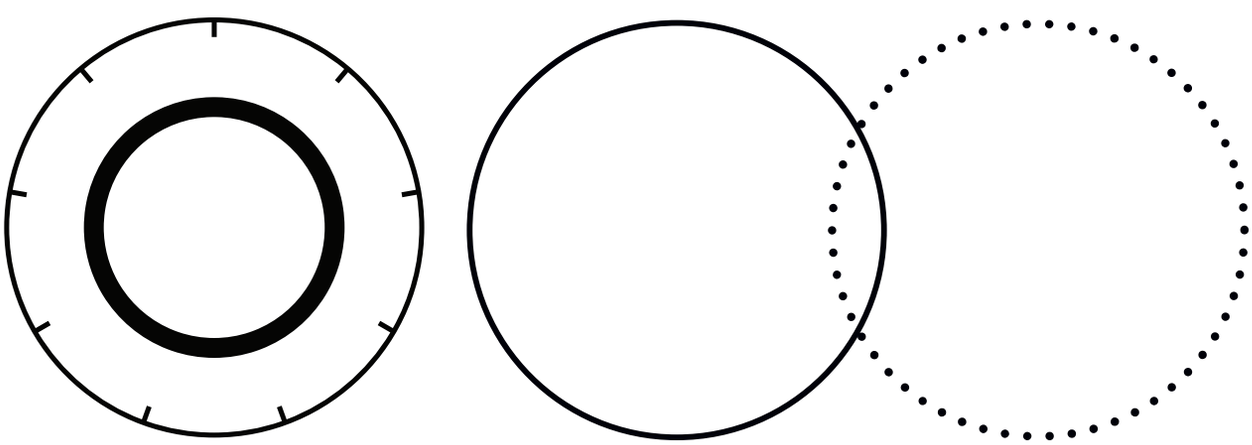
FieldMaxII-TOP™

User Manual



INNOVATIONS THAT RESONATE

COHERENT

User Manual
FieldMaxII-TOP
Laser Power/Energy Meter

COHERENT

27650 SW 95th Ave.
Wilsonville, OR 97070

Patents referenced in this user manual were active as of the printing date of the manual (see last page for date). The patents referenced herein may have expired. You are advised to check to see if the patents are still active: http://portal.uspto.gov/external/portal/pair.

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Should you experience any difficulties with your product or need any technical information, please visit our website: www.Coherent.com. Additional support can be obtained by contacting our Technical Support Hotline at 1.800.343.4912 (1.503.454.5700 outside the U.S.), or e-mail LSMupport@Coherent.com.

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

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

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If you are located outside the U.S., visit our website for technical assistance or contact our local service representative. Representative phone numbers and addresses can be found on the Coherent website: www.Coherent.com.

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1 Introduction

1.1 Signal Words and Symbols in this Manual

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

1.1.1 Signal Words

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

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

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

WARNING!
Indicates a hazardous situation that, if not avoided, 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 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 FieldMaxII-TOP™ laser power/energy meter.

1.3 Safety and Compliance

Read and obey all safety and compliance information provided in the next chapter before equipment is set up and operated.

1.4 Publication Updates

To view information that may have been added or changed since this publication went to print, connect to www.Coherent.com/resources.

2 Safety and Compliance

Carefully review the following safety information to avoid personal injury and to prevent damage to this meter or any sensor connected to it. Except for replaceable batteries—discussed under 'AC Adapter' (p. 12)—there are no user-serviceable parts in the FieldMaxII-TOP meter. For service information, refer to 'THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, OR IMPLIED. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS PRODUCTS.' (p. 55).

WARNING!
Use only the power cord specified for the meter. The grounding conductor of the cord must be connected to earth ground.

WARNING!
Do not operate the meter if its panels are removed or any of the interior circuitry is exposed.

WARNING!
Do not operate the meter in wet or damp conditions, or in an explosive atmosphere.

NOTICE
Operate the meter only within the specified voltage range.

NOTICE
Do not apply a voltage outside the specified range of the input connections.

NOTICE
Do not operate the meter if there are suspected failures. Refer damaged units to qualified Coherent service personnel.

2.1 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

2.1.1 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.

2.1.2 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.

2.1.3 Environmental Compliance

This section describes compliance with various environmental regulatory directives to identify hazardous substances.

2.1.4 RoHS Compliance

The European Union RoHS Directive EN 50581:2012 restricts the use of certain hazardous substances in electrical and electronic equipment.

Coherent product(s) conform to all applicable requirements of the EU-RoHS Directive (2011/65/EU) and Amendment Directive (EU) 2015/863. Compliance Declarations are available upon request.

2.1.4.1 China RoHS Compliance

The China RoHS (Restriction of Hazardous Substances) Regulation SJ/T 11364-2014 restricts the use of certain hazardous substances in electrical and electronic equipment. The China RoHS Regulation applies to the production, sale, and import of products into the Peoples Republic of China.

Any hazardous substances in Coherent products (if applicable) are listed on the product label, as shown in the example shown in Figure 2-1:

	产品中有害物质的名称及含量						
部件名称 Part Name	有害物质 Hazardous Substances						
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
印刷电路板组装 Printed Circuit Board Assembly	X	O	O	O	O	O	
电源 Power Supply	X	O	O	O	O	O	
电源线 Power Cord	X	O	O	O	O	O	
本表格依据 SJ/T 11364 的规定编制 O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。 X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。							

Figure 2-1. China RoHS Label

The China RoHS Regulation also requires that the date of manufacture be identified. This information is provided on the *Certificate of Calibration* shipped with each product.

2.1.5 Waste Electrical and Electronic Equipment (WEEE, 2002)

Coherent product(s) conform to all applicable requirements of the EU Waste Electrical and Electronic Equipment (WEEE)- Directive (2012/19/EU). WEEE management also covers EU Directive 2006/66/EC-EU Battery Directive and Directive 94/62/EC on Packaging and Packaging Waste. Do not dispose of these products or packaging as unsorