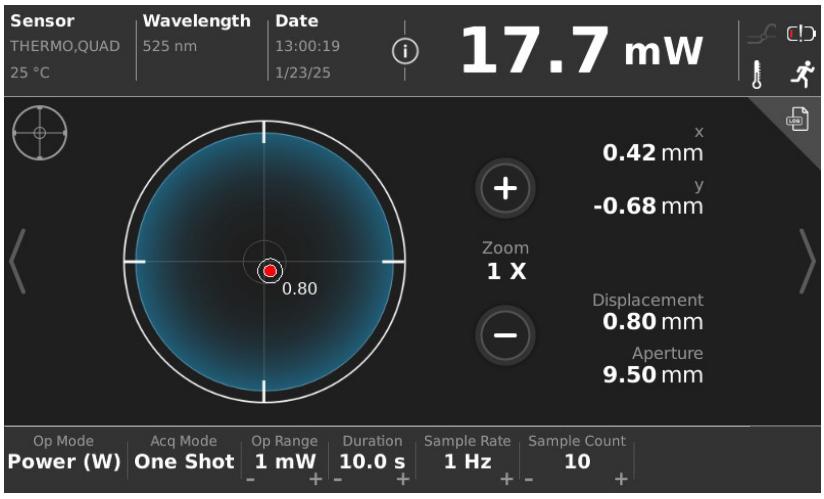

Figure 5-6. Touch Meter Beam Position View

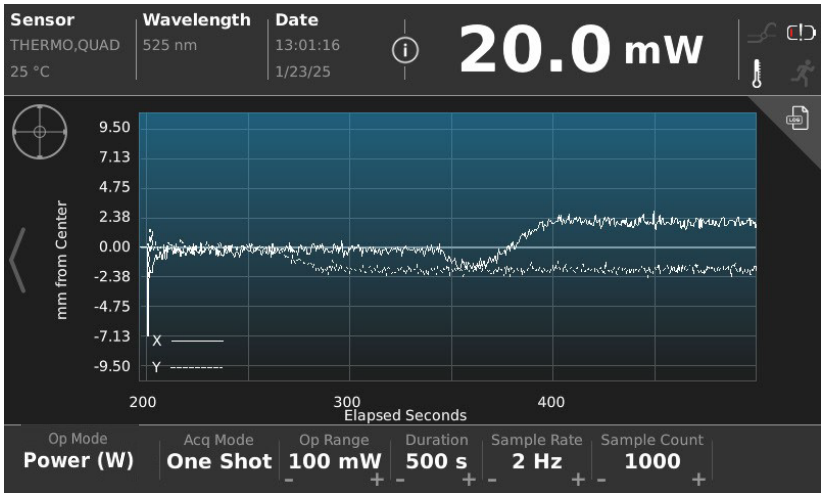

Figure 5-7. Beam Position Data

5.5 Pyroelectric (Power) Watts Mode

The figure shows the options in Power Watts Operation mode, in the bottom information and button bar. The ‘Op Mode’ button can be pressed to toggle between Power Watts and Energy Joules modes.

Note that the buttons that are visible change depending on factors such as the selected Operating Mode or the attached sensor.



Figure 5-8. Bottom Information Bar - Power Watts Mode

Pyroelectric-specific power information settings are available and displayed. The following describes the functions of all button modes used in both Power Watts and Energy Joules modes:

Acquisition Mode: Toggles between Continuous and One Shot pulses.

Refresh Mode: Toggles between internal Triggered and Free Run pulses. Only applies to sensors that have trigger functionality, such as Pyroelectric sensors.

Op Range: Allows manual selection of operating range (varies by sensor).

Duration: Allows selection for pulse duration between 1.00 and 10.00 ms.

Sample Rate: Allows selection of sample count rate.

- Pyroelectric sensors: **not applicable** (sample rate auto-selected)
- PowerMax Pro sensors: 1.00 Hz to 10 Hz.
- All other sensors: 1Hz to 10Hz



Figure 5-9. Sample Rate Setting Menu

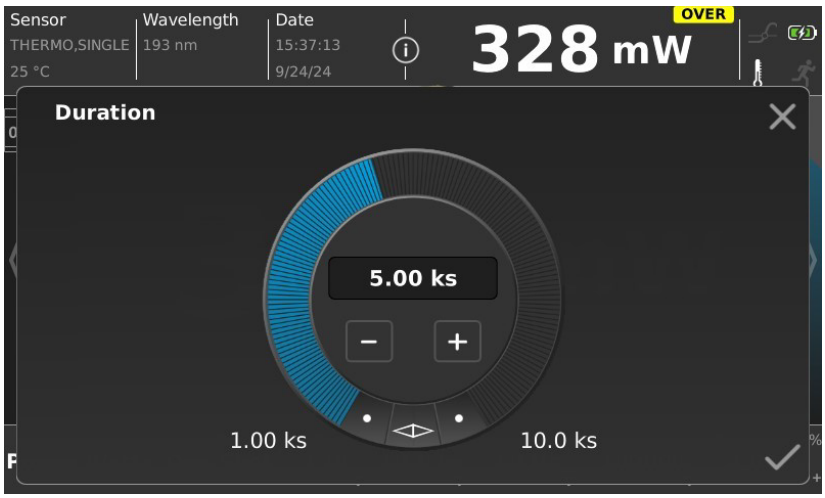

Figure 5-10. Duration Setting Menu

Sample Count: Allows selection of sample count value between 1000 and 100000. Note that directional arrows indicate the dial can be continuously rotated in order to reach the desired value.

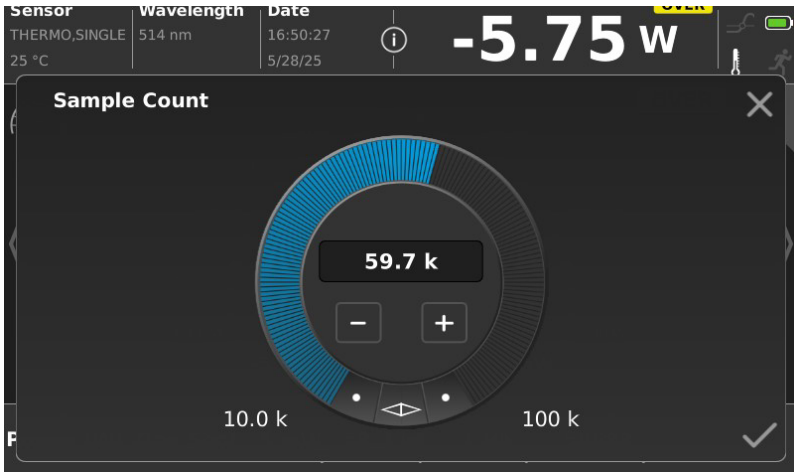

Figure 5-11. Sample Count Setting Menu

Trigger Level %: Allows selection of internal Trigger Level percentage in terms of the selected operating range, 0 to 100%.

NOTICE
Triggers and their indicators only apply to EnergyMax pyroelectric sensors. They do not apply to thermopile, optical or PowerMax Pro sensors.

5.6 Pulsed Thermopile Energy Joules Mode

NOTICE
This section applies only to the use of the FIeldMax Touch Pro model.

Figure 5-12 shows options in Energy Joules Operation mode, accessed via the bottom information and button bar. Press the ‘Op Mode’ button to toggle between Joules and Power Watts modes.

Note that the buttons that are visible change depending on factors such as the selected Operating Mode or the attached sensor.

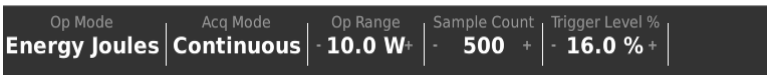

Figure 5-12. Bottom Information Bar - Energy Joules Mode

5.7 Auto Range Setting

This setting is available only for the thermopile and optical sensors. Acquisition source setting must be set to 'Slow' in the Acquisition Settings menu or via long-press of the Op Range button in the bottom button panel. Refer to Figure 5-13.

Pressing AUTO toggles between Auto Ranging and Manual Ranging mode.

- Auto Ranging mode instructs the meter to select the best measurement range for the incoming signal.
- Manual Ranging mode requires that the user select the range.

With Auto Ranging, unless it is at the top range, the instrument automatically ranges up rather than go into an over-range condition.

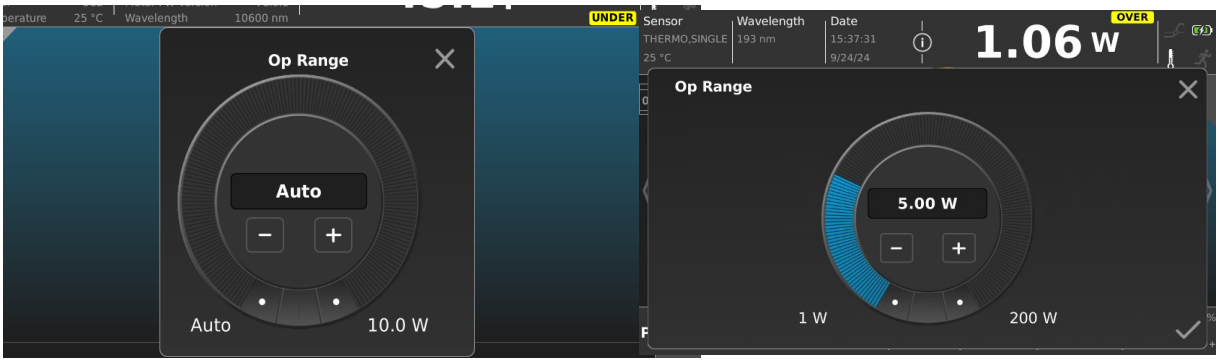

Figure 5-13. Auto Range Mode Selection - via Settings Menu or via Bottom Button Panel

NOTICE

If the measurement is above the maximum range allowed by the sensor, an over-range condition will occur, even while in Auto Ranging mode.

5.8 Indicators

As necessary, the user interface displays information in certain temporary conditions via indicators, visible here in the Measurement View in the Title Bar.

These indicators are also visible in the Tuning Measurement, and Statistics views, in addition to the Title Bar Measurements View.

Figure 5-14 shows possible indicators that can display on the touchscreen.

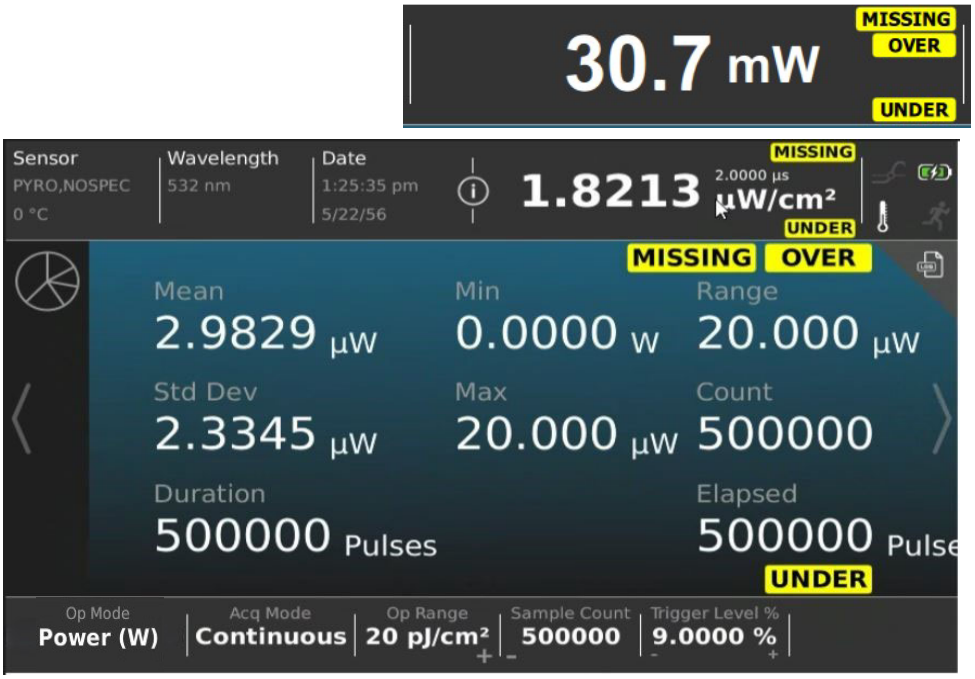

Figure 5-14. Indicator Display Types

MISSING: Indicates a hardware error condition that only happens with pyroelectric sensors, known as ‘missing pulses’. Normally for pyroelectric, the sensor receives a continuous sequence of power pulses.

The hardware detects the start and stop of the pulses automatically and generates an energy sample for each one it finds. Detection relies on various operating conditions, and sometimes fails to detect a pulse.

Causes and their remedies include:

- Pulse peak was less than 0.05% of range (remedy is to change to a more sensitive range).
- Baseline drifting too low (because the rep rate of the laser is too high).
- Gap in sequence numbers from the DSP.

OVER: Indicates that the acquisition hardware encountered signals that are too large for the current range. User should switch to a higher range or to Auto Range (thermopile and optical sensors only). If a display value is greater than the maximum allowable level for the selected range, over-ranging takes place.

UNDER: Indicates that the acquisition hardware encountered signals that went negative. This may mean the meter must be zeroed.

NOTICE

Measurement range selection is dependent on the sensor type and characteristics, as well as the wavelength of operation.

5.8.1 Meter Must be Zeroed

A configuration change may require the meter to be set to zero. When this occurs, a warning indicator appears at the top of the screen.

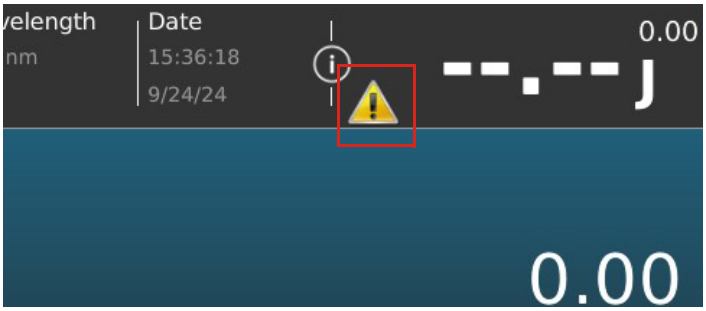

Figure 5-15. Meter is not Zeroed Warning Indicator

A popup message also displays. Refer to the example in Figure 5-16.

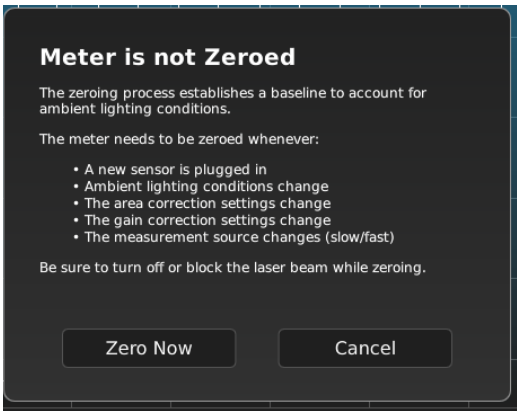

Figure 5-16. Meter is not Set to Zero Popup Message

If the meter is not set to zero (user presses ‘Cancel’), the warning indicator continues to display at the top of the screen. Refer to Figure 5-16.

For information on the Zero mode, refer to ’Set the Meter to Zero’ (p. 81).

5.9 Set the Meter to Zero

The ZERO indicator indicates that the instrument is in Zero mode. When the ZERO button is pressed, a Zeroing Meter message displays in the center of the screen and disappears when the zeroing process completes.

This indicator is not displayed when either of the following conditions exist:

- An invalid sensor is attached to the instrument.
- The instrument is in a Non-Zero mode (an EnergyMax pyroelectric sensor is used or acquisition mode is operating).

Pyroelectric sensors have a relative zero and, therefore, the ZERO indicator is not used with these types of sensors.

Optical sensors, on the other hand, use semiconductor diodes that have an absolute zero reference. When an *optical* sensor is attached to the instrument, pressing the Zero button causes the meter to toggle between the Zero and the Non-Zero modes.

Pressing the ZERO button clears all data and resets all values to zero.

The meter does not retain its zero values when it is turned off and then on again.

NOTICE

It is recommended that the meter is set to zero after first setting it on and before beginning any new set of power measurements. It should be the first thing that is done when using a thermopile, optical, or PowerMax Pro 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, the Zero button should be pressed 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 can only zero a finite level of offset. If zeroing on a selected range is unsuccessful, the meter displays an error message.

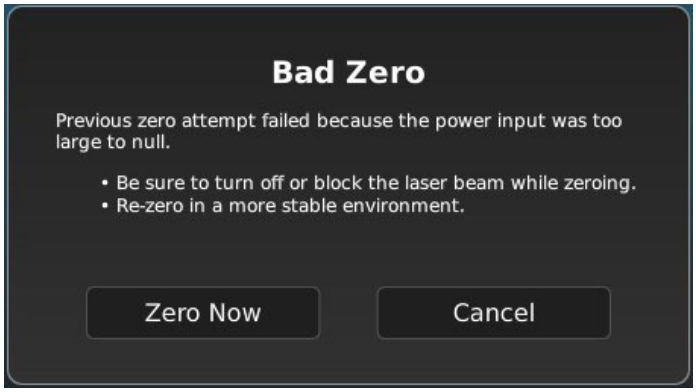

Figure 5-17. Bad Zero Error

NOTICE

If zero procedure is unsuccessful, this means that the power input is too large to zero it. Procedure must be done, without any laser input on the sensor, in a more stable environment or a different range must be selected.

5.10 Sensor Errors

If an invalid or unrecognized sensor is attached to the instrument, the meter and sensor data area at the top left of the screen displays ‘NONE’ for the Sensor Type. A message can also be displayed that indicates the sensor failed to initialize.If this occurs, contact Customer Service for support—refer to ’Service and Support’ (p. 189) for contact information.

5.11 Trigger States

NOTICE

Triggers and their indicators only apply to EnergyMax pyroelectric sensors and operating modes. They do not apply to thermopile, optical or PowerMax Pro sensors.

Triggering is done with either an external trigger input or a user-adjustable internal trigger. This section describes the following:

- External trigger input
- User-adjustable internal trigger
- Analog output

5.11.1 External Trigger Input

External triggering provides the most accurate readings. Since the meter is not looking for trigger events itself, the measured value is an actual laser pulse. External triggers also allow monitoring the missed pulses in Statistics mode, useful when diagnosing laser problems. The trigger is delivered with the supplied trigger-in/analog-out cable. Refer to Figure 2-9.

To prevent ground loop noise from interfering with accurate measurement, the external trigger input is optically isolated from the FieldMax Touch Meter internal ground by an optoisolator.

The trigger input pulse must be 3 to 6V, 500 nS pulse from a 50 ohm source. If a current source is used, the minimum trigger current is 5 mA. One possible buffer circuit is shown in Figure 5-18.

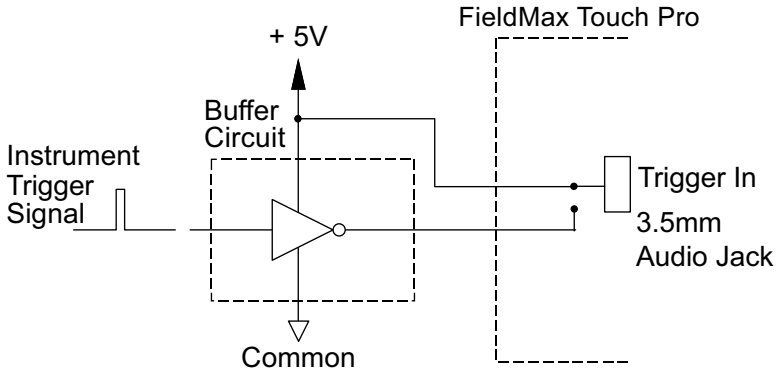

Figure 5-18. Boost Source Current of Triggering Device

The external trigger signal can be either a rising or a falling edge. Trigger polarity is selected in the Acquisition Settings menu (refer to Figure 5-19) or in the Coherent Measurement Connection software.



Figure 5-19. Trigger Settings

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

5.11.2 User-Adjustable Internal Trigger

NOTICE

Triggers and their indicators only apply to EnergyMax pyroelectric sensors. They do not apply to thermopile, optical sensors or PowerMax Pro sensors.

The internal trigger can be set from 0% to 100% of the operating range for pyroelectric sensors. Refer to 'Pyroelectric (Power) Watts Mode' (p. 75).

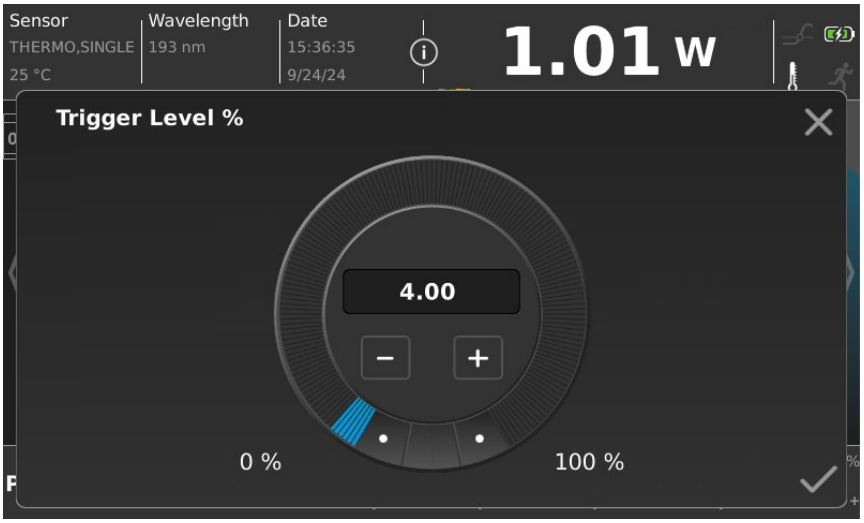

Figure 5-20. Trigger Level Setting

Instead of triggering the meter using an external signal, the internal trigger analyzes the signal waveform and waits for the set trigger level increase or decrease in the incoming signal. If the range is set to 1 Joule and the trigger to 10%, then the meter will wait until a 100mj rise/fall is seen on the meter and be triggered on that edge. This internal trigger is not applicable to thermopiles or optical sensors.

5.12 Analog Output Voltage Range

When power is on, the Analog Out SMB connector outputs a voltage in proportion 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 over-ranged. The full-scale output voltage (1, 2, or 4V from a 50 ohm source) is selected via the meter or the host interface. Factory default full-scale output voltage is 2V.

Analog output Full Range can be set under the Measurement tab in the Acquisition Settings. Refer to Figure 4-19. This voltage correlates with what the operating range is set to. For an operating range of 100mW and an Analog Output Full Range of 2VDC, then an output of 2V correlates to 100mW and an output of 0V correlates to 0mW.

6 Operation - Touch Screen Interface

6.1 Overview

Before any measurements described in this section are taken, read and observe all safety precautions about working in a laser environment.



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

This section provides instructions about how to take common power measurements with the FieldMax Touch Meter. This is done with the direct touchscreen interface for the following measurement types:

- **Power** – An average power reading between 1Hz to 10 Hz sampling rate. PowerMax Pro thermopile and optical sensors (non-pyroelectric). Applicable to use of FieldMax Touch Pro meter model only.
- **Pyroelectric (pyro)** – An energy reading with the use of a pyroelectric sensor up to 1000 pulses per second.
- **Pulsed Thermopile Joules (PTJ)** - (also known as Long Pulse Joules mode) A mode of measurement that uses a thermopile sensor to measure pulse energy of long pulses (greater than 1 ms) a single pulse at a time

For information on operation with the Coherent Meter Connection software, refer to 'Operation - Coherent Meter Connection' (p. 101).

The following sections provide procedures for these measurement types.

The types of energy measurement modes and the related compatible sensors are described in Table 6-1. Note, this is *only* applicable to the use of the FieldMax Touch Pro meter

Table 6-1. Energy Measurement Types

Energy Measurement Types	Sensor	Description
Pyroelectric	Pyroelectric	The sensor natively measures energy.
Long-pulse joules	Thermopile	

6.2 Take a Basic Power Measurement

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

Basic mode is compatible with PowerMax-Pro sensors and with thermopile and optical power sensors.

6.2.1 Overview

The Basic power measurement uses a maximum 10 Hz sampling rate.

In 10 Hz sampling mode, PowerMax sensors provide extremely fast (almost instantaneous) average power readings. This is similar to a photodiode, while also taking advantage of the sensor's ability to directly read very high powers.

However, because data is sampled every 100 milliseconds, temporal pulse information is not displayed.

6.2.2 Basic Measurement Procedure

Note that illustrations shown in this section are not repeated in subsequent tutorials for the exact same steps.

1. Connect the DB25 sensor to the FieldMax Touch Meter.
2. Press the Power button to set the FieldMax Touch Meter to ON.



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

3. Press the MENU function button to display the Settings menu.

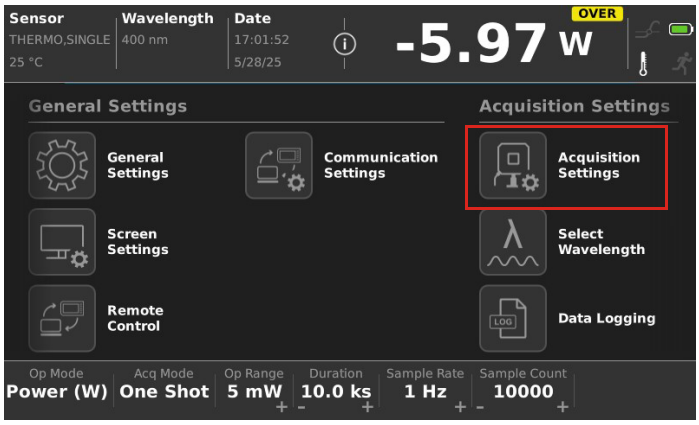

Figure 6-1. Settings Main Menu

4. Press the **Acquisition Settings** button on the touch screen.
5. Make sure that the **Acquisition Settings** sub-tab is selected. Refer to Figure 6-2.

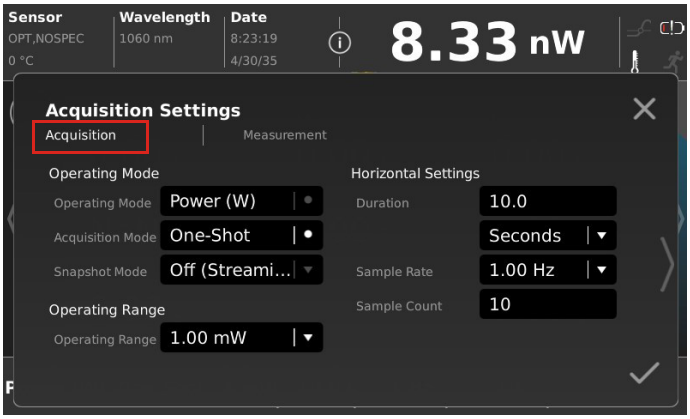

Figure 6-2. Acquisition Settings

6. Make sure that Power Watts is selected in the **Operating Mode** field.
7. In the **Range** field, set the operating range to the next value higher than the maximum expected power. Operating range can also be set

by long-pressing **OpRange** in the bottom menu bar. Refer to Figure 6-3.

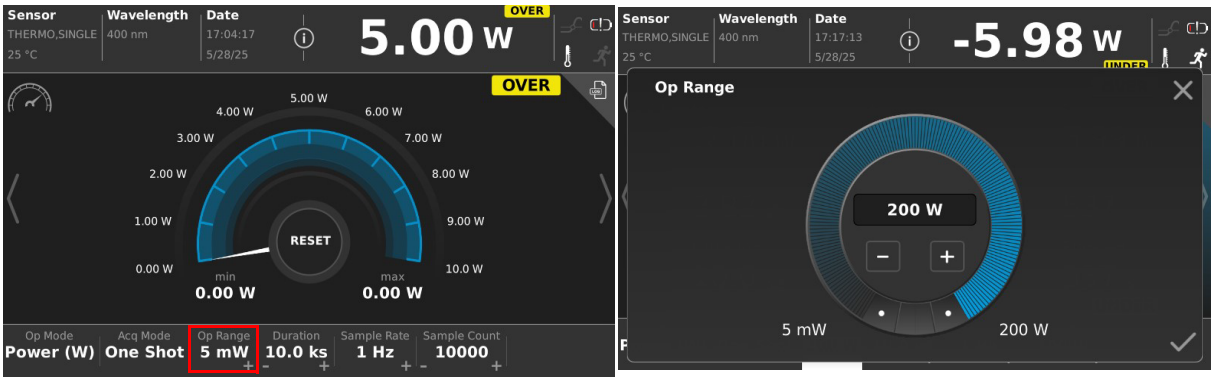

Figure 6-3. Set Operating Range from Settings Menu or Bottom Button Bar

The default range is specific to each sensor's electronics, so should be set each time a sensor is replaced or the meter is power-cycled.Select **Continuous** in the **Acquisition Mode** field if data collection should continue until it is manually stopped.

8. Deselect **Continuous** to have data collection end after the data buffer is full.
9. Select the Sample Rate to be collected in the **Sample Rate** field, from 1 Hz, 2 Hz, 5 Hz, or 10 Hz.
10. Press the **Measurement** sub-tab. Refer to Figure 6-4.

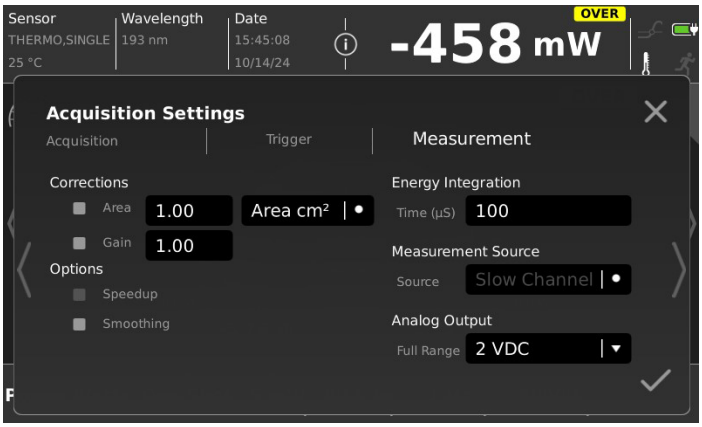

Figure 6-4. Acquisition Settings - Measurement

11. Press the BACK function button to close the Settings menu.
12. Press the WAVELENGTH function button.

- Select the needed wavelength from the drop-down menu.
- If the laser wavelength is not available, press **Edit List** to manually input the needed measurement wavelength to the Wavelength Table.

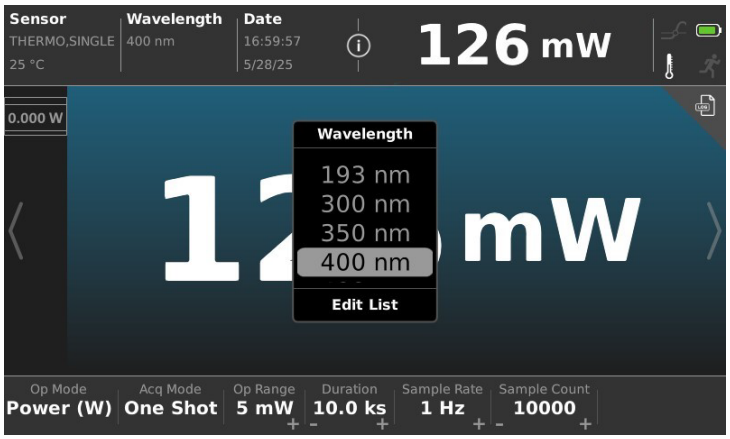

Figure 6-5. Select Wavelength

NOTICE

The default wavelength is specific to each sensor's electronics, so should be set each time a sensor is replaced or the meter is power-cycled

13. Swipe left or right on the touchscreen to select the desired view while data is captured.

NOTICE

To set the meter to zero, the laser must be set to OFF (or the beam blocked).

14. Press the ZERO function button to measure a baseline value for the sensor.
15. If desired, press the **Log File** button in the top right corner of the main display area to save the measurement data to a log file. Refer to

Figure 6-6. Note that the Log File button only appears if there is a USB connection to device.



Figure 6-6. Log File Button

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

16. Set the laser to ON and expose the sensor to the laser beam.
17. Press the RUN/STOP function button to begin data collection, and then activate the laser.
18. Press the RUN/STOP function button to end data collection.
19. When done, set laser to OFF.

6.3 Pyroelectric Energy Measurement

NOTICE
This section applies only to the use of the FieldMax Touch Pro model.

This tutorial describes how to take an energy reading with a pyroelectric sensor.

6.3.1 Set Up Basic Settings

1. Connect a compatible EnergyMax DB25 sensor to the FieldMax Touch Meter.
2. Set the FieldMax Touch Meter to ON.

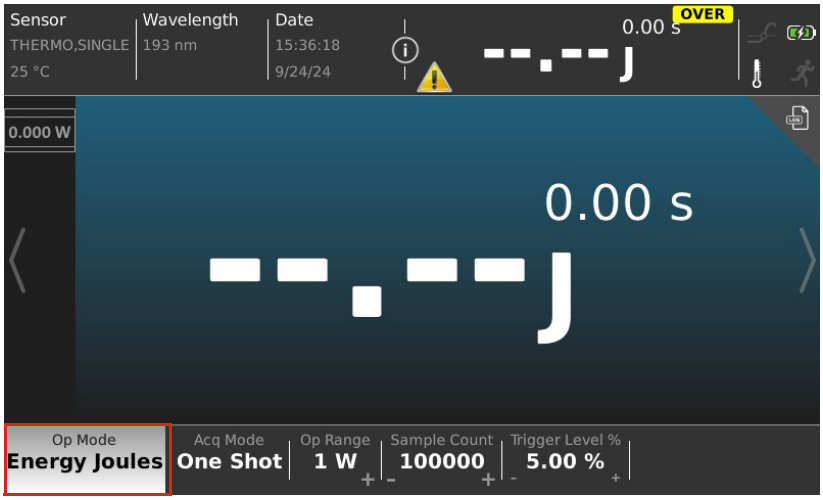

Figure 6-7. Bottom Information Bar - Energy Joules Mode Selected

3. Press the MENU function button to display the main Settings menu.
4. Press the **Acquisition Settings** button. Refer to Figure 6-1.
5. Select Energy Joules in the **Operating Mode** field. Alternately, press the **Op Mode** button in the bottom menu to select Energy Joules.
6. Select the **Operating Range** for the sensor.

   This value should be *above* the anticipated energy measurement. The default range is specific to each sensor's electronics, so should be set each time a sensor is replaced or the meter is power-cycled.

7. Select **Continuous** in the **Data Capture** field if data collection should continue until it is manually stopped. Deselect **Continuous** to have data collection end after the data buffer is full.

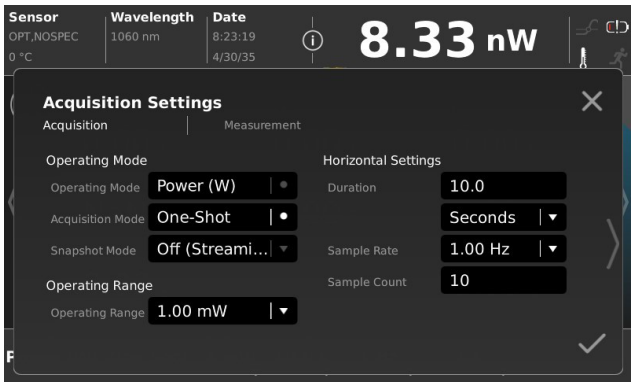

Figure 6-8. Acquisition Settings

8. Press the WAVELENGTH function button. Select the laser wavelength from the drop-down menu. Refer to Figure 6-9.
   - If the laser wavelength is not available, choose the one closest to it.
   - Alternatively, press **Edit Wavelength** to input a value to add to the Wavelength Table.

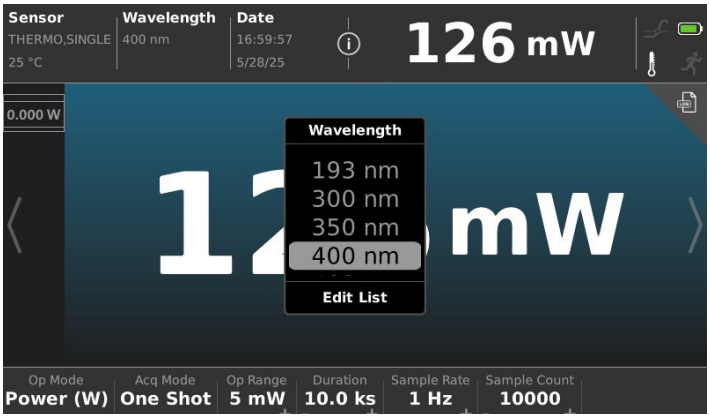

Figure 6-9. Wavelength Selection and Edit List Option

6.3.2 Set a Trigger Level

The trigger level is a threshold used to determine which signals are collected as energy measurements and which signals are ignored as noise. Set the trigger level at a threshold *below* the energy being measured and *above* the noise level of the sensor.

- Setting the trigger level too high can result in actual energy pulses being missed.
- Setting the trigger level too low can result in noise being picked up as readings.

To set a trigger level, do the following:

1. Press the MENU function button to display the Settings menu.
2. Press the **Acquisition Settings** button. Refer to Figure 6-1.
3. Press the **Trigger** tab to display Trigger settings. Refer to Figure 6-10.

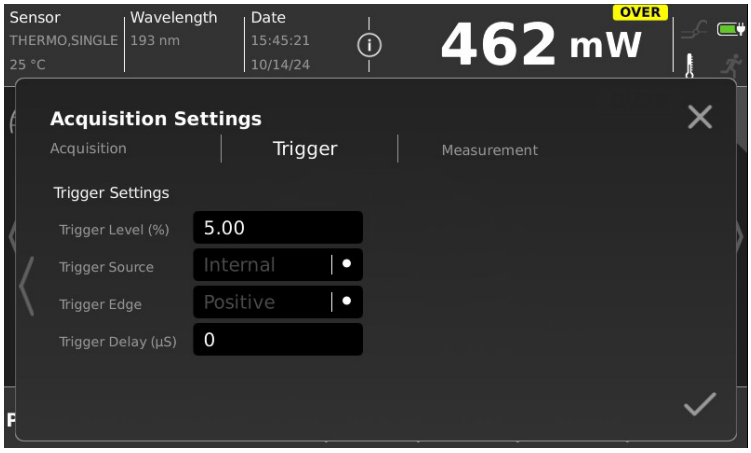

Figure 6-10. Acquisition Settings - Trigger

4. Select **Internal Trigger** in the **Trigger Source** field.
5. Set the Trigger Level. There are two ways:

   a.) Type the percentage in the **Trigger Level %** field to a level that is *below* the expected pulse energy to be measured.

   (or)

   a.) Press **Trigger Level%** in the bottom button bar. A dial displays to select the percentage. Refer to Figure 6-11.

   b.) Set the Trigger Level percentage in the popup menu to a level that is *below* the expected pulse energy to be measured.

   Note that the trigger level is always set as a percentage of the selected operating range.

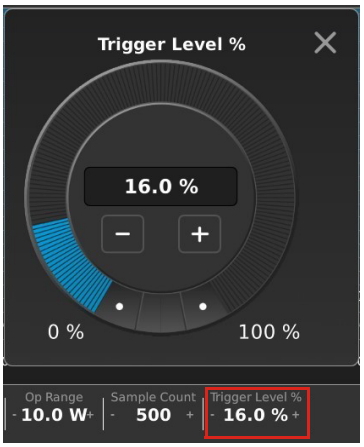

Figure 6-11. Trigger Level Percent Setting

6.3.3 Start Measurement and View the Results

1. If desired, press the **Log** button to save the measurement data to a log file. Refer to Figure 6-12.



Figure 6-12. Log File Button



CAUTION!
Make sure that either the laser is set to OFF or the beam is blocked until you are ready to take an energy measurement.

2. Swipe left or right on the main screen to go to the desired view while data is captured.
3. Set the laser to ON and expose the sensor to the laser beam.



WARNING!
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser can cause serious eye injury and possible blindness. Follow all safety precautions (see p. 177).

4. Press RUN/STOP to start measurement and collect data.

NOTICE
If the trigger setting is too high, no data displays and a Wait trigger indicator displays.

TIP: To determine if the meter is triggering appropriately, observe both the energy level being measured and the calculation for the rep rate, also known as the Pulse Repetition Frequency (PRF) rate. This PRF should match with the operating parameter of the laser.

5. If a 'Wait' or 'Too Many Pulses' message displays, or if readings don't match the readings expected from the laser, do the following:
   a.) Re-adjust the trigger level setting. Start just above the expected energy measurement.
   b.) Then slowly lower the threshold until pulses are visible at the expected rate.
6. If data logging was selected, the measurement is now saved as a log file in the meter's memory. Refer to 'Save a Log File' (p. 98) for more information on log files and file management.
7. Press the RUN/STOP function button to end measurement and data collection.
8. When done, set the laser to OFF.

6.4 Display Statistics

To display statistics, do the following:

1. Do the necessary procedure to complete a measurement with the sensor, as described previously in this chapter.
2. In the main window, swipe left or right to view the Statistics screen.

The associated statistics display in the statistics view:

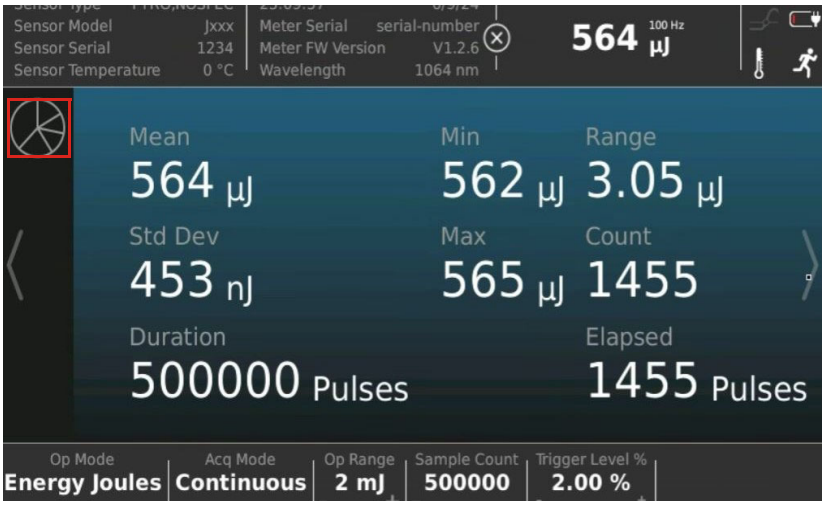

Figure 6-13. Statistics View

3. To adjust the statistics that are displayed, press the **Statistics Selection** button at the top left. Refer to the highlighted example in Figure 6-13.

6.5 Save a Log File

To save measurement data to a log file:

1. Perform the steps to set up data logging on the meter. Refer to 'Data Logging' (p. 55).
2. Complete a measurement with the sensor, as described in the sections above in this chapter.

   When the RUN/STOP button is pressed to end data capture, the captured data can then be saved as a specified log file.

3. Press the Log file button in the upper right corner of the screen to save a log file.



Figure 6-14. Log File Button

6.6 Export Capture Data to File

To export and save the log file that is currently in the buffer to an external flash drive, do the following:

1. Insert a flash drive into the USB port on the FieldMax Touch Meter. Note that it is recommended that USB flash drive format is FAT32, for compatibility.
2. Press the MENU function button.
3. Press **Export Capture Data** in the **System Utilities** tab on the Settings menu. Refer to Figure 4-11.
4. Select the necessary folder location on the USB drive, in the **Folder** field. Refer to the example in Figure 6-15.

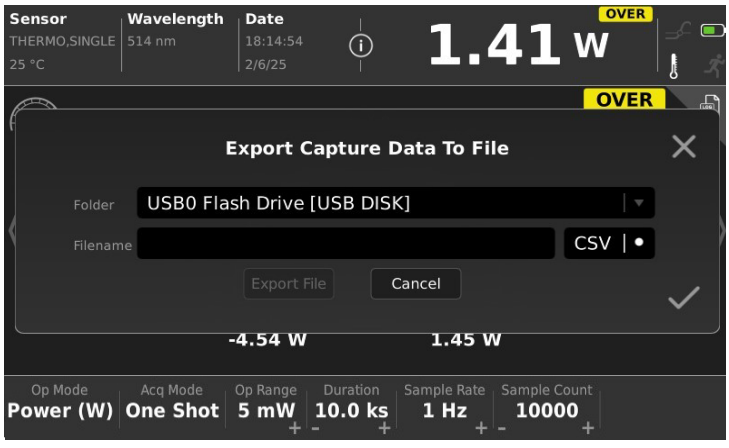

Figure 6-15. Save to File Settings

5. Select the file type (**CSV/TSV**) in the drop-down.
6. Press the **Filename** field to type the name for the file and then press the Enter key on the touchpad keyboard.
7. Press the **Export File** button to save the file to the USB flash drive.

7 Operation - Coherent Meter Connection

7.1 Overview

Before any measurements described in this section are taken, read and observe all safety precautions about working in a laser environment.

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

This section provides a limited description of the graphical user interface for the Coherent Meter Connection (CMC) software. It also provides instructions about how to take power measurements with the FieldMax Touch Meter with the CMC software for the following measurement modes:

- **Power**– A nearly instant average power reading at 10 Hz fixed sampling rate for legacy non-pyro sensors.
- **Energy** – An energy reading with use of an EnergyMax pyroelectric sensor; maximum 1 kHz pulse repetition rate with FieldMax Touch Pro only.

NOTICE
To enable use of the PC software with the device, Remote Communications must be enabled on the touch screen in the Settings menu. Refer to 'Bottom Main Window Information Bar' (p. 42).

For more information, refer to the *Coherent Meter Connection Software User Manual* available at:

www.coherent.com/resources

7.2 Graphical User Interface

Figure 7-1 shows the main screen user interface when the software is started.

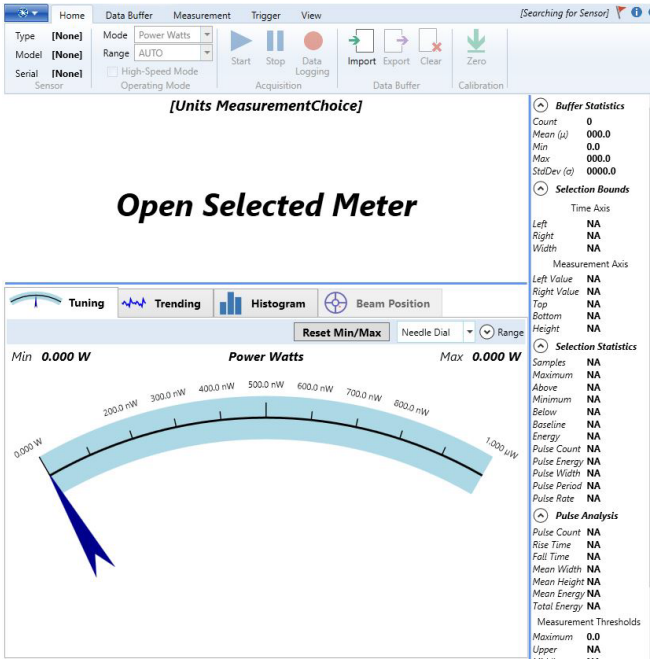

Figure 7-1. Coherent Meter Connection Main Start Screen

7.2.1 Manage Display Cursors

This section describes how to set up and manage the Cursors feature in the software.

The Cursors feature is a powerful tool to analyze pulses that have been captured. This feature can be used either after stopping live data collection or after importing a saved data file into the software.

7.2.1.1 Procedure

1. [**Trending view tab**] Right-click in the Graphics viewing panel to open the Trending Window Options popup menu. Refer to Figure 7-2.

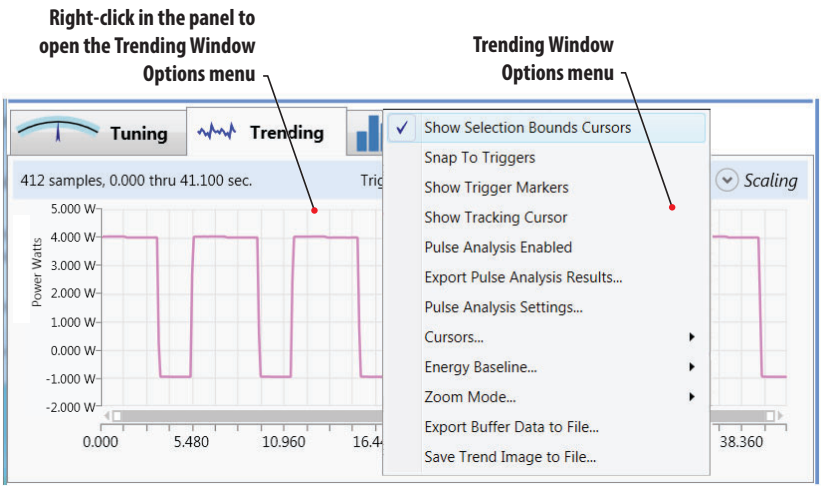

Figure 7-2. Trending Options

2. From the pop-up menu shown in Figure 7-2, select the desired options to display:

Table 7-1. Select Cursor

Option	Description	
Show Selection Bounds Cursor…	Displays lines in the Trending chart.	
	Vertical	Mark sample time positions.
	Horizontal	Mark measurement levels.
Show Tracking Cursor	Allows you to inspect a single pulse at a time.	
Cursors…	Allows you to drag a cursor to zoom in on a range of data: • Reposition cursor. • Zero lower cursor. • Select entire buffer.	

3. Click the **Show Selection Bounds Cursors** check box in the pop-up menu. A horizontal dashed line is displayed at the baseline and in the middle to upper portion of the window.

   To display vertical lines, click the mouse at the side of the chart and drag a vertical line close to the pulse you want to view. Repeat on both the left and right sides of the chart.

   Notice that the software shades the area under the pulse that falls between the cursors, as shown in Figure 7-3.

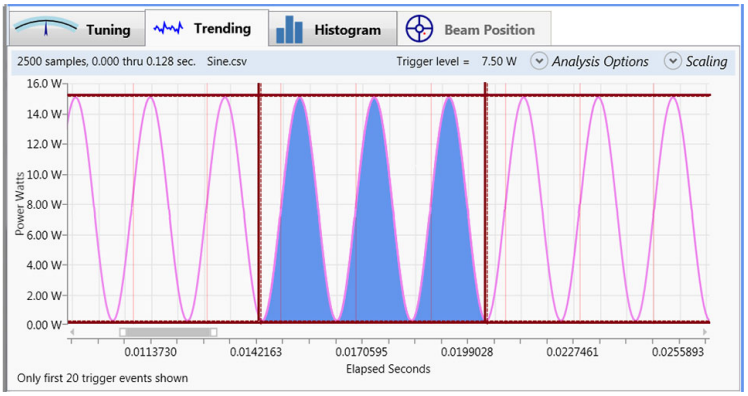

Figure 7-3. Trending Window

   The default settings for cursors are set in equidistant thirds in the display panel.

   After the first time they are used, cursor settings are retained until they are changed. Cursors across Start/Stop and Import/Export actions stay the same, rather than being reset each time.

4. Drag the cursors to fit around the necessary pulse shapes or features.

5. To zoom in on details of the pulse and further refine the data:

   - Click and drag the mouse around the pulse shape. When you release the mouse, the shape expands.

- Use the wheel on the mouse to zoom in and out on the shape of the pulse.

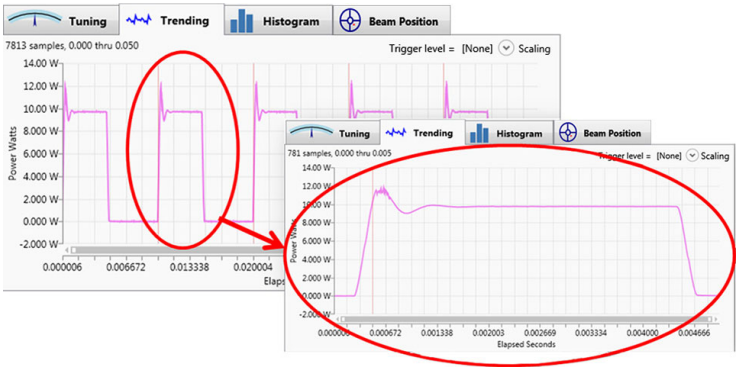

Figure 7-4. Zoom In/Out of the Pulse Display

The software calculates the energy of a pulse or pulses in the area selected by the cursors.

7.2.1.2 Selection Bounds Statistics

Based on the region of the plot selected by the cursors, statistics automatically update for the Selection Bounds. See the Statistics Panel on the right side of the window to see the results (as shown in Figure 7-5).



Figure 7-5. Selection Bounds

View the **Time Axis –Width** measurement to determine pulse width, rise-time, or fall time of a pulse in the plot.

7.2.1.3 Energy Baseline

To determine if the pulse energy calculation is based on the 0 mW baseline level or the lower cursor level, use the **Energy Baseline** option in the pop-up menu. You can also customize this level, as shown in Figure 7-6.

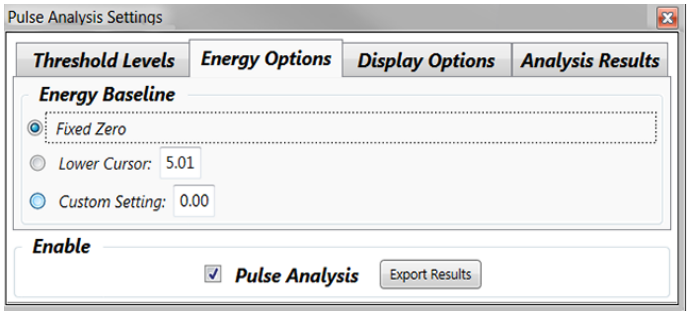

Figure 7-6. Set Energy Baseline

7.2.1.4 Snap To Triggers

Use the **Snap To Triggers** setting to set the cursors to the trigger point at the beginning of successive pulses.

If **Snap To Triggers** is set to OFF, this allows the cursors to be moved to non-trigger positions, as shown in Figure 7-7.

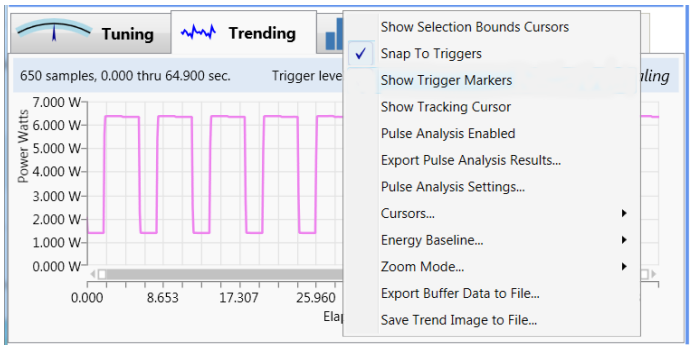

Figure 7-7. Snap to Triggers

7.2.1.5 Reset Cursors

Cursor settings are retained across Start/Stop and Import/Export actions, rather than being reset each time as in previous releases.

To reset cursors to their original positions:

1. Go to any area in the Trending window and right-click to display a pop-up menu.
2. From the pop-up menu, select Cursors … > Reposition Cursors.

7.2.1.6 Show Tracking Cursor

A tracking cursor can be used separately or in combination with the Selection Cursor Bounds.

When selecting Show Tracking Cursor from the pop-up menu, a set of dashed lines are displayed (one horizontal, one vertical). The intersection of the horizontal and vertical lines over the pulse is the sample point, as shown in Figure 7-8.

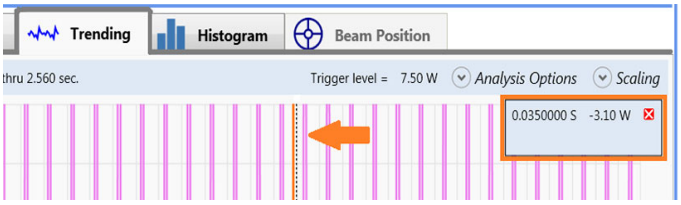

Figure 7-8. Show Tracking Cursor

Continue to zoom in to refine the data.

The data box in the right corner of the Trending chart shows the current values for the width and power level. This information is not used for statistics or analysis, but for purposes of review and inspection only.

7.3 Take a Basic Power Measurement

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

Basic mode is compatible with PowerMax-Pro sensors, as well as with thermopile and optical power sensors.

7.3.1 Overview

The Basic power measurement mode uses a typical 10 Hz sampling rate.

In 10 Hz sampling mode, PowerMax-Pro sensors provides extremely fast (almost instantaneous) average power readings. This is similar to a photo-diode, while also taking advantage of the sensor's ability to directly read very high powers.

However, because data is sampled every 100 milliseconds, temporal pulse information is not displayed.

7.3.2 Basic Measurement Procedure

Please note that Illustrations shown in this section are not repeated in subsequent tutorials for the exact same steps.

1. Set the FieldMax Touch Meter to ON.
2. Double-click the shortcut icon to start the FieldMax Touch Meter PC software.



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

3. [**Home tab**] To take a basic power measurement, select or change the following settings in the Home tab:

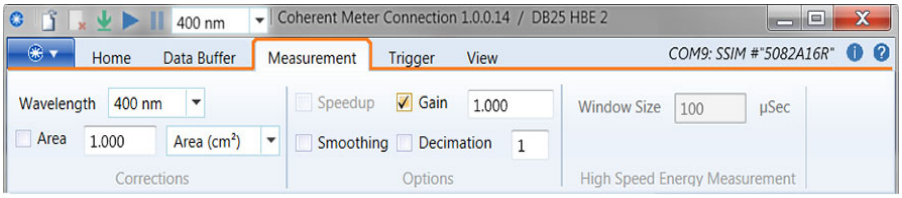

Figure 7-9. Settings for a Power Measurement

4. **[Home tab]** Press the **Zero** button shown in Figure 7-10 to measure a baseline value for the sensor. A dialog box displays the zeroing process; this takes only a few seconds.

   NOTE: To set the meter to zero, the laser must be set to OFF (or the beam blocked).

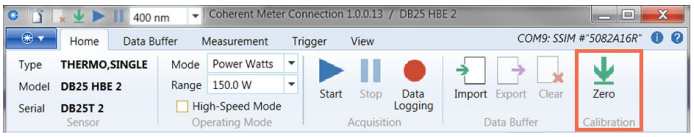

Figure 7-10. Zero to Set Baseline

For a basic power measurement, select or change the following settings in the [**Data Buffer tab**]:

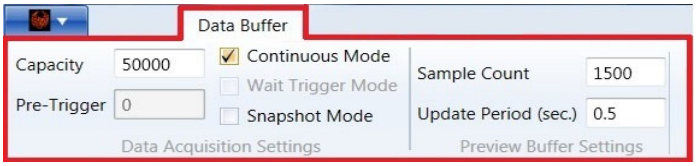

Figure 7-11. Data Buffer Settings

5. [**Data Buffer tab**] In the **Capacity** field, enter a value that represents the sample size you want to collect. This value is also the sample size used to calculate Statistics.
6. [**Data Buffer tab**] For the **Continuous Mode** check box:
   - Click the check box if you want data collection to continue until you manually stop it.
   - Deselect the check box to have data collection end after the Data buffer is full (when it reaches the value in the Capacity field).

   For a basic power measurement, select or change the following settings in the [**Measurement tab**]:

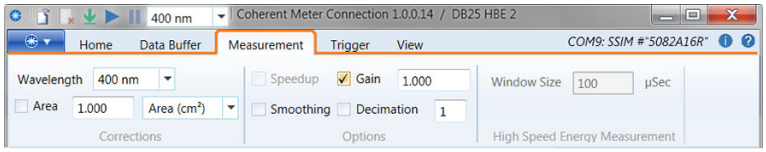

Figure 7-12. Measurement Tab Settings

7. [**Measurement tab**] Select your laser **Wavelength** from the drop-down menu. If the laser wavelength is not available, choose the setting that is closest to it.

   Alternatively, type the specific wavelength to replace [None]; the value you enter is added to the Wavelength Table.

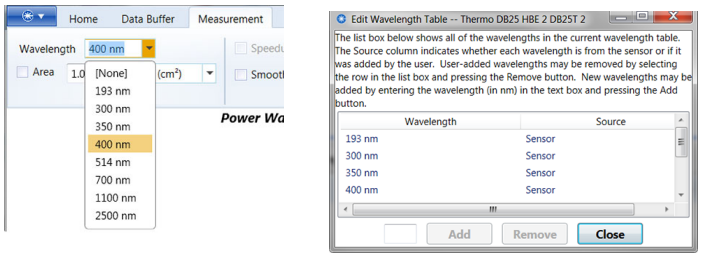

Figure 7-13. Select the Wavelength

8. [**Trending view tab**] Click the Trending tab in the lower half of the window to display the Graphics viewing panel.

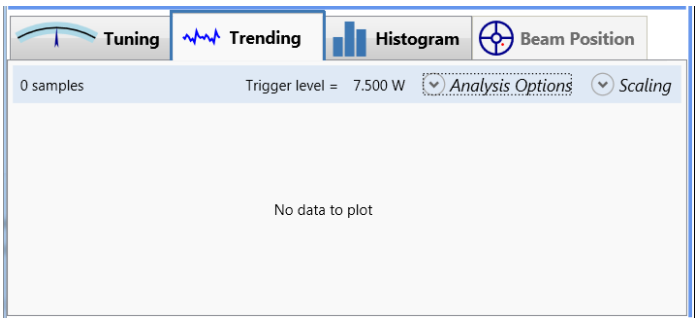

Figure 7-14. Display Trending Tab Panel

9. Set the laser to On and expose the sensor to the laser beam.



WARNING!
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser WILL cause serious eye injury and possible blindness. Follow all safety precautions (see p. 177).

10. [**Quick Access toolbar** or **Home tab**] To begin data collection, press the **Start** button in the toolbar or the Home tab.

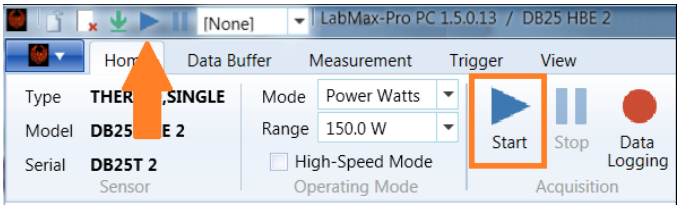

Figure 7-15. Start Measurement

11. [**Quick Access toolbar** or **Home tab**] To end data collection, click the **Stop** button in either the toolbar or the Home tab.

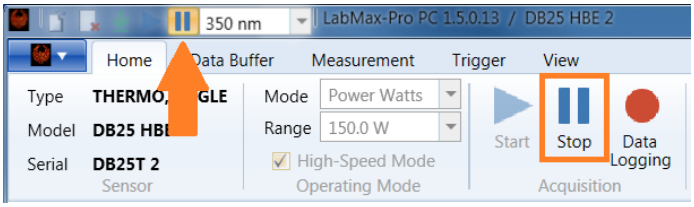

Figure 7-16. Stop Measurement

The following example shows how and where information is displayed during data collection:

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

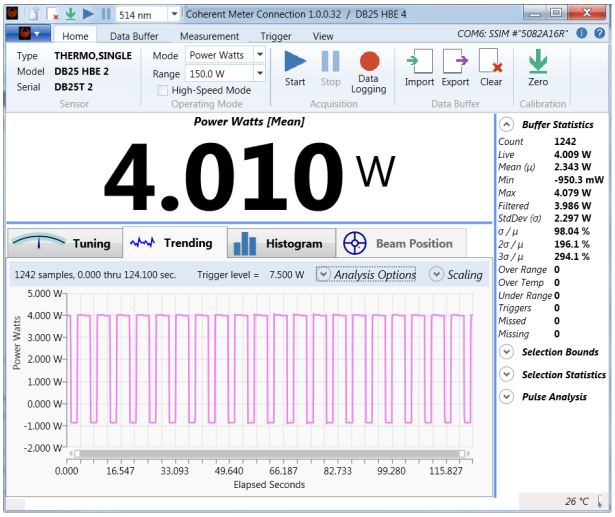

Figure 7-17. Trending Tab View

The Trending view chart and Statistics can be viewed to see the overall minimum and maximums for the data.

12. In the **[Home tab]**, click an button to **Export** or **Clear** the capture. The Clear icon can also be clicked in the Quick Access toolbar.

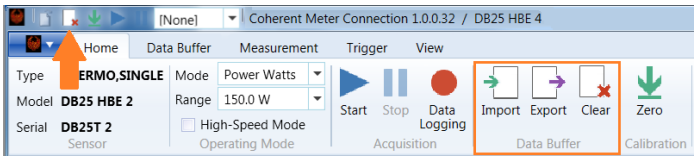

Figure 7-18. Export or Clear the Capture

7.3.3 Zoom Mode

The following examples describe how to zoom in or out when viewing the measurement in the Trending view chart.

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

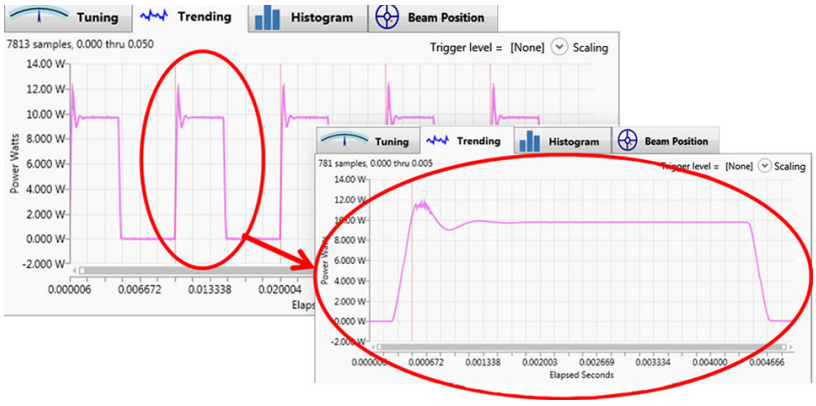

Figure 7-19. Zoom Mode

- Use the mouse wheel to zoom in or out.
- Use the scroll bar to define a portion of the display (drag either the left or right handle in the scroll bar) or scroll the display (drag the scroll bar to the left or right).

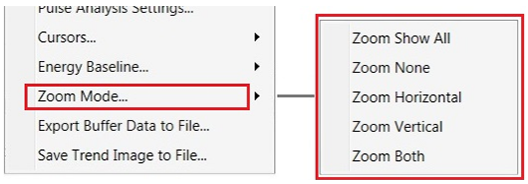

Figure 7-20. Zoom Options

Alternatively, right-click in the Trending chart and select zoom settings from the pop-up menu.

7.4 Pyroelectric Energy Measurement

This tutorial describes how to take a high-energy reading using a pyroelectric sensor.

7.4.1 Procedure

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



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

2. [**Home tab**] select or change the following settings in the Home tab:
   - In the drop-down menu for **Mode**, select Energy Joules.
   - In the drop-down menu for **Range**, select the energy range (typically the next higher range than the expected energy level being measured).

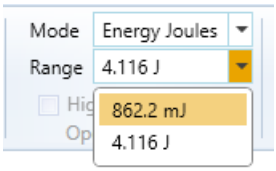

Figure 7-21. Select Range

3. [**Data Buffer tab**] Select or change the following settings in the Data Buffer tab:
4. [**Data Buffer tab**] In the **Capacity** field, enter a value that represents the sample size you want to collect. This value is also the sample size used to calculate Statistics.
5. [**Data Buffer tab**] For the **Continuous Mode** check box:
   - Click the check box to have data collection continue until it is manually stopped.

- Deselect the check box to have data collection end after the Data buffer is full (which is when it reaches the value you entered in the Capacity field).

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

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

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

6. [**Measurement tab**] Select the laser wavelength from the drop-down menu. If the laser wavelength is not available, choose the one closest to it.

   Alternatively, type a specific wavelength to replace [None]; the value you enter is added to the Wavelength Table.

7.4.2 Set an Internal Trigger Level

1. [**Trigger tab**] Set an appropriate **Trigger Level** (based on either units of joules *or* percent).
2. Set the **Source** to Internal.

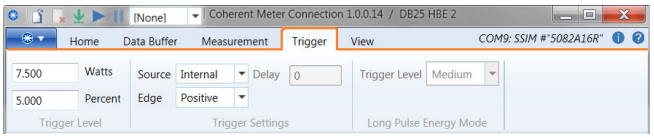

Figure 7-22. Set Trigger

TIP: If the energy level being measured is known, the trigger level can be entered as a joules value that is lower than the expected energy level to be measured.

Alternately, the trigger level can be set as a percent of the currently selected energy range.

The trigger level is a threshold used to determine which signals are collected as energy measurements and which signals are ignored as noise. Set the trigger level at a threshold below the energy being measured and above the noise level of the sensor.

- Setting the trigger level too high can result in actual energy pulses being missed.
- Setting the trigger level too low can result in noise being picked up as readings.

To view the acceptable limits for the trigger level settings, hover the cursor over the settings in the software.

7.4.3 Display the Results

1. [**Trending view tab**] Click the **Trending** tab in the lower half of the window to display the Graphics viewing panel.
2. Set the laser to ON and expose the sensor to the laser beam.



WARNING!
Exposure to laser radiation can be harmful. Direct eye contact with the output beam from a laser can cause serious eye injury and possible blindness. Follow all safety precautions (see p. 177).

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

The following example shows information displayed during data collection:

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

  TIP: To determine if the meter is triggering appropriately, observe both the energy level being measured and the calculation for the rep rate, also known as the Programmable Rate Frequency (PRF) rate.

  If those readings do not match the readings expected from the laser, re-adjust the trigger level setting until the energy level and the rep rate fall within an acceptable range.

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

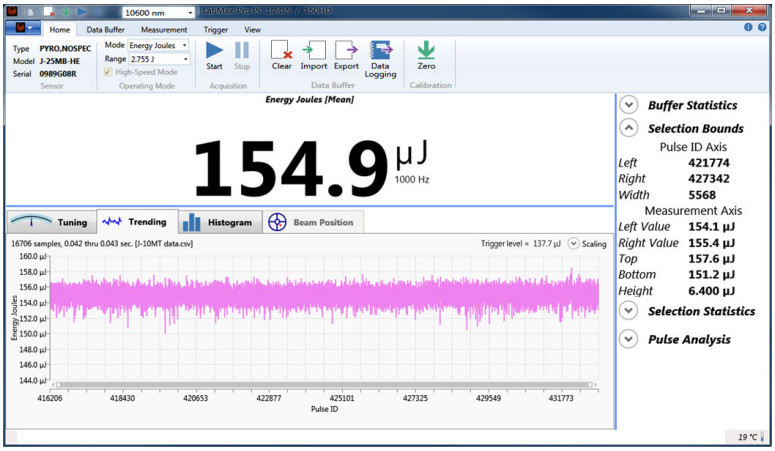

Figure 7-23. View Data Collection

8 External Computer Control Host Commands

This section describes the external control and host software interface for the FieldMax Touch Meter touch screen.

8.1 Communication Channels

NOTICE

To enable remote PC interface with the meter, Remote Communications must be enabled on the touch screen with the quick access toolbar. Refer to 'Bottom Main Window Information Bar' (p. 42).

FieldMax Touch Meter supports three different communication channels:

- USB
- Ethernet

Only one channel can be active at a given time. To simplify set-up, all channels listen passively for incoming commands. As soon as a channel receives a valid command, it becomes the active channel.

Each of these channels can be viewed as a bidirectional byte-stream and therefore operate with the same command protocol and syntax.

The USB channel presents itself as a virtual COM port, with the use of a simple USB Type A cable. The port is configured with 115kbaud N/8/1 no flow control.

The Ethernet port uses TCP/IP and the meter listens on a user-configurable port (default is 58975).



NOTICE

The Ethernet channel is unencrypted and unauthenticated. Therefore, it is unsuitable for communicating over a public network, such as the Internet. The assumption is that the customer will use the device only on a local network, behind a company firewall.

8.2 Communication Protocol

The meter uses SCPI syntax, similar to other test and measurement equipment.

Commands are strings of ASCII characters. Commands are grouped into a hierarchy by functional area. Levels in the hierarchy are separated by colons (:). The protocol is case-insensitive; however, most commands have a long and a short form. It is customary (but not required) to:

- Capitalize the characters that are required for the short form.
- Use lowercase for the additional characters that may be sent for the long form.

For example, both are equally valid:

```
CONFigure:GAIN:FACTor 1.0
CONF:GAIN:FACT 1.0
```

Most commands can also be queried by appending a question mark:

```
CONFigure:GAIN:FACTor? // host sends a query 1.0
                       // meter replies with the value
CONF:GAIN:FACT?
1.0
```

All communication is initiated by the host sending a command to the meter. The meter simply responds to requests from the host.

Table 8-1. Touch Meter Host Commands

FieldMax Touch Command	Description	Argument
SCPI Common Commands		
*IDN?	Queries meter identification string, such as model name, FW version, FW date	
*RST	Resets all parameters to their default values.	
*WAI	Blocks until all pending commands have been processed.	
System Options		
Local Control Lockout		
SYSTem:REMote	Places the meter in remote mode.	
SYSTem:LOCal	Places the meter in local mode.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
SYSTem:RESTart	Restart the meter.	
SYSTem:SHUTdown	Power off the meter.	
Meter Information		
SYSTem:STATus?	Queries the system status.	
SYSTem:INForma-tion:BATTery:HEALth?	Queries the battery health as a percentage.	
SYSTem:INForma-tion:BATTery:PERCent?	Queries the remaining battery capacity as a percent of full charge.	
SYSTem:INForma-tion:BATTery:STATus?	Queries the current battery status.	
SYSTem:INFormation:INSTru-ment:BOARd?	Queries the board ID.	
SYSTem:INFormation:INSTrume nt:CPU:TEMPerature ?	Queries the cpu temperature in Celsius.	
SYSTem:INFormation:INSTru-ment:FVER?	Queries the meter firmware version.	
SYSTem:INFormation:INSTru-ment:MDATe?	Queries the meter manufacture date.	
SYSTem:INForma-tion:PNUMber?	Queries the meter part number.	
SYSTem:TIME	Sets the time maintained within the meter.	{hour},{minute},{se cond}
SYSTem:TIME?	Queries the time maintained within the meter.	
SYSTem:DATE	Sets the date maintained within the meter.	{year},{month},{da y}
SYSTem:DATE?	Queries the date maintained within the meter.	
SYSTem:INFormation:INSTru-ment:SNUMber?	Queries the meter serial number.	
Sensor Information		
SYSTem:INForma-tion:PROBe:TYPE?	Queries the currently-connected sensor type.	
SYSTem:INForma-tion:PROBe:MODel?	Queries the currently-connected sensor model.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
SYSTem:INForma-tion:PROBe:SNUMber?	Queries the serial number of the sensor.	
SYSTem:INForma-tion:PROBe:RESPonsivity?	Queries the currently-connected sensor calibra-tion responsivity.	
SYSTem:INForma-tion:PROBe:CDATe?	Queries the calibration date of the sensor.	
SYSTem:INForma-tion:PROBe:TEMPerature?	Queries the head temperature of the sensor.	
SYSTem:INForma-tion:PROBe:DIAMeter?	Queries the sensor diameter.	
SYSTem:INForma-tion:PROBe:CODe?	Queries the probe code.	
Display Control		
DISPlay:BACKlight	Controls the backlight on/off state.	{DEFault|ON|OFF}
DISPlay:BACKlight?	Queries the backlight on/off state.	
DISPlay:INTensity	Controls the backlight intensity.	{DEFault|float: 0.0-1.0}
DISPlay:CLEar	Clears the text display.	
DISPlay:SAVE	Save a screenshot to internal or external flash.	{string} Optional path argu-ment
DISPlay:TEXT	Displays text message on the GUI. Limited to 80 characters.	{string}
Numeric Display Resolution		
CONFigure:RESolution	Sets the number of display digits used for displaying measurements.	{DEFault|integer}
Meter Configuration Management		
MEMory:STATe:SAVE	Stores the current configuration to the named configuration file.	{filename}
MEMory:STATe:RECall	Loads and activates the configuration state held in the named configuration file.	{filename}
Communication Settings		

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
Message Handshaking		
SYSTem:COMMunicate:HANDshaking	Selects the state of SCPI message round-trip handshaking.	{ON|OFF}
SYSTem:COMMunicate:HANDshaking?	Queries the state of SCPI message round-trip handshaking.	
Ethernet Specific		
SYSTem:COMMunicate:ETHernet:DHCP?	Queries whether the router automatically assigns network settings to the meter.	
SYSTem:COMMunicate:ETHernet:GATeway?	Queries the default gateway for network communications.	
SYStem:COMMunicate:ETHernet:HOSTname?	Queries the hostname used for network communication.	
SYSTem:COMMunicate:ETHernet:IPADdr?	Queries the IP address of the meter.	
SYSTem:COMMunicate:ETHernet:MAC?	Queries the MAC address of the meter.	
SYSTem:COMMunicate:ETHernet:PORT?	Queries the port number on which the meter listens for communications from a remote host.	
SYSTem:COMMunicate:ETHernet:NETMask?	Queries the subnet mask for network communications.	
Measurement Setup and Control		
Measurement Mode Select		
CONFigure:MEASure	Selects the meter measurement mode.	{DEFault|J|W}
CONFigure:MEASure?	Queries the meter measurement mode.	
Display Mode Select		
CONFigure:DISPlay	Selects the display mode.	{DEFault|HISTogram|STATistics|PSTability|TUNE|MEASure}
Area Correction		
CONFigure:AREA:CORRection	Enables or disables area correction.	{DEFault|ON|OFF}
CONFigure:AREA:CORRection?	Queries area correction.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
CONFigure:AREA:APERture	Sets the aperture area.	{float}
CONFigure:AREA:APERture?	Queries the aperture area.	
Analog Output Full Scale Voltage		
CONFigure:AOUT:FSCale	Selects the full scale output voltage at the analog output connector.	{DEFault|1|2|4}
CONFigure:AOUT:FSCale?	Queries voltage at the output connector.	
CONFigure:SPEedup	Sets the speedup algorithm for thermopile sensors.	{DEFault|ON|OFF}
Data Display Smoothing		
CONFigure:AVERage:PULSe	Sets the display data smoothing window size in number of pulses.	{DEFault|OFF|AUTO|integer}
CONFigure:AVERage:PULSe?	Queries the display data smoothing window size.	
CONFigure:AVERage:TIME	Sets the display data smoothing window size in seconds.	{DEFault|OFF|AUTO|integer}
CONFigure:AVERage:TIME?	Queries the display data smoothing window size.	
Wavelength Correction		
CONFigure:WAVElength:CORRection	Enables or disables wavelength corrrection.	{DEFault|ON|OFF}
CONFigure:WAVElength:CORRection?	Queries the wavelength corrrection.	
CONFigure:WAVElength:WAVElength	Sets the operational wavelength.	{MAXimum|MINimum|integer}
CONFigure:WAVElength:WAVElength?	Queries the operational wavelength.	
CONFigure:WAVElength:LIST?	Queries the wavelength table entries.	
Gain Compensation		
CONFigure:GAIN:COMPensation	Enables or disables gain compensation.	{DEFault|ON|OFF}
CONFigure:GAIN:COMPensation?	Queries gain compensation.	
CONFigure:GAIN:FACTor	Sets the gain compensation factor	{DEFault|0.001…..100000.0} {DEFault|float}

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
CONFigure:GAIN:FACTor?	Queries the gain compensation factor	
Probe Zero		
CONFigure:ZERO	Sets the current sensor input voltage as the zero baseline voltage.	
CONFigure:ZERO?	Queries the current sensor input voltage.	
Range Select		
CONFigure:RANGe:SELect	Selects the meter measurement range.	{float} (maximum expected measurement value)
CONFigure:RANGe:SELect?	Queries the meter measurement range.	
CONFigure:RANGe:AUTO	Enables or disables automatic selection of the meter measurement range.	{DEFault|ON|OFF}
CONFigure:RANGe:AUTO?	Queries the meter measurement range.	
CONFigure:RANGe:LIST?	Queries list of available ranges.	
Trigger Parameters		
TRIGger:SOURce	Selects the trigger source.	{DEFault|INTernal|EXTernal}
TRIGger:SOURce?	Queries the trigger source.	
TRIGger:LEVel	Sets the trigger level.	{DEFault|float:0.0-100.0}
TRIGger:LEVel?	Queries the trigger level.	
TRIGger:SLOPe	Selects the external trigger edge.	{DEFault|POSitive|NEGative}
TRIGger:SLOPe?	Queries the external trigger edge.	
TRIGger:DELay	Sets the external trigger delay time.	{DEFault|integer:0-1000}
TRIGger:DELay?	Queries the external trigger delay time.	
TRIGger:PTJ:LEVel	Sets the trigger level for the Pulsed-Thermopile-Joules algorithm.	{DEFault|LOW|MEDium|HIGH}
TRIGger:STATus?	Queries the trigger status.	
Alarms and Limits		
LIMIT:FAULt:HIGHlight	Enables/disables highlight measurement window.	{DEFault|ON|OFF}

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
LIMIT:FAULt:HIGHlight?	Queries whether the highlight measurement window is on or not.	
LIMIT:FAULt:STOP	Enables/disables stop on fault.	{DEFault|ON|OFF}
LIMIT:FAULt:STOP?	Queries stop on fault.	
LIMIT:FAULt:COUNt?	Returns number of measurements that failed the criteria since start of acquisition.	
LIMIT:MAXimum	Set the maximum threshold for alarm/limit testing.	{float}
LIMIT:MAXimum?	Queries the maximum threshold for alarm/limit testing.	
LIMIT:MINimum	Set the minimum threshold for alarm/limit testing.	{float}
LIMIT:MINimum?	Queries the minimum threshold for alarm/limit testing.	
LIMIT:CRITeria	Set the pass criteria for alarm/limit testing.	{ DEFault|INSide|OUTSide|LESMIN|LEQMIN|GTRMIN|GTEMIN|LESMAX|LEQMAX|GTRMAX|GTEMAX}
LIMIT:CRITeria?	Queries the pass criteria for alarm/limit testing.	
LIMIT:STATe	Enables alarm/limit testing.	{DEFault|ON|OFF}
LIMIT:STATe?	Queries alarm/limit testing.	
Data Acquisition Commands		
ACQ:STATe	Sets the acquisition state.	{DEFault[ON]OFF}
ACQ:STATe?	Queries the acquisition state.	
INITiate	Begins collecting data to the fetch buffer.	
ABORt	Stops collecting data to the fetch buffer.	
ACQuire:BSIZe	Sets the acquisition batch size.	{integer (2-500000)}
ACQuire:BSIZe?	Queries the statistics batch size.	
ACQuire:DURation	Sets the statistics batch size (time).	{float}
ACQuire:DURation?	Queries the statistics batch size (time).	
ACQuire:SRATe	Sets the sample rate in terms of samples/second.	{float}

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
ACQuire:SRATe?	Queries the statistics sampling rate (pulses).	
ACQuire:STATe	Turns the acquisition state on or off. {ON|OFF}	
CONFigure:READings:CONTinuous	Sets the behavior of the FETCH queue.	{DEFault|LAST|STREam}
CONFigure:READings:CONTinuous?	Queries behavior of the FETCH queue.	
Measurement Data Format		
CONFigure:READings:SEND	Selects which items are included in the FETCH data	{DEFault|token_list}
CONFigure:READings:SEND?	Queries which items are included in the FETCH data	
CONFigure:READings:HEADers	Selects whether or not data value identification strings will prefix data values reported over the host interface.	{DEFault|ON|OFF}
CONFigure:READings:HEADers?	Queries whether or not data value identification strings will prefix data values reported over the host interface.	
CONFigure:READings:MODe	Sets the data format for the FETCh query.	{ASCii|BINary}
CONFigure:READings:MODe?	Queries the data format for the FETCh query.	
Statistics		
CONFigure:STATistics:DISPlay	Selects which items are displayed in the statistics view in the GUI.	{DEFault|token_list}
STATistics:CLEar	Clears the trend buffer and statistics accumulators.	
STATistics:LIMit	Sets the maximum number of measurements over which to compute statistics.	{DEFault|INFinite|integer}
STATistics:LIMit?	Queries the maximum number of measurements over which statistics are computed.	
STATistics:MODe	Sets the statistics mode.	{DEFault|BUFFer|ACCumulate}
STATistiscs:MODe?	Queries the statistics mode.	
STATistics:ALL?	Return all of the above values as a comma-separated list.	
STATistics:COUNt?	Return the number of measurements in the statistics interval.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
STATistics:DOSe?	Return the sum of all measurements in the statistics interval.	
STATistics:FLAG?	Returns the bitwise or flags for all measurements that contributed to the statistics.	
STATistics:MAXimum?	Return the maximum measurement in the statistics interval.	
STATistics:MEAN?	Returns the mean of all measurements in the statistics interval.	
STATistics:MINimum?	Returns the minimum measurement in the statistics interval.	
STATistics:MISSed?	Returns the number of missed pulses during the measurement interval.	
STATistics:RANGe?	Returns the range of all measurements in the statistics interval.	
STATistics:STDV?	Returns the standard deviation of all measurements in the statistics interval.	
STATistics:WAIT?	Wait for statistics to complete.	{timeout}
Data Query		
FETCh:NRECords?	Queries the number of unread data records available in the fetch buffer at the time of the query.	
FETCh:NEXT?	Queries the next N unread available measurement data record(s) in the fetch buffer at the time of the query.	{integer}
FETCh:ALL?	Queries all unread available measurement data records at the time of the query. Gets the entire contents of the fetch buffer. The queue is cleared as a result.	
FETCh:MISSing?	Queries the missing data count due to a measurement data transmission queue full condition. Queries number of measurements that were dropped due to a buffer full condition.	
READ?	Returns the latest measurement at the time of the query.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
FETCh:WAIT?	If STREam was selected AND a count was specified for the INITiate command, this pauses the interface until the requested measurements have been collected. Optional timeout in terms of milliseconds which defaults to 10000 if not specified. Query returns 1 when all the requested measurements have been collected, or 0 if a timeout occurs.	[timeout]
FETCh:TRENd	Copies the trend buffer into the fetch buffer.	
Data Logging		
LOG:REDuce:CONDition	Determines how often to save a measurement.	{DEFault|ALL|TIME|COUNt}
LOG:REDuce:CONDition?	Queries how often a measurement is saved.	
LOG:REDuce:COUNt	Sets number of measurements to acquire before writing one measurement to the log.	{integer}
LOG:REDuce:COUNt?	Queries number of measurements to acquire before writing one measurement to the log.	
LOG:REDuce:METHod	Selects how to reduce the data stream.	{DEFault|AVERage|DISCard}
LOG:REDuce:METHod?	Queries how the data stream is reduced.	
LOG:REDuce:TIME	Sets the time interval between writing measurements to the log, in units of seconds.	{float}
LOG:REDuce:TIME?	Queries the time interval between writing measurements to the log, in units of seconds.	
LOG:DELimiter	Selects the log file format to use.	{DEFault|COMMa|TAB}
LOG:DELimiter?	Queries the log file format to use.	
LOG:FNAMe	Sets the log filename.	{string}
LOG:FNAMe?	Queries the log filename.	
LOG:CONFlict	Selects what action to take when the filename points to an existing file.	{DEFault|UNIQue|OVERwrite|APPend}
LOG:CONFlict?	Queries what action is taken when the filename points to an existing file.	
LOG:STATe	Enables/disables logging.	{DEFault|ON|OFF}

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
LOG:STATe?	Queries whether logging is enabled/disabled.	
File System Commands		
MEMory:CATalog?	Lists the contents of a directory. Optional quoted string naming the directory to list, no argument provided lists the current working directory.	{directory}
MEMory:CDIRectory	Sets the current working directory.	{string}
MEMory:CDIRectory?	Queries the current working directory.	
MEMory:MDIRectory	Creates a new directory.	{dirname}
MEMory:DELete	Deletes a file.	{filename}
MEMory:RDIRectory	Removes a directory.	{dirname}
MEMory:REName	Renames (or moves) a file or directory.	{quoted original file/dir name},{quoted new file/dir name}
MEMory:COPY	Copies a source file to a destination.	{source},{destination}
MEMory:STORe	Export the trend buffer to a file in flash memory.	{filename}
MEMory:FILe:OPEN	Open a file in read,write, or append mode	{filename},{READ|WRITe|APPend}
MEMory:FILe:CLOSE	Closes the currently open file.	
MEMory:FILe:DATa	Writes a block of data to the currently open file.	{binary block}
MEMory:FILe:DATa?	Reads a block of data from the currently open file.	{integer}
MEMory:LOAD	Import a CSV or TSV from flash memory into the trend buffer.	{filename}
MEMory:REDIRectory:RECursive	Recursively remove a directory. Same as MEMory:RDIRectory, but the directory does not need to be empty.	{dirname}
MEMory:WAIT?	Waits for asynchronous copy/rename operation to complete. Optional timeout in millisecond.	{timeout}
Error Records		
SYSTem:ERRor:COUNT?	Queries the number of error records in the error queue.	
SYSTem:ERRor:NEXT?	Queries the next error record in the error queue.	

Table 8-1. Touch Meter Host Commands (Continued)

FieldMax Touch Command	Description	Argument
SYSTem:ERRor:ALL?	Queries all error records in the error queue.	
SYSTem:ERRor:CLEar	Clears all error records in the error queue.	
Miscellaneous Commands		
ECHo	Returns the string that was passed as an argument.	{string}
INSTall	Begin firmware installation.	{filename}
Debugging		
DEBug:EXPort:LOG	Exports log files, a system report, and any crash dumps to an external flash drive.	
Demo Source		
DEMo:SOURce:FUNCtion	Sets the waveform shape for the demo source.	{OFF|SINE|RAMP|TRIAngle|SQUAre}
DEMo:SOURce:FUNCtion?	Queries the waveform shape for the demo source.	
DEMo:SOURce:PRATe	Sets the pulse rate for the demo source.	{float}
DEMo:SOURce:PRATe?	Queries the pulse rate for the demo source.	

8.3 External Control: Handshaking

Sometimes it is useful to get instant feedback whether a command passed for failed.

When handshaking is on, the meter reports either OK or ERR<N> after every command/query. This can also help with flow-control when commands are being sent programmatically.

The OK/ERR<N> response indicates that the meter finished processing the previous command and is ready for the next command.

```
SYSTem:COMMunicate:HANDshaking ON // turn on handshaking
OK                                // meter sends OK, is
                                     ready for next command

SYSTem:COMMunicate:HANDshaking?   // send a query
ON                                // meter replies with the
value
OK                                // meter sends OK, is ready
for
                                     the next command
```

```
INVAlid:COMMand                  // send an invalid command
ERR100                           // meter sends error, is
ready
                                    for the next command
```

8.4 Data Commands

The Read and Fetch commands are described in this section.

8.4.1 READ

The most simple way to get a measurement from the meter is to use the READ? query. This returns the latest measurement at the time of the query, and is analogous to glancing at the numeric readout on the display.

```
READ?
9.5896E-01
```

This value is updated only a few times per second, and no care is taken to avoid duplicate measurements. The READ query may return the same value if queried too fast. If duplicate measurements are undesirable or if fast measurements are needed, consider using the FETCh commands below.

8.4.2 FETCh

The meter has an internal buffer that is 500k samples deep. These commands control filling the buffer:

```
INITiate [count]  // Enables measurement data collection,
                  // optional argument specifies the number of
                  // measurements to collect
ABORt             // Disables measurement data collection
```

This command determines whether the buffer acts as a FIFO (STREam), or simply holds the latest sample (LAST).

```
CONFigure:READings:CONTinuous {LAST|STREam}
```

If STREam was selected *and* a count was specified for the INITiate command, then the following query can be used to pause the interface until the requested measurements have been collected. This query takes an optional timeout argument in terms of milliseconds, which defaults to 10000 if not specified.

The query returns 1 when all the requested measurements have been collected, or 0 if a timeout occurs.

```
FETCh:WAIT? [timeout]
```

The buffer can be read using these commands:

```
FETCh:NRECords? // Queries the number of unread data records
                   available
FETCh:NEXT?     // Queries the next unread available measure-
ment
                   data record
FETCh:ALL?      // Queries all unread available measurement
data
                   records
FETCh:MISSing?  // Queries how many samples were dropped due to
                   buffer full
```

Data streaming can be accomplished by sending the `FETCh:NEXT?` or `FETCh:ALL?` query in a loop. In this case, it may be useful to periodically check `FETCh:MISSing?` to see if any samples were dropped due to a buffer overflow condition.

The trend buffer can be copied into the fetch buffer and then queried using the normal `FETCh` commands. For example:

```
FETCh:TRENd  // copy trend buffer -> fetch buffer
FETCh:ALL?   // query the data
```

8.5 Binary Data Transfer

While ASCII communication is often simpler, it has significant overhead that can make it unsuitable for large data transfers. For example, a 4-byte floating point number is typically formatted as 12 ASCII characters “1.234E+00\r\n”

Use this command to switch to binary mode:

```
CONFigure:READings:MODe BINary
```

This setting affects the data returned by the `FETCh` query:

```
FETCh:ALL?
#542960[.......BINARY DATA.......]OK
```

where:

- The # character signifies the start of a binary block
- Followed by the **`Length-of-Length`** field: a single ASCII digit.
  In this case, ‘5’ indicates the length field is 5 characters.
- Followed by the **`Length`** field: 0-9 ASCII digits, depending on the length-of-length field. In this case, ‘42960’ indicates a length of 42960 bytes.
- Followed by block of binary data with the specified length.
- Followed by ‘OK’ if handshaking is ON.

- Followed by the usual newline, now the meter is ready for the next command.

8.5.1 Valid File Paths

Some commands operate on files in nonvolatile memory. Files are referenced using UNIX-style file paths:

- Directories are separated by slashes '/' (backslashes are allowed, but forward slashes are preferred).
- A path beginning with a slash is considered an absolute path.
- A path not beginning with a slash is considered a relative path (relative to the current working directory).
- Two dots '..' is an alias for the parent directory.

All commands that accept a file path as an argument can operate only on the paths listed in Table 8-2. All other path-prefixes are considered invalid, and the command is rejected. All relative paths must resolve to a location underneath one of these paths.

Table 8-2. User-Accessible Data Locations

Media	Absolute Path	UI Alias	Host Interface Alias
USB Flash Drive	/fs/usb0	USB0	/usb0

8.5.2 Valid File Types

Table 8-3 lists the types of files that the meter can operate on. All file types are identified by a 3-character extension.

Table 8-3. File Types

Extension	Type	Function
`.bmp`	Bitmap Image	Screenshot
`.csv`	Comma Separated Values	Data logging, data export

Table 8-3. File Types

Extension	Type	Function
`.tsv`	Tab Separated Values	Data logging, data export
`.ini`	Configuration Settings	Save/Recall settings
`.img`	Firmware Image	Firmware update

8.6 Acquisition Commands

For time-based measurements (thermopile, optical, PMP in Watts mode), acquisition is defined by the following equation:

```
Duration = BufferSize / SampleRate
```

The BufferSize and SampleRate can be specified directly, in which case the Duration is updated automatically. Alternatively, a user can specify the Duration and an appropriate BufferSize and SampleRate are picked from a table.

For pulse-based measurements (pyro, PMP in Joules mode), acquisition is defined by the BufferSize and Decimation.

8.6.1 Duration

Set/get the acquisition Duration in terms of seconds. This command is only allowed for time-based sensors (thermopile, optical, PMP in Watts mode).

```
Command:  ACQuire:DURation {float}
Default:  10.0
Query:    ACQuire:DURation?
Reply:    {float}
```

Setting the duration implicitly updates the Sample Rate and Buffer Size. First, the fastest sample rate is chosen that can satisfy the duration without exceeding the maximum buffer size (500k). Then the buffer size is calculated according to the equation:

```
Duration = BufferSize / SampleRate
```

8.6.2 Buffer Size

Set/get the Buffer Size in terms of measurements. This command is valid for all sensors.

```
Command: ACQuire:BSIZe {integer: 2-500000}
```

```
Default: {varies per sensor}
Query: ACQuire:BSIZe?
Reply: {integer}
```

For time-based sensors (thermopile, optical, PMP in Watts mode), setting the buffer size implicitly updates the duration according to the equation:

```
Duration = BufferSize / SampleRate
```

8.6.3 Sample Rate

Set/get the Sample Rate in terms of samples/second (Hz). This command is only allowed for time-based sensors (thermopile, optical, PMP in Watts mode).

```
Command: ACQuire:SRATe {float}
Default: {varies per sensor}
Query:   ACQuire:SRATe?
Reply:   {float}
```

Setting the Sample Rate implicitly updates the duration according to the equation:

```
Duration = BufferSize / SampleRate
```

Only certain Sample Rates are allowed, and the available Sample Rates depend on the type of sensor. The value is snapped to the nearest available Sample Rate. See the tables under Duration for a list of available Sample Rate.

Sample Rate is query-only for pyro probes because it is determined automatically from the rise and fall times of the probe.

8.6.4 Decimation

Set/get the pulse Decimation. This command only applies to pulse-based sensors (Pyro, PMP in Joules mode).

```
Command: ACQuire:DECimation {integer: 1-100000}
Default: 1
Query:   ACQuire:DECimation?
Reply:   {integer}
```

Keep every *n*th pulse and discard the rest. Default value of 1 means all the pulses are kept (no decimation).

8.6.5 Mode

Set/get the acquisition mode.

```
Command: ACQuire:MODe {DEFault|CONTinuous|SINGle}
Default: CONTinuous
```

```
Query:   ACQuire:MODe?
Reply:   {CONTinuous|SINGle}
```

where:

- CONTinuous -- the meter continues acquiring until told to stop

SINGle -- the meter automatically stops after the buffer size (or duration) is reached. In snapshot mode, the meter stops after the first trigger event.

8.6.6 State

Set/get the Acquisition State. ON means running, OFF means stopped.

```
Command: ACQuire:STATe {DEFault|ON|OFF}
Default: OFF
Query:   ACQuire:STATe?
Reply:   {ON|OFF}
```

8.7 Alarms and Limits Commands

8.7.1 Highlight Measurement Window

Enable highlight measurement window.

```
Command: LIMIT:FAULt:HIGHlight {DEFault|ON|OFF}
Default: OFF
Query:   LIMIT:FAULt:HIGHlight?
Reply:   {ON|OFF}
```

When ON, the measurement window on the graphical user interface changes color as soon as a measurement fails the criteria.

8.7.2 Stop on Fault

Enable stop on fault.

```
Command: LIMIT:FAULt:STOP {DEFault|ON|OFF}
Default: OFF
Query:   LIMIT:FAULt:STOP?
Reply:   {ON|OFF}
```

When ON, acquisition is stopped as soon as a measurement fails the criteria.

8.7.3 Fault Count

Returns the number of measurements that failed the criteria since the start of acquisition.

```
Query:   LIMIT:FAULt:COUNt?
Reply:   {long integer}
```

8.7.4 Maximum

Set the maximum threshold for alarm/limit testing.

```
Command: LIMIT:MAXimum {float}
Default: 5.0
Query:   LIMIT:MAXimum?
Reply:   {float}
```

This threshold is compared to each incoming measurement according to the LIMit:CRITeria.

8.7.5 Minimum

Set the minimum threshold for alarm/limit testing.

```
Command: LIMIT:MINimum {float}
Default: 0.0
Query:   LIMIT:MINimum?
Reply:   {float}
```

This threshold is compared to each incoming measurement according to the LIMit:CRITeria.

8.7.6 Pass Criteria

Set the pass criteria for alarm/limit testing.

```
Command: LIMIT:CRITeria
   {DEFault|INSide|OUTSide|LESMIN|LEQMIN|GTRMIN|GTEMIN|LES-
MAX|
   LEQMAX|GTRMAX|GTEMAX}
Default: INSide


Query: LIMIT:CRITeria?
Reply: {INSide|OUTSide|LESMIN|LEQMIN|GTRMIN|GTEMIN|LESMAX|
       LEQMAX|GTRMAX|GTEMAX}
```

Table 8-4 lists how each incoming measurement is compared to the threshold(s).

Table 8-4. Pass Criteria

Measurement	Pass Criteria
INSide	Pass if (minimum ≤ value) and (value ≤ maximum)
OUTSide	Pass if (value < minimum) or (maximum < value)
LESMIN	Pass if (value < minimum)
LEQMIN	Pass if (value ≤ minimum)
GTRMIN	Pass if (value > minimum)
GTEMIN	Pass if (value ≥ minimum)
LESMAX	Pass if (value < maximum)
LEQMAX	Pass if (value ≤ maximum)
GTRMAX	Pass if (value > maximum)
GTEMAX	Pass if (value ≥ maximum)

8.7.7 State

This command enables alarm/limit testing.

```
Command: LIMit:STATe {DEFault|ON|OFF}
Default: OFF
Query:   LIMIT:STATe?
Reply:   {ON|OFF}
```

8.8 Configuration Commands

8.8.1 Analog Output Scale

Set/get 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}
```

8.8.2 Aperture Area

Set/get the aperture area in square centimeters. Minimum is 0.01, maximum is 500.0

```
Command: CONFigure:AREA:APERture
Default: 1.0
Query:   CONFigure:AREA:APERture?
Reply:   {float}
```

8.8.3 Area Correction

Set/get the area correction state.

```
Command: CONFigure:AREA:CORRection {DEFault|ON|OFF}
Default: OFF
Query:   CONFigure:AREA:CORRection?
Reply:   {ON|OFF}
```

8.8.4 Auto Range

Set/get the auto-range state.

```
Command: CONFigure:RANGE:AUTO {DEFault|ON|OFF}
Default: OFF
Query:   CONFigure:RANGE:AUTO?
Reply:   {ON|OFF}
```

When auto-ranging is on, the meter will automatically adjust the selected range in response to the measurement value. Only applies when the selected measurement source is SLOW.

8.8.5 Data Headers

When headers are ON, each item in the FETCh data is prefixed by its name.

```
Command: CONFigure:READings:HEADers {DEFault|ON|OFF}
Default: OFF
Query:   CONFigure:READings:HEADers?
Reply:   {ON|OFF}
```

This setting only applies in ASCii mode. For example:

```
// Turn on all fields
CONFigure:READings:SEND PRI,QUAD,FLAG,SEQ,PER,UNIT

// Query data without headers
CONFigure:READings:HEADers OFF
FETCH:NEXT?
1.2340E-05,1.2,-4.6,0000,654321,123456,W

// Query data with headers
CONFigure:READings:HEADers ON
FETCH:NEXT?
PRI=1.2340E-05,QUAD=1.2,-4.6,FLAG=0000,SEQ=654321,PER=123456,
   UNIT=W
```

8.8.6 Data Item Select

Select which items are included in the FETCh data.

```
Command: CONFigure:READings:SEND {DEFault|token_list}
Default: PRI
Query:   CONFigure:READings:SEND?
Reply:   {token_list}
```

This command accepts one or more of the following tokens in any order (separated by commas). However, the FETCh query always sends the items in the order listed in Table 8-5.

Table 8-5. Data Items in FETCh Data

Token	Description	ASCII Mode	Binary Mode
PRI	Primary data value (Watts or Joules)	Scientific Notation (for example, “2.888E-03”)	4-byte floating point (little endian)
QUAD	Quad distance X/Y data in mm (valid only when an LM probe is attached)	Two floating point values in X,Y order (for example, “-1.2,+1.5”)	X: 4-byte floating point (little endian) Y: 4-byte floating point (little endian)
FLAG	Flags - see Table 8-6	4 hexadecimal digits (for example “00C0”)	2-byte unsigned integer (little endian)

Table 8-5. Data Items in FETCh Data (Continued)

Token	Description	ASCII Mode	Binary Mode
SEQ	Sequence ID	Up to 10 decimal digits (for example, "1234567890")	4-byte unsigned integer (little endian)
PER	Pulse period in micro-seconds	Up to 10 decimal digits (for example, "1234567890")	4-byte unsigned integer (little endian)
UNIT	Primary data value display units	String format (for example, "W/cm2")	1 byte unsigned integer: 0x00=J, 0x40=J/cm2, 0x80=W, 0xC0=W/cm2

Table 8-6 explains the bits in the FLAG field.

Table 8-6. Bits in the FLAG Field

Bit Position	Hex Value	Qualification
0	0001	Trigger Event
1	0002	Baseline Clip
2	0004	Calculating (PTJ mode only)
3	0008	Final energy record (PTJ mode only)
4	0010	Over-range
5	0020	Negative Power
6	0040	Measurement is sped up
7	0080	Over-temperature error
8	0100	Missed measurement
9	0200	Missed pulse
10	0400	Reserved for future use
11	0800	Limit fault (See Alarms and Limits)
12-14	7000	Reserved for future use
15	8000	Error
N/A	0000	No qualification

8.8.7 Data Streaming Mode

Set/get the behavior of the FETCh queue.

```
Command: CONFigure:READings:CONTinuous {DEFault|LAST|STREam}
Default: LAST
Query:   CONFigure:READings:CONTinuous?
Reply:   {LAST|STRE}
```

where:

- LAST means only the latest reading is kept.
- STRE means all readings are queued if there is space available in the queue.

This command takes effect next time INITialize is sent.

8.8.8 Display Mode

Set/get the display mode. Selects which page is active on the graphical user interface.

```
Command: CONFigure:DISPlay
   {DEFault|HISTogram|STATistics|TRENd|PSTability|TUNE|MEA-
Sure}
Default: TRENd
Query:   CONFigure:DISPlay?
Reply:   {HISTogram|STATistics|TRENd|PSTability|TUNE|MEASure}
```

8.8.9 Gain Compensation

This command enables or disables gain compensation.

```
Command: CONFigure:GAIN:COMPensation {DEFault|ON|OFF}
Default: OFF
Query:   CONFigure:GAIN:COMPensation?
Reply:   {ON|OFF}
```

8.8.10 Gain Factor

This command gets/sets the gain factor. The minimum is 0.001, maximum is 100e3.

```
Command: CONFigure:GAIN:FACTor {DEFault|float}
Default: 1.0
Query:   CONFigure:GAIN:FACTor?
Reply:   {float}
```

8.8.11 Numeric Display Resolution

Set/get the number of digits displayed in the numeric readout(s) of the graphical user interface.

```
Command: CONFigure:RESolution {DEFault|integer}
Default: 3
Query:   CONFigure:RESolution?
Reply:   {integer}
```

8.8.12 Operating Mode

Set/get the operating mode: either energy (Joules) or power (Watts).

```
Command: CONFigure:MEASure {DEFault|J|W}
Default: J for Pyro probes, W for all other probes
Query:   CONFigure:MEASure?
Reply:   {J|W}
```

8.8.13 Range List

Returns a comma-separated list of available ranges. If auto-range is allowed by the current probe and configuration, then the first item in the list is AUTO.

```
Query:   CONFigure:RANGe:LIST?
Reply:   {float_list}
```

For example:

```
CONFigure:RANGe:LIST?
AUTO,2e-05,5e-05,0.0001,0.0002,0.0005,0.001,0.002,0.005,0.01,
   0.02,0.05,0.1,0.2,0.5,1
OK
```

8.8.14 Selected Range

Set/get the selected range, defined as the maximum expected measurement value.

```
Command: CONFigure:RANGe:SELect {float}
Default: 5.0
Query:   CONFigure:RANGe:SELect? [MAXimum|MINimum]
Reply:   {float}
```

If the probe has more than one gain configuration, the selected range is used to configure the gain. The query takes an optional argument to return the min/max range for the probe; if no argument is given, it returns the currently selected range.

8.8.15 Selected Wavelength

Set/get the wavelength for wavelength compensation in units of nanometers.

```
Command: CONFigure:WAVElength:WAVElength {MAXimum|MINimum|
   integer}
Default: 193
Query:   CONFigure:WAVElength:WAVElength? [MAXimum|MINimum]
Reply:   {integer}
```

The query takes an optional argument to return the min or max wavelength for the currently attached sensor; if no argument is given, it returns the currently selected wavelength.

8.8.16 Smoothing (Pulse)

Set/get the smoothing window size in terms of an integer number of pulses.

```
Command: CONFigure:AVERage:PULSe {DEFault|OFF|AUTO|integer}
Default: AUTO
Query:   CONFigure:AVERage:PULSe?
Reply:   {OFF|AUTO|integer}
```

Applies only when a pulse-based sensor is attached. Minimum is 2, maximum is 999.

8.8.17 Smoothing (Time)

Set/get the smoothing window size in terms seconds, rounded to the nearest integer.

```
Command: CONFigure:AVERage:TIME {DEFault|OFF|AUTO|integer}
Default: AUTO
Query:   CONFigure:AVERage:TIME?
Reply:   {OFF|AUTO|integer}
```

Applies only when a time-based sensor is attached. Minimum is 1, maximum is 60.

8.8.18 Statistics Display

This command is unused, and may be removed.

```
Command: CONFigure:STATistics:DISPlay {DEFault|token_list}
Default: MEAN,MIN,MAX,STDV
Query:   CONFigure:STATistics:DISPlay?
Reply:   {token_list}
```

Valid tokens are MEAN,MIN,MAX,STDV,1SIG,2SIG,3SIG,RANGe,DOSE,MISSed.

8.8.19 Thermopile Speed-Up

Enables the speedup algorithm for thermopile probes.

```
Command: CONFigure:SPEedup {DEFault|ON|OFF}
Default: ON
Query:   CONFigure:SPEedup?
Reply:   {ON|OFF}
```

Depending on the time constant of the probe, it can take several seconds for the measurement to ramp up to its final value. The speedup algorithm helps the measurement reach its final value faster. Speedup only applies to probes with a long time constant (i.e. thermopile).

8.8.20 Wavelength Correction

Enable wavelength correction.

```
Command: CONFigure:WAVElength:CORRection {DEFault|ON|OFF}
Default: ON
Query:   CONFigure:WAVElength:CORRection?
Reply:   {ON|OFF}
```

8.8.21 Wavelength List

Return the list of calibration wavelengths for the currently attached sensor, in units of nanometers.

```
Query:   CONFigure:WAVElength:LIST?
Reply:   {integer_list}
```

The first/last items in this list are the min/max wavelength, respectively.

8.8.22 Zero

Command: Sets the current sensor input as the baseline.

Query: Returns the offset in Watts for the current range.

```
Command: CONFigure:ZERO
Query:   CONFigure:ZERO?
Reply:   {float}
```

This launches a procedure that measures the average ambient light hitting the sensor for each possible range. The command returns immediately, although the procedure may take several seconds to complete.

The status of the procedure can be monitored with the “SYSTem:STATus?” query. When complete, the measured offset is subtracted from all future measurements. This command has no effect if there is no probe present, or if a pyroelectric probe is present.

8.9 Fetch

8.9.1 Data Format

Set/get the data format for the FETCh query.

```
Command: CONFigure:READings:MODe {ASCii|BINary}
Default: ASCii
Query:   CONFigure:READings:MODe?
Reply:   {ASCii|BINary}
```

8.9.2 Data Gating

8.9.2.1 Abort

Stop collecting data into the FETCh buffer.

```
Command: ABORt
```

8.9.2.2 Initialize

Begin collecting data into the FETCh buffer.

```
Command: INITialize [count]
```

Takes an optional count argument. If the argument is present, the meter will automatically ABORt after collecting the requested number of samples. Otherwise, the meter continues filling the FETCh buffer until the ABORt command is received.

NOTICE

ACQuire:STATe globally enables the data stream. It is not considered an error to send INITialize while ACQuire:STATe is OFF, but no data will be collected until ACQuire:STATe is turned ON.

8.9.3 All

Get the entire contents of the fetch buffer. The queue is cleared as a result of this query.Query: FETCh:ALL?
Reply: {bulk data}

A list of measurements is returned, where each measurement is composed of one or more items. CONFigure:READings:SEND determines which items are sent for each measurement.

CONFigure:READings:MODe determines the format of the returned data:

- BINary -- the return data is a binary block, items are fixed-width and are sent in sequence without delimiters. Host software must take into account the size of each item to decode the data.
- ASCii -- the return data is ascii text. Measurements are separated by carriage-return-newlines (\r\n) and items within each measurement are separated by commas (,).

8.9.4 Missing

Get the number of measurements that were dropped due to a buffer full condition.

```
Query:   FETCh:MISSing?
Reply:   {integer}
```

8.9.5 Next

Get the next N measurements from the fetch buffer.

```
Query:   FETCh:NEXT? [integer]
Reply:   {integer}
```

Optional argument determines how many samples are returned; default is 1. The returned measurements are removed from the queue.

A list of measurements is returned, where each measurement is composed of one or more items. CONFigure:READings:SEND determines which items are sent for each measurement.

CONFigure:READings:MODe determines the format of the returned data:

- BINary -- the return data is a binary block, items are fixed-width and are sent in sequence without delimiters. Host software must take into account the size of each item to decode the data.

- ASCii -- the return data is ascii text. Measurements are separated by carriage-return-newlines (\r\n) and items within each measurement are separated by commas (,).

8.9.6 Number of Records

Returns the number of records currently in the fetch buffer.

```
Query:   FETCh:NRECords?
Reply:   {integer}
```

8.9.7 Trend

Copies the trend buffer into the fetch buffer, which can then be queried using FETCh:NEXT? and FETCh:ALL?

```
Command: FETCh:TRENd
```

This command implicitly sends ABORt to avoid conflicting with live acquisition data.

8.9.8 Wait

This query pauses the communications interface until the requested number of measurements have been collected into the fetch buffer.

```
Query:   FETCh:WAIT? [integer]
Reply:   {0|1}
```

It takes an optional timeout argument in milliseconds, which defaults to 10000.

Care should be taken when specifying a timeout longer than a few minutes as it may make the communications interface unresponsive if the condition never occurs, and may require physical access to the device to reset it.

Returns 1 upon success, otherwise returns 0 if the timeout expires before the requested number of samples have been collected.

This query returns 0 immediately if either of the following requirements are not met:

- CONFigure:READings:CONTinuous must be set to STREam
- INITiate was previously sent, and a count was specified

8.9.9 Read Latest Measurement

This is the simplest way to get a measurement from the meter.

```
Query:   READ?
Reply:   {comma-separated list}
```

The READ? query returns the latest measurement at the time of the query, and is analogous to glancing at the numeric readout on the graphical user interface.

By default, this returns only the primary measurement value. Use CONFigure:READings:SEND to select additional items.

This value is only updated a few times per second, and no care is taken to avoid duplicate measurements. The read query may return the same value if queried too fast. If duplicate measurements are undesirable, or if fast time spacing is needed, consider using the FETCh commands instead.

8.9.10 Export Log Files and System Report

Exports log files, a system report, and any crash dumps to an external flash drive.

```
Command: DEBug:EXPort:LOG
```

The file 'system_report.tar.gz' is created at the root of the first external flash drive, overwriting any file with the same name. The file can be sent to Coherent Technical Support (see 'Service and Support' (p. 189)) for analysis and troubleshooting.

8.10 Display Commands

8.10.1 Backlight Enable

Controls the backlight on/off state.

```
Command: DISPlay:BACKlight {DEFault|ON|OFF}
Default: ON
Query:   DISPLAY:BACKLIGHT?
Reply:   {ON|OFF}
```

8.10.2 Backlight Intensity

Controls the backlight intensity. (DISPlay:CONTrast is an alias for the same value).

```
Command: DISPlay:INTensity {DEFault|float: 0.0-1.0}
Default: 0.67
Query:   DISPlay:INTensity?
Reply:   {float}
```

8.10.3 Clear

Clears the text display.

```
Command: DISPlay:CLEar
```

8.10.4 Screenshot

Save a screenshot to internal or external flash. Screenshots are written in bmp format.

```
Command: DISPlay:SAVE [string]
```

Takes an optional path argument, which defaults to the first available location in priority order:

- /usb0
- /usb1‘

The path can specify a file or a directory. If it is a directory, then a file named ‘screenshotXXX.bmp’ will be created in that directory, where XXX is the lowest numeric suffix that does not conflict with an existing file.

The command fails if it specifies a file that already exists, or if the parent directory does not exist.

8.11 Logging Commands

8.11.1 Data Reduction

Data reduction may be applied to slow down the data stream and/or reduce the size of the log files. Note that this data reduction applies only to logging, and is in addition to any acquisition data reduction; see ’Acquisition Commands’ (p. 133).

8.11.2 Condition

Determines how often to save a measurement.

```
Command: LOG:REDuce:CONDition {DEFault|ALL|TIME|COUNt}
Default: ALL
Query:   LOG:REDuce:CONDition?
Reply:   {ALL|TIME|COUNt}
```

where:

- ALL -- all measurements are written to the log
- TIME -- one measurement is written every X seconds
- COUNt -- one measurement is written out of every X measurements

8.11.3 Count

Defines the number of measurements to acquire before writing one measurement to the log.

```
Command: LOG:REDuce:COUNt {integer}
Default: 1
Query:   LOG:REDuce:COUNt?
Reply:   {integer}
```

Applies only when LOG:REDuce:CONDition is set to COUNt.

8.11.4 Method

Determines how to reduce the data stream.

```
Command: LOG:REDuce:METHod {DEFault|AVERage|DISCard}
Default: AVERage
Query:   LOG:REDuce:METHod?
Reply:   {AVERage|DISCard}
```

where:

- AVERage -- intermediate measurements are averaged
- DISCard -- intermediate measurements are discarded

8.11.5 Time

Defines the time interval between writing measurements to the log, in units of seconds.

```
Command: LOG:REDuce:TIME {float}
Default: 1.0
```

```
Query:   LOG:REDuce:TIME?
Reply:   {float}
```

Applies only when LOG:REDuce:CONDition is set to TIME.

8.11.6 Delimiter

Specifies the file format to use.

```
Command: LOG:DELimiter {DEFault|COMMa|TAB}
Default: COMMa
Query:   LOG:DELimiter?
Reply:   {COMMa|TAB}
```

where:

- COMMa -- comma-separated-values (CSV) with period '.' as the decimal point
- TAB -- tab-separated-values (TSV) with comma ',' as the decimal point

8.11.7 Filename

Set/get the log filename.

```
Command: LOG:FNAMe {string}
Default: "/usb0/log000.csv"
Query:   LOG:FNAMe?
Reply:   {string}
```

The command accepts an absolute or relative path, as long as it resolves to a location underneath one of the user-defined data locations (see 'Valid File Paths' (p. 132)). The query always returns an absolute path.

Valid extensions are ".csv" for comma-separated format, or ".tsv" for tab-separated format. If the filename points to an existing directory, then "log000.csv" is automatically appended.

8.11.8 Filename Conflict Resolution

Specifies what action to take when the filename points to an existing file.

```
Command: LOG:CONFlict {DEFault|UNIQue|OVERwrite|APPend}
Default: UNIQue
Query:   LOG:CONFlict?
Reply:   {UNIQue|OVERwrite|APPend}
```

where:

- UNIQue -- create a unique filename by incrementing the numeric suffix until it no longer collides with an existing file.

- OVERwrite -- the new data overwrites the existing file
- APPend -- the new data is appended to the existing file

8.11.9 State

Turn logging on/off. Logging is active when both LOG:STATe and ACQuire:STATe are set to ON.

```
Command: LOG:STATe {DEFault|ON|OFF}
Default: OFF
Query:   LOG:STATe?
Reply:   {ON|OFF}
```

The log file is opened as soon as both are set to ON.

The log file is closed as soon as either of them are set to OFF.

8.12 Memory Commands

8.12.1 Catalog

List the contents of the current working directory.

```
Query:   MEMory:CATalog?
Reply:   {list}
```

The first line of the reply contains the used and remaining storage space in terms of bytes. The following lines list the files and directories in the current working directory, along with their sizes in bytes. For example:

```
MEMory:CATalog?
used=256815104,remain=7561334784
“screenshot000.bmp”,FILE,2457654
“screenshot001.bmp”,FILE,2457654
“settings2.ini”,FILE,1337
“settings.ini”,FILE,1337
“log000.csv”,FILE,606955
“log001.csv”,FILE,568735
“log002.csv”,FILE,348172
“test”,DIR,4096
OK
```

8.12.2 Copy

Copy a file from one location to another. Takes two quoted filenames as arguments.

```
Command: MEMory:COPY {source},{destination}
```

This command returns immediately and does not wait for the copy to finish. Instead, query MEMory:WAIT? to wait for the operation to finish, or poll bit position 12 (ox1000) of SYSTem:STATus?

Furthermore, only one copy/rename operation is allowed at a time. This command returns an error if another copy/rename is already in progress. Copying a directory to a subdirectory of itself is not allowed.

8.12.3 Current Working Directory

Set/get the current working directory. Relative file paths are with respect to this directory.

```
Command: MEMory:CDIRectory {string}
Default: "/loc"
Query:   MEMory:CDIRectory?
Reply:   {string}
```

8.12.4 Delete

Delete a file. Takes a quoted filename as an argument.

```
Command: MEMory:DELete {filename}
```

8.12.5 Export Data File

Export the trend buffer to a file in flash memory. Takes a quoted filename as an argument.

```
Command: MEMory:STORe {filename}
```

8.13 File Transfer

8.13.1 File Close

Close the currently open file.

```
Command: MEMory:FILe:CLOSe
```

Opening a new file implicitly closes the currently open file.

*RST implicitly closes the currently open file.

8.13.2 File Data

The command writes a block of data to the currently open file.

```
Command: MEMory:FILe:DATa\n{binary block}
Query:   MEMory:FILe:DATa? [integer]
Reply:   {binary block}
```

The host sends the command, followed by a newline, followed by a binary block. A file must have been previously opened for writing, otherwise and error is returned. An error is returned if the storage medium is out of space.

In case the binary block is malformed or interrupted, the command times out after 10 seconds on inactivity, and the interface will be ready to accept a new command.

The query reads a block of data from the currently open file. It takes an optional argument specifying how many bytes to read. If the argument is not provided, it reads until end-of-file. A file must have been previously opened for reading, otherwise an error is returned.

In the example below, the pound sign '#' signifies the start of a binary block. The following digit '2' indicates that the length is two digits. The next two digits '43' indicate the payload is 43 bytes. The payload in this example is made entirely of printable ascii characters, but this is not required.

See the section 'Binary Data Transfer' (p. 131) for further details about the binary block format.

For example:

```
...// write a file
MEMory:FILe:OPEN “test.txt” WRITe
MEMory:FILe:DATA
#243The quick brown fox jumps over the lazy dog
MEMory:FILe:CLOSe

// read the file back
MEMory:FILe:OPEN “test.txt” READ
MEMory:FILe:DATA?
#243The quick brown fox jumps over the lazy dog
MEMory:FILe:CLOSe
```

8.13.3 File Open

Opens a file.

```
Command: MEMory:FILe:OPEN {filename},{READ|WRITe|APPend}
```

Open a file in one of the modes listed in 'Mode to Open File' (p. 155):

This command implicitly closes any previously opened file before opening the new file. *RST implicitly closes the currently open file.

Table 8-7. Mode to Open File

Mode	If the file exists	If the file does not exist...
READ	Open for reading	Return error
WRITe	Truncate and open for writing	Create it
APPend	open for writing at the end-of-file	Create it

8.13.4 Make Directory

Make a new directory. Takes a quoted directory name as an argument.

```
Command: MEMory:MDIRectory {dirname}
```

8.13.5 Remove Directory Recursively

Remove a directory recursively. `MEMory:RDIRectory` but the directory does not need to be empty. Takes a quoted directory name as an argument.

```
Command: MEMory:RDIRectory {dirname}
```

8.13.6 Rename File or Directory

Rename a file or directory. Takes two quoted filenames as arguments.

```
Command: MEMory:REName {source},{destination}
```

8.14 State

8.14.1 Recall

Recalls a configuration file from the provided filename. Expects a filename with the extension ".ini".

```
Command: MEMory:STATe:RECall {filename}
```

8.14.2 Save

Save a configuration file.

```
Command: MEMory:STATe:SAVE {filename}
```

If the filename argument points to a directory, then a file named "settings.ini" will be added to that directory.

Otherwise, it assumes the argument specifies a file, and the extension ".ini" will be appended if it is missing. If the filename has a different extension, then it will be changed to ".ini".

8.15 Miscellaneous Commands

8.15.1 Echo

Returns the string that was passed as an argument. Useful for testing basic communication with the meter.

```
Command: ECHo {string}
Reply:   {string}
```

8.15.2 Firmware Update

Begin firmware installation.

```
Command: INSTall [filename]
```

Takes an optional filename argument, which defaults to "/usb0/LabMax-Touch.img".

The system automatically restarts during installation.

8.16 SCPI Common Commands

8.16.1 Identify

Returns the meter identification string, containing the manufacturer name, model name, and firmware version/date.

```
Query:   *IDN?
Reply:   {string}
```

For example:

```
*IDN?
Coherent, Inc - FieldMax-Pro Touch - V0.1.12 - 03 Jun 2021
```

8.16.2 Reset

Resets all parameters to their default values.

```
Command: *RST
```

8.16.3 Wait

Blocks until all pending (previous) commands have been processed.

```
Command: *WAI
```

8.17 Statistics Commands

8.17.1 Clear

Clears the trend buffer and the statistics accumulators.

```
Command: STATistics:CLEar
```

8.17.2 Limit

Set/get the statistics limit, which is the maximum number of measurements over which to compute statistics.

```
Command: STATistics:LIMit {DEFautl|INFinite|integer}
Default: INFinite
Query:   STATistics:LIMit?
Reply:   {INFinite|integer}
```

- In accumulate mode, the statistics keep updating until the count reaches this limit, then the statistics remain constant until they are cleared (either by the STATistics:CLEar command, or by a settings change).
- In buffer mode, this setting is ignored and the statistics are always computed over the entire trend buffer.

8.17.3 Mode

Set/get the statistics mode. In buffer mode, the statistics are computed over the trend buffer, and are recomputed whenever the trend buffer updates.

```
Command: STATistics:MODe {DEFault|BUFFer|ACCumulate}
```

```
Default: RECord
Query:   STATistics:MODe?
Reply:   {BUFFer|ACCumulate}
```

In accumulate mode, measurements are added to the statistics continuously until either a limit is reached or the statistics are cleared. Use accumulate mode to compute statistics over larger time spans than allowed by the trend buffer.

8.18 Results

8.18.1 1-Sigma

Return the ratio of standard deviation to mean, expressed as a percentage.

1SIG = 100 * stdDev / mean

```
Query:   STATistics:1SIG?
Reply:   {float}
```

8.18.2 2-Sigma

Return 2x the ratio of standard deviation to mean, expressed as a percentage.

2SIG = 200 * stdDev / mean

```
Query:   STATistics:2SIG?
Reply:   {float}
```

8.18.3 3-Sigma

Return 3x the ratio of standard deviation to mean, expressed as a percentage.

3SIG = 300 * stdDev / mean

```
Query:   STATistics:3SIG?
Reply:   {float}
```

8.18.4 All

Return all of the above values as a comma-separated list, optionally with headers if CONFigure:READings:HEADers is set to ON.

```
Query:   STATistics:ALL?
```

```
Reply:   {comma-separated list}
```

For example:

```
CONFigure:READings:HEADers ON
STATistics:ALL?
MIN=0,MAX=0.930271,MEAN=0.395016,STDV=0.240461,RANGE=0.930271,
DOSE=395.016,1SIG=60.8738,2SIG=121.748,3SIG=182.621,MISSED=0,C
OUNT=1000,FLAG=0000

CONFigure:READings:HEADers OFF
STATistics:ALL?
0,0.930271,0.395016,0.240461,0.930271,395.016,60.8738,121.748,
182.621,0,1000,0000
```

8.18.5 Count

Return the number of measurements in the statistics interval (i.e. the population).

```
Query:   STATistics:COUNt?
Reply:   {long integer}
```

8.18.6 Dose

Return the sum of all measurements in the statistics interval.

```
Query:   STATistics:DOSe?
Reply:   {float}
```

8.18.7 Flags

Returns the bitwise OR of the flags for all measurements that contributed to the statistics.

```
Query:   STATistics:FLAG?
Reply:   {4 hexadecimal digits}
```

This can be used to detect errors, such as over-range conditions that may affect the validity of results.

See CONFigure:READings:SEND for the definitions of each flag bit.

8.18.8 Max

Return the maximum measurement in the statistics interval.

```
Query:   Query: STATistics:MAXimum?
```

```
Reply:   {float}
```

8.18.9 Mean

Return the mean of all measurements in the statistics interval.

```
Query:   STATistics:MEAN?
Reply:   {float}
```

8.18.10 Min

Return the minimum measurement in the statistics interval.

```
Query:   STATistics:MINimum?
Reply:   {float}
```

8.18.11 Missed

Return the number of missed pulses during the statistics interval.

```
Query:   STATistics:MISSed?
Reply:   {long integer}
```

8.18.12 Range

Return the range of all measurements in the statistics interval. Range is defined as (maximum – minimum).

```
Query:   STATistics:RANGe?
Reply:   {float}
```

8.18.13 Standard Deviation

Return the standard deviation of all measurements in the statistics interval.

```
Command: STATistics:STDV?
Reply:   {float}
```

8.18.14 Wait

Wait for statistics to complete.

```
Query:   STATistics:WAIT? [timeout]
Reply:   {0|1}
```

In buffer mode, this waits for the trend buffer to fill up.

In accumulate mode, this waits for the STATistics:LIMit to be reached.

This query takes an optional timeout argument in terms of milliseconds, which defaults to 10000 if not specified.

- Returns 1 when the requested limit has been reached, or 0 if a timeout occurs.
- Returns 0 immediately if STATistics:MODe is set to ACCumulate and STATistics:LIMit is set to INFinite.

8.19 System Commands

8.19.1 Battery

8.19.1.1 Health

Get the battery health as a percentage.

```
Query:   SYSTem:INFormation:BATTery:HEALth?
Reply:   {integer: 0-100}
```

8.19.1.2 Percent Remaining

Returns the remaining battery capacity as a percent of full charge.

```
Query:   SYSTem:INFormation:BATTery:PERCent?
Reply:   {integer: 0-100}
```

8.19.1.3 Status

Returns a list of tokens indicating the current battery status.

```
Query:   SYSTem:INFormation:BATTery:STATus?
Reply:   {PRESENT|LOW|CHARGING|ERROR}
```

8.19.2 Time

Set/get the time maintained within the meter.

```
Command: SYSTem:TIME {hour},{minute},{second}
Query:   SYSTem:TIME?
Reply:   {hour},{minute},{second}
```

This is always in 24-hour format, regardless of SYSTem:TIME:FORMat.

8.19.3 Time Format

Set/get the time format: either 12-hour time (AM/PM) or 24-hour time.

```
Command: SYSTem:TIME:FORMat {DEFault|12|24}
Default: 12
Query:   SYSTem:TIME?
Reply:   {12|24}
```

This setting only applies to the time displayed in the graphical user interface. The time returned by SYSTem:TIME? is always in 24-hour format.

8.20 Communication Settings

8.20.1 Ethernet

8.20.1.1 DHCP

This setting is read-only (can only be changed from the graphical user interface).

```
Default: ON
Query:   SYSTem:COMMunicate:ETHernet:DHCP?
Reply:   {ON|OFF}
```

where:

- ON -- the router automatically assigns network settings to the meter
- OFF -- the network settings can be assigned manually

8.20.1.2 Gateway

Read-only: the default gateway for network communications.

```
Default: {set by router}
Query:   SYSTem:COMMunicate:ETHernet:GATeway?
Reply:   {string}
```

If DHCP is on, this is set automatically by the router. Otherwise, this can only be changed from the graphical user interface.

8.20.1.3 Hostname

Read-only: Get the host name used for network communication. This can only be changed from the graphical user interface.

```
Default: LM{serial-number}
Query:   SYSTem:COMMunicate:ETHernet:HOSTname?
Reply:   {string}
```

8.20.1.4 IP Address

Read-only: the IP address the meter, used for network communications.

```
Default: {set by router}
Query:   SYSTem:COMMunicate:ETHernet:IPADdr?
Reply:   {string}
```

If DHCP is on, this is set automatically by the router. Otherwise, this can only be changed from the graphical user interface.

8.20.1.5 MAC Address

Read-only: Get the MAC address used for network communication.

```
Query:   SYSTem:COMMunicate:ETHernet:MAC?
Reply:   {string}
```

8.20.1.6 Port

Read-only: the port number on which the meter listens for connections from a remote host. This can only be changed from the graphical user interface.

```
Default: 58975
Query:   SYSTem:COMMunicate:ETHernet:PORT?
Reply:   {integer}
```

8.20.1.7 Subnet Mask

Read-only: the subnet mask for network communications.

```
Default: {set by router}
Query:   SYSTem:COMMunicate:ETHernet:NETMask?
Reply:   {string}
```

If DHCP is on, this is set automatically by the router. Otherwise, this can only be changed from the graphical user interface.

8.20.2 Handshaking

Enable handshaking to get immediate feedback on whether a command passed or failed.

```
Command: SYSTem:COMMunicate:HANDshaking {DEFault|ON|OFF}
Default: OFF
Query:   SYSTem:COMMunicate:HANDshaking?
Reply:   {ON|OFF}
```

If enabled, the meter either responds with OK or ERR{N} after each command, where N is an integer error code that identifies the type of failure. This can also be useful for synchronizing the host with the meter.

8.21 Instrument Information

8.21.1 Board ID

Returns the board ID.

```
Query:   SYSTem:INFormation:INSTrument:BOARd?
Reply:   {hex_int}
```

8.21.2 CPU Temperature

Get the CPU temperature in degrees Celsius.

```
Query:   SYSTem:INFormation:CPU:TEMPerature?
Reply:   {float}
```

8.21.3 Calibration Date

Get the system calibration date.(Read only.)

```
Query:   SYSTem:INFormation:INSTrument:CDATe?
Reply:   {string}
```

8.21.4 Firmware Version

Get the meter firmware version.

```
Query:   SYSTem:INFormation:INSTrument:FVER?
Reply:   {string}
```

8.21.5 Instrument Type

Get the instrument type. (Read only.)

```
Query:   SYSTem:INFormation:INSTrument:TYPE?
Reply:   {TO|TOP}
```

8.21.6 Manufacture Date

Get the system manufacture date. (Read only.)

```
Query:   SYSTem:INFormation:INSTrument:MDATe?
Reply:   {string}
```

8.21.7 Part Number

Get the meter part number. (Read only.)

```
Query:   SYSTem:INFormation:INSTrument:PNUMber?
Reply:   {string}
```

8.21.8 Serial Number

Get the meter serial number. (Read only.)

```
Query:   SYSTem:INFormation:INSTrument:SNUMber?
Reply:   {string}
```

8.22 Power Management

8.22.1 Restart

Restart the meter.

```
Command: SYSTem:RESTart
```

8.22.2 Shutdown

Power off the meter.

```
Command: SYSTem:SHUTdown
```

8.23 Probe Information

8.23.1 Calibration Date

Get the probe calibration date.

```
Query:   SYSTem:INFormation:PROBe:CDATe?
Reply:   {string}
```

8.23.2 Code

Get the probe code.

```
Query:   SYSTem:INFormation:PROBe:CODe?
Reply:   {integer}
```

8.23.3 Diameter

Get the probe diameter in millimeters.

```
Query:   SYSTem:INFormation:PROBe:DIAMeter?
Reply:   {NA|float}
```

8.23.4 Model

Get the probe model.

```
Query:   SYSTem:INFormation:PROBe:MODel?
Reply:   {string}
```

8.23.5 Responsivity

Get the probe responsivity.

```
Query:   SYSTem:INFormation:PROBe:RESPonsivity?
Reply:   {float}
```

8.23.6 Serial Number

Get the probe serial number.

```
Query:   SYSTem:INFormation:PROBe:SNUMber?
Reply:   {string}
```

8.23.7 Temperature

Get the probe temperature in degrees Celsius.

```
Query:   SYSTem:INFormation:PROBe:TEMPerature?
Reply:   {integer}
```

8.23.8 Type

Get the probe type.

```
Query:   SYSTem:INFormation:PROBe:TYPE?
Reply:   {string}
```

8.24 Remote Lockout

8.24.1 Local

Unlocks the meter and returns it to normal operation.

```
Command: SYSTem:LOCal
```

8.24.2 Remote

Blanks the graphical user interface, displays a message that the meter is being controlled remotely, and locks the touchscreen and physical buttons.

```
Command: SYSTem:REMote
```

8.25 Status

Get the systems status bit mask.

```
Query:   SYSTem:STATus?
Reply:   {8 hexadecimal digits}
```

Status bits are described in Table 8-8.

Table 8-8. Status Bits

Bit Position	Hex Value	Description
0	00000001	Battery is low
1	00000002	Probe damage temperature exceeded
2	00000004	Valid probe is attached
3	00000008	USB flash drive is attached
4	00000010	Logging storage media is not able to keep up with the data stream, resulting in Missing Samples. Cleared when logging starts
6	00000040	A configuration change requires the meter to be zeroed out
7	00000080	Power switch state (always on)

Table 8-8. Status Bits (Continued)

Bit Position	Hex Value	Description
8	00000100	Zero in progress
9	00000200	Logging stopped due to disk full. Cleared when logging starts.
10	00000400	Logging stopped due to disk error (e.g. USB drive removed). Cleared when logging starts.
11	00000800	Remote mode enabled (touch-screen/button lockout)
12	00001000	Host file copy in progress
13	00002000	reserved for future use
14	—	Internal Use Only
15-31	FFFF8000	Reserved

8.26 System Error Queue

8.26.1 All Errors

Return all errors in the error queue, and clear the queue.

```
Query:   SYSTem:ERRor:ALL?
Reply:   {error list}
```

Table 8-9 lists the system error codes.

Table 8-9. System Error Codes

Error Code	Quoted Error String	Description
–350	Queue overflow	Error queue is full.
–310	System error	Unexpected or unrecoverable hardware or software fault.
–254	Media full	No more storage available on the mass storage volume.
–240	Operation not allowed	Requested operation is not allowed in the current configuration.

Table 8-9. System Error Codes (Continued)

Error Code	Quoted Error String	Description
–220	Timeout	A timeout expired while meter was waiting for data from the host.
–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.
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 not open for reading	Attempted to read from a file that is not open for reading.
206	File not open for writing	Attempted to write to a file that is not open for writing.
207	File is busy or already open	File is already open by another process.
208	Destination is a subdirectory of the source	The destination is below the source in the directory hierarchy

8.26.2 Clear

Clear the error queue.

```
Command: SYSTem:ERRor:CLEar
```

8.26.3 Error Count

Return the number of errors in the queue.

```
Query:   SYSTem:ERRor:COUNT?
Reply:   {integer}
```

8.26.4 Next Error

Remove and return the next error from the queue.

```
Query:   SYSTem:ERRor:NEXT?
Reply:   {error list}
```

8.27 Trigger Commands

8.27.1 Pulsed Thermopile Joules Level

Set/get the trigger level for the Pulsed-Thermopile-Joules algorithm. This applies only when the Selected Source is set to SLOW and the operating mode is set to J (Joules).

```
Command: TRIGger:PTJ:LEVel {DEFault|LOW|MEDium|HIGH}
Default: LOW
Query:   TRIGger:PTJ:LEVel?
Reply:   {LOW|MEDIUM|HIGH}
```

8.27.2 Trigger Delay

Set/get the trigger delay in microseconds when pyroelectric sensors are used.

```
Command: TRIGger:DELay {DEFault|integer:0-1000}
Default: 0
Query:   TRIGger:DELay?
Reply:   {integer}
```

8.27.3 Trigger Level

Set/get the trigger level as a percent of the current range. This applies only when the Selected Source is set to FAST.

```
Command: TRIGger:LEVel {DEFault|integer:0-100}
Default: 5
Query:   TRIGger:LEVel?
Reply:   {integer}Trigger Slope
```

Set/get the trigger slope. This determines whether the meter triggers on a rising or falling edge. This applies only when the Selected Source is set to FAST

```
Command: TRIGger:SLOPe {DEFault|POSitive|NEGative}
Default: POS
Query:   TRIGger:SLOPe?
Reply:   {POS|NEG}
```

8.27.4 Trigger Source

Set/get the trigger source. Internal means the meter triggers on the signal from the connected probe. External means the meter triggers on the external trigger input. This applies only when the Selected Source is set to FAST.

```
Command: TRIGger:SOURce {DEFault|INTernal|EXTernal}
Default: INTernal
Query:   TRIGger:SOURce?
Reply:   {INT|EXT}
```

8.27.5 Trigger Status

Get the trigger status.

```
Query:   TRIGger:STATus?
Reply:   {FREE|WAIT|TRIG}
```

Returns one of the following states:

- FREE -- the meter is free-running
- WAIT -- the meter is waiting for a trigger event
- TRIG -- a trigger event occurred within the last second

This command is always valid for all probes and modes.

- For pulse measurements, it returns WAIT when waiting for a pulse, or TRIG if a pulse occurred within the last second.
- For all other modes, it simply returns FREE.

9 Troubleshooting

This section provides information about how issues are reported by the FieldMax Touch Meter to assist in troubleshooting.

For Technical Support assistance, see ’Service and Support’ (p. 189) for information about various ways to contact Coherent.

9.1 Safe Mode

If there is an issue with startup of the FieldMax Touch Meter, the unit can be started in Safe Mode. This could happen if the saved settings file is corrupt or from an incompatible firmware version.

To start in safe mode, power the device off and then on. When the startup screen displays with the Coherent logo, press and hold the physical Back button.

At startup, the meter then displays a message that indicates that Safe Mode is enabled and that all settings are reset to default values.

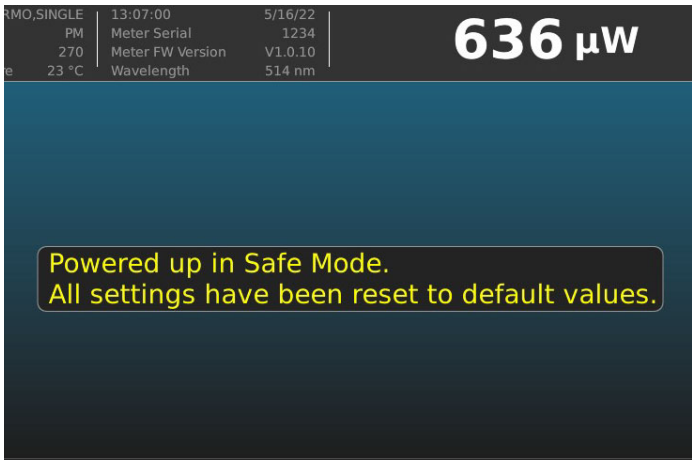

Figure 9-1. Startup in Safe Mode

9.2 Measurement Errors

The touchscreen user interface displays information in certain temporary conditions via indicators, visible here in the Measurement View in the Title Bar. For more information, refer to 'Indicators' (p. 79).



Figure 9-2. Error Indicator Types

9.3 Set Meter to Zero

Pressing the ZERO button clears all data and resets all values to zero. For information on the Zero mode, refer to 'Set the Meter to Zero' (p. 81).



NOTICE

It is recommended that the meter is set to zero after it is first set to ON and before any new set of power measurements is begun.
It should be the first thing that is done when using a thermopile or PmP sensor.

Appendix I: Parts and Accessories

This section describes parts and accessories for the FieldMax Touch Meter. This section also describes how to replace the battery in the meter.

I.1 Shipped with the Meter

Table I-1 shows the cables that are shipped with the FieldMax Touch Meter. For more information about cables, see ’Product Description’ (p. 11).

Table I-1. Cables for the FieldMax Touch Meter

P/N	Component
2237381	Cable, Trigger Input and Analog Output
1108906	Cable, USB A-to-USB B Mini
1256370	Power Supply 2.08A, 12V (24W)
1106344	Cord, Power Supply, 10A, 125V, NEMA5-15P/320-C13, 8' Black SJT, PVC Jacket, 18 AWG, Lead-Free
1122466	Carrying Case
—	Certificate of Calibration

I.2 Optional Accessories

Optional Accessories for the FieldMax Touch Meter are shown in Table I-2.

Table I-2. Accessories for the FieldMax Touch Meter

P/N	Description
2318247	Replacement Battery Pack, (Lithium Polymer); see 'Replace the Battery' (p. 173) for instructions.
2269910	Meter Mounting Accessory Kit, with two (2) 20 mm-wide brackets and (4) screws - see 'Put Meter on a Mount' (p. 30) for details about the Kit and instructions for mounting.

The following cable can also be used, but are customer-supplied and not included nor shipped with the FieldMax Touch Meter. Contact a local vendor for these cables.

- CAT5 Ethernet cable

I.3 Shop.Coherent

These accessories or product bundles can be ordered on the Shop.coherent.com website.

SHOP COHERENT

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

Appendix II: Safety

This section describes general requirements for safety for persons when using Coherent meters, sensors, and software in any environment where lasers are present. This section includes:

- 'Laser Safety Hazards' (p. 177)
- 'Electrical Safety' (p. 181)
- 'Safety for Lithium-Polymer Batteries' (p. 182)

These laser safety sections must be reviewed thoroughly BEFORE you begin. Carefully follow all safety instructions presented throughout this manual.



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

II.1 Laser Safety Hazards

The safety precautions shown below are to be read and observed by anyone working with or near a laser.

Hazards associated with lasers generally fall into the following categories:

- Biological hazards from exposure to laser radiation that may damage the eyes or skin
- Electrical hazards generated in the laser power supply or associated circuits
- Chemical hazards resulting from contact of the laser beam with volatile or flammable substances, or released as a result of laser material processing

This list is not intended to be exhaustive. Anyone operating a laser must consider the interaction with its specific working environment to identify potential hazards. Hazards vary with the input angle and the laser beam.



CAUTION!
Always avoid eye or skin exposure to both DIRECT and SCATTERED radiation.

Also refer to: https://www.coherent.com/support/laser-safety-standards

II.1.1 Optical Safety

Laser light, because of its optical qualities, poses safety hazards not associated with light from conventional light sources. The safe use of lasers requires all operators, and everyone near a laser, to be aware of the dangers involved. Users must be familiar with the instrument and the properties of coherent, intense beams of light.

At all times, ensure that all personnel who operate, maintain or service the laser are protected from accidental or unnecessary exposure to laser radiation exceeding the accessible emission limits defined in the laser safety standards.



CAUTION!
Direct eye contact with the output beam from the laser may cause serious eye injury and possible blindness.

The greatest concern when using a laser is eye safety. In addition to the main beam, there are often many smaller beams present at various angles near a laser. These beams are formed by specular reflections of the main beam at polished surfaces such as lenses or beamsplitters. While weaker than the main beam, such beams may still be sufficiently intense to cause eye damage.

Laser beams are powerful enough to burn skin, clothing, or combustible materials, even at some distance. They can ignite volatile substances such as alcohol, gasoline, ether, and other solvents, and can damage light-sensitive elements in video cameras, photomultipliers, and photodiodes. Follow the control measures listed in 'Precautions for Laser Safety' (p. 180).

II.1.1.1 Laser Safety Eyewear

Always wear appropriate laser safety eyewear for protection against the specific wavelengths and laser energy being generated.

The appropriate eye protection can be calculated as defined in the “EN 207 Personal eye protection equipment—Filters and eye-protectors against laser radiation (laser eye-protectors)”, in other national or international standards (such as ANSI, ACGIH, or OSHA) or as defined in national safety requirements.



CAUTION!

Laser safety eyewear protects from accidental exposure to laser radiation by blocking light at the laser wavelengths. However, laser safety eyewear may also prevent the operator from seeing the beam or the beam spot. Exercise extreme caution even while wearing safety glasses.

II.1.1.2 Viewing Distance

A laser produces optical power levels that are dangerous to the eyes and skin if exposed directly or indirectly. This product must be operated only with proper eye and skin protection at all times. Never view directly emitted or scattered radiation with unprotected eyes.

When viewing the laser during operation, the operator must maintain the Nominal Ocular Hazard Distance (NOHD) between the laser or scatter radiation and the operator's eyes. Check the *Operator’s Manual* for the laser being used.

II.1.1.3 Maximum Accessible Radiation Level

A laser produces visible radiation over the various wavelengths. See the Product Label on the laser being used for details about maximum emission levels.

II.1.2 Laser Back Reflection

Back reflection (also referred to as retroreflection) occurs when a part of the laser beam is sent back into the laser’s exit aperture.

Back reflection can be caused by any object in front of the laser and can result in instability, noise, or damage to the laser. Damage from back reflection can be immediate, or it can be subtle and slowly decrease the service life of a laser. A laser that shows symptoms—such as low output power, no output power, over-current, or high noise—indicates a possibility of back reflection to the laser.

II.1.3 Precautions for Laser Safety

The following recommended precautions and guidelines to prevent damage to persons or property should always be observed. Laser beams can easily cause flesh burns or ignite clothing. These precautions also help to increase the operating life of the laser.

- Read and follow all safety precautions in the associated product manuals (whether Installation, Set-Up, Quick Start, Operator's or User Manuals).
- Set up the laser so that the beam height is either well below or well above eye level.
- Never look directly into the laser light source or at scattered laser light from any reflective surface, even when wearing laser safety eyewear. Never sight down the beam.
- Always wear appropriate eyewear for protection against the specific wavelengths and laser energy being generated. See 'Laser Safety Eyewear' (p. 178) for more information.
- Watch where the reflections from objects are returning to make sure the reflections are not at or near the laser exit aperture. Change the objects to add an angle so the object is less reflective whenever possible. Add an optical isolator to those applications with laser exit aperture back reflections that cannot be corrected by angling the optics.
- Review any objects in front of the laser and make a note of which surfaces are a possible hazard for back reflections. Keep precautions in mind when moving objects that can create a back reflection in front of the laser.
- Avoid wearing watches, jewelry, or other objects that may reflect or scatter the laser beam.
- Block the beam before applying tools such as Allen wrenches or ball drivers to external optics.
- Provide enclosures for beam paths whenever possible.
- Stay aware of the laser beam path, particularly when external optics are used to steer the beam.
- Use appropriate energy-absorbing targets for beam blocking.
- Terminate the laser beam with a light-absorbing material. Laser light can remain collimated over long distances and therefore presents a

potential hazard if not confined. It is good practice to operate the laser in an enclosed room.

- Decrease the power from any possible back reflections by starting the laser at lower output power—for example, 10% output power—before opening the laser shutter.
- Exercise extreme caution when using solvents in an area with any laser.
- Post laser warning signs in the area of the laser beam to alert those present.
- Limit access to the laser to trained and qualified users who are familiar with laser safety practices. When not in use, lasers should be shut down completely and made off-limits to unauthorized personnel.

Advise all those working with or near the laser of these precautions.

II.2 Electrical Safety

Everyone must observe the following precautions when working with potentially hazardous electrical circuitry.

II.2.1 Electrical Safety Precautions

Following are recommended electrical safety precautions:

1. Disconnect the power supply before working on any electrical equipment when it is not necessary for the equipment to be operating.
2. Do not short or ground the power supply output. Protection against possible hazards requires proper connection of the ground terminal on the power cable, and an adequate external ground. Check these connections at the time of installation, and periodically thereafter.



CAUTION!
Normal operation of the meter should not require access to the power supply circuitry. Removing the power supply cover gives exposure to potential electrical hazards.

3. When possible, keep one hand away from the equipment to reduce the danger of current flowing through the body if a live circuit is touched accidentally.

4. Always use approved, insulated tools.

II.2.2 ESD Protection

The most common Electrostatic Discharge (ESD) damage occurs when handling a device during installation or use. Dry air and carpet also create a higher potential for ESD.

When mobile equipment (a cart or table) is used as an ESD-protected workstation, connect it to ESD ground that meets ANSI/ESD S4.2 required limits for an ESD-protected workstation (<1 x 10^9 ohms).



CAUTION!
Electrostatic charges as high as 4000 volts easily collect on the human body and equipment and can discharge without detection. Although the electronics features have input protection, permanent damage can occur on devices subjected to high-energy electrostatic discharges.

Take necessary precautions or shielding to protect the system from ESD to prevent damage or performance degradation to the system.

II.3 Safety for Lithium-Polymer Batteries

The FieldMax Touch Meter includes a 7.3V 3Ah LI-POLY (Lithium Polymer) battery.



WARNING!
Read these safety precautions carefully before testing or using the battery. Improper handling of Li-Poly cells may lead to loss of efficiency, overheating, electrolyte leakage, ignition, or even explosion.

Do not use the cell in an environment that may cause problems. The following conditions may reduce the cycle life of the cell:

- Static electricity
- Vibration
- Humid environment
- An area of high-frequency microwave or ultrasonic wave

II.3.1 Battery Operating Temperature

Do not use the battery in high or low temperatures. For example, do not use or store the battery in direct sunlight or near heat sources (such as heaters) where the temperature could exceed 60°C.



WARNING!
If the battery generates excessive heat, emits a smell, changes color, becomes deformed, or shows any other abnormalities during use or testing, IMMEDIATELY stop use. The battery may fail and ignite.



IMPORTANT!
Other than opening the Battery compartment to replace a battery, do NOT open the case. Tampering with the case voids the Warranty.

Table II-1 shows the operating and storage temperatures for the battery:

Table II-1. Lithium-Polymer Battery Operating Temperatures

Operating Temperature	Temperature	Maximum Continuous Rate
Operating Temperature: **Charge**	0°C ≤ T ≤ 15°C	0.2C (500 mA)
	15°C < T ≤ 30°C	0.5C (1250 mA)
	30°C < T ≤ 50°C	1C (2500 mA)
Operating Temperature: **Discharge**	–20°C ≤ T ≤ 0°C	0.2C (500 mA)
	0°C < T ≤ 20°C	1C (2500 mA)
	20°C < T ≤ 45°C	3C (7500 mA)
	45°C < T ≤ 60°C	1C (2500 mA)

CAUTION!
Always work in correct operating temperature. Using batteries outside of its operating temperature leads to reduced performance and increased safety risk.

Table II-2 shows the recommended Storage Temperature:

Table II-2. Lithium-Polymer Battery Storage Temperature

Time	Temperature	Relative Humidity
One month	–20°C ~ 50°C	≤ 80%
Three months	–20°C ~ 45°C	≤ 80%
One year	–20°C ~ 25°C	≤ 75%

II.3.2 Battery Safety Precautions

Do not store the battery without proper isolation, nor connect the positive and negative electrodes directly with conductive materials. Doing so may short-circuit the battery.

Do not place the battery in packaging or bags with any metal objects, such as tools, screws, coins, keys, or watches.

Do not get the battery wet or throw it into water. When the battery is not in use, place it in a dry environment with a relatively low temperature.

If the leaking chemicals from the battery gets into your eyes, do not rub your eyes. Rinse the eyes with clean water and seek medical attention if problems remain. If the chemical gets onto the skin or clothing, immediately flush with clean water.

II.3.3 Battery Long-Term Storage

When delivered, cells are charged to a voltage of 3.60V ~ 3.80V. Storing cells at/more than 80% SOC for a long time leads to loss of capacity and cycle life. Put cells into use within 90 days when the capacity is more than 80%.

Cells can have lower capacity than expected due to the self-discharge when cells are to be delivered at 30% SOC.

II.3.4 Pack or Recycle the Battery

If for any reason the FieldMax Touch Meter is to be shipped, you must first remove the Lithium Polymer battery. Cells area required to be in a half-charged state when packed.

The surface of the packing boxes must contain the following information:

- Product name
- Type
- Nominal voltage
- Quantity
- Gross weight
- Date
- Capacity
- Impedance

Mark the shipping box with a label that indicates it contains a Lithium-polymer battery, as in the example shown in Figure II-1:



Figure II-1. Label for Lithium-Polymer Battery

II.3.5 Transportation

During transportation, do not subject the cells or the boxes to violent shaking, bumps, rain or direct sunlight. When properly prepared, cells can be transported by ground, ship, or air.

II.4 Safety Label Location and Information

The bottom of the FieldMax Touch Meter unit has a product label that provides serial number, safety and compliance information. Refer to the example in Figure II-2.



Figure II-2. FieldMax Touch Meter Product Label

Appendix III: Compliance

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

For additional information about Coherent Compliance, please visit:

https://www.coherent.com/company/environmental

III.1 CE Marking

The European Community requirements for product safety are specified in the Low-Voltage Directive (LVD) (published in 2014/35/EU).

This Directive requires that lasers comply with the standard EN 61010-1/IEC 61010-1 “Safety Requirements For Electrical Equipment For Measurement, Control and Laboratory Use” and EN 60825-1/IEC 60825-1 “Safety of Laser Products”. Compliance with the European requirements is certified by CE Marking.

III.2 Electromagnetic Compatibility

The primary issue for electromagnetic compatibility is to design covers, shielding, grounding, routing of electrical cable assemblies, and control elements with the proper safety features for a complete system.

The European requirements for Electromagnetic Compliance (EMC) are specified in the EMC Directive (published in 2014/30/EU).

Class A:
Conformance (EMC) concerning emission and immunity is achieved through compliance with the harmonized standard EN 61326-1_Ed2:2013 (IEC 61326-1_Ed2:2012 for Electrical Requirement for Measurement, Control and Laboratory for Class A.

Class B:
Conformance to the EMC requirements is achieved through compliance with the harmonized standards EN55011:2009 for emission and ENC61000-6-2:2006 for immunity.

III.3 Environmental Compliance

Coherent is committed to delivering products that meet or exceed global regulatory requirements for safety, environmental responsibility, and ethical sourcing. Our comprehensive compliance program supports international frameworks including:

- RoHS, REACH, WEEE, and other regional substance and waste directives
- Battery, packaging, and energy efficiency regulations
- Conflict minerals, PFAS, and supply chain transparency initiatives
- Export control, trade compliance, and product stewardship obligations

To support transparency and facilitate access to product-specific documentation, Coherent provides a centralized online portal where customers and partners can:

- Search for declarations and certificates by part number or product family
- Download regulatory statements, safety datasheets, and environmental disclosures
- Contact our compliance team for product-specific questions or documentation requests

Compliance Portal: www.coherent.com/company/environmental

Compliance Contact: productstewardship@coherent.com

Coherent continuously monitors global regulatory developments and updates its documentation accordingly. For region-specific requirements or additional support, please contact us through the portal or the email listed above.

Appendix IV: Service and Support

This section provides information about technical support, service and shipping instructions.

IV.1 Technical Support

Coherent provides telephone and web-based technical assistance as a service to its customers and assumes no liability for any injury or damage that can occur at the same time with such services.

Operation of any Coherent laser with any of its interlocks (or safety features) defeated is always at the operator's own risk. Under no circumstances do these support services affect the terms of any Warranty agreement between Coherent and the buyer.

Be prepared to provide the following information to the Product Support Engineer responding to the request:

- The unit model or part number
- Laser head serial number
- A description of the problem
- Any corrective steps that have been attempted

IV.1.1 Support in the USA and North America

Should any difficulties with the unit be experienced or for product or technical information, contact Coherent as follows:

- By email: LSMservice@coherent.com
- Website: www.Coherent.com

For further assistance, please contact Coherent Technical Support for laser measurement products:

- By phone: (800) 343-4912 or 1-(503)-454-5700 outside the U.S.

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

IV.1.2 International Support

If located outside the U.S., visit www.Coherent.com for technical assistance, or contact your local Service Representative directly:

- Germany: +49–6071–968–0
- Japan: +813–5635–8680

On the Coherent website, contact information (telephone numbers and addresses) for Service Representatives worldwide is provided.

IV.2 Obtain Service

To obtain product 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) as instructed in 'Product Shipment Instructions' (p. 191)
- Ship it to the address specified by the Company, with shipping prepaid. back to Coherent in conjunction with recalibration and recertification.
- Coherent shall pay the cost of shipping the Product back to the Customer in conjunction with product failures within the first twelve (12) months of time of sale or during an extended 12-month warranty period.

IV.3 Product Shipment Instructions

A Returned Material Authorization number (RMA) assigned by the Company must be provided on the outside of all shipping packages and containers. Items returned without an RMA number are subject to return to the sender. Detailed instructions to prepare a product for shipping are provided in the next section.

To prepare a product for shipping to Coherent:

1. Contact Customer Service 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 that was received from Coherent Customer Service. Pack this tag inside the box.
3. Wrap the product with polyethylene sheeting or equivalent material.
4. Using the original shipping and packaging materials, pack the product.
5. Seal the shipping carton with shipping tape or an industrial stapler.
6. Add the RMA number that was received from Coherent Customer Service to the shipping label on the outside of the box. Ship the product to one of the following addresses:

USA

Coherent Laser Measurement and Control Service Center
Attn: (your RMA number)
27650 SW 95th Avenue
Wilsonville, OR 97070

Europe

Coherent Shared Services B.V.
Dieselstr. 5 b
D-64807 Dieburg
Germany

Asia

Coherent, Inc. Japan
Atsugi Technical Center
Toda 1042-4
Atsugi, Kanagawa Prefecture
243-0023, Japan

Appendix V: Warranty

Coherent Corp. warrants the FieldMax Touch Meter to the original purchaser (the Buyer) only, that the laser system, that is the subject of this sale, (a) conforms to Coherent's published specifications and (b) is free from defects in materials and workmanship.

Laser systems are warranted to conform to Coherent's published specifications and to be free from defects in materials and workmanship for a period stated in the sales agreement.

V.1 Responsibilities of the Buyer

The buyer is responsible for providing the appropriate utilities and an operating environment as outlined in the product literature. Damage to the laser system caused by failure of buyer's utilities or failure to maintain an appropriate operating environment, is solely the responsibility of the buyer and is specifically excluded from any warranty, warranty extension, or service agreement.

The Buyer is responsible for prompt notification to Coherent of any claims made under warranty. In no event will Coherent be responsible for warranty claims made later than seven (7) days after the expiration of warranty.

V.2 Limitations of Warranty

The foregoing warranty shall not apply to defects resulting from:

- components and accessories manufactured by companies, other than Coherent, which have separate warranties
- improper or inadequate maintenance by the buyer
- buyer-supplied interfacing
- operation outside the environmental specifications of the product
- unauthorized modification or misuse
- improper site preparation and maintenance or

- opening the laser head housing

Coherent assumes no responsibility for customer-supplied material. The obligations of Coherent are limited to repairing or replacing, without charge, equipment which proves to be defective during the warranty period. Replacement sub-assemblies may contain reconditioned parts. Repaired or replaced parts are warranted for the duration of the original warranty period only. Our warranty does not cover damage due to misuse, negligence or accidents, or damage due to installations, repairs or adjustments not specifically authorized by Coherent.

Warranty applies only to the original purchaser at the initial installation point in the country of purchase, unless otherwise specified in the sales contract. Warranty is transferable to another location or to another customer only by special agreement which will include additional inspection or installation at the new site. Coherent disclaims any responsibility to provide product warranty, technical or service support to a customer that acquires products from someone other than Coherent or an authorized representative.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED, AND DOES NOT COVER INCIDENTAL OR CONSEQUENTIAL LOSS. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

Glossary

°C	Degrees Centigrade or Celsius
°F	Degrees Fahrenheit
Ω	Ohm(s)
µ	Micron(s)
µm	Micrometer(s) = 10^{-6} meters
µrad	Microradian(s) = 10^{-6} radians
µsec	Microsecond(s) = 10^{-6} seconds
$1/e^2$	Beam diameter parameter = 0.13534

AC	Alternating current
Amp	Ampere(s)
APC	Angle physical contact
Application Protocol	A set of application defined commands and replies used to implement a system of cooperative devices
Automatic Send Data Control	An optional hardware feature that is useful to control enable/disable of transmit enable line of RS-485 transceiver

BNC	Type of connector
Broadcast Message	Message sent by a master device and received by all connected slave devices
BUSMGMT	Message is a bus management message.

CCB	Coherent Connection Bus, a RS-485 communication bus
CDRH	Center for Devices and Radiological Health
cm	Centimeter(s)
CW	Continuous wave

DC	Direct current
DDL	Direct diode laser
Destination Address	Address of the recipient device for a message
DHCP	Dynamic Host Configuration Protocol. A protocol that provides a means to dynamically allocate IP addresses to computers on a local area network.
DLE	Data link escape

EOM	A two-byte sequence indicating the end of a message packet
ESD	Electrostatic discharge
ETX	End of message data

FC	Fiber-connector
FP	Fiber pigtail

g	Gram(s) or earth’s gravitational force (gravity)
GUI	Graphical user interface

Hz	Hertz or cycles per second (frequency) (= 1/pulse period)
IEC	International Electrotechnical Commission
IR	Infrared (wavelength)
I/O	Input/output
IP	Internet Protocol Address
PTJ	Pulsed-Thermopile-Joules
kg	Kilogram(s) = 10^3 grams
kHz	Kilohertz = 10^3 hertz
kOhm	Kilohm(s) = 10^3 ohms
LCD	Liquid crystal display
LED	Light emitting diode
m	Meter(s) (length)
mA	Milliamp(s) = 10^{-3} Amperes
mAmp	Milliampere(s)
Master	Controlling device which manages bus direction, assigns device addresses, and generally the source for all application protocol command initiation
MHz	Megahertz = 10^6 hertz
mm	Millimeter(s) = 10^{-3} meters
mrad	Milliradian(s) = 10^{-3} radians (angle)
ms	Millisecond(s) = 10^{-3} seconds
mV	Millivolt(s)
MVP	Modulation and variable power
mW	Milliwatt(s) = 10^{-3} Watts (power)
NA	Numerical aperture
nm	Nanometer(s) = 10^{-9} meters (wavelength)
Nm	Newton meter (torque)
OEM	Original equipment manufacturer
OPSL	Optically-pumped semiconductor laser
oz·in.	Ounce inches
PIP	Port Identification Pin, a signal pin located on the cable connecting the slave device to the CCB
PMP	PowerMax Pro
PPS	Pulses per second
rms	Root mean square (effective value of a sinusoidal wave)
RMA	Return material authorization
SCPI	Standard commands for programmable instruments. This standard, developed by Hewlett-Packard, complements IEEE 488.2 and is promoted by the SCPI Consortium.
SDR	Shrunk delta ribbon. This connector type is used on the back panel of the OBIS Laser for the full-feature I/O cable.
Slave	Device which receives and interprets messages and responds as required

Source Address
: Address of the device transmitting a message

Standard Message
: Message sent from the master device to a specific slave device address

SRCCCB
: Message originated from CCB stack.

SRCCONT
: Message originated from master device (controller).

STX
: Start of message data

System Protocol
: A set of predefined bus management commands and responses used by CCB protocol stacks for set-up and management of the bus

TEC
: Thermoelectric cooler

TEM
: Transverse electromagnetic mode (cross-sectional laser beam mode)

TTL
: Transistor-transistor logic

UART
: Universal asynchronous receiver/transmitter

UFC
: Ultra-flat contact

UV
: Ultraviolet

V
: Volt(s)

VAC
: Volts, alternating current

VDC
: Volts, direct current

W
: Watt(s) (power)

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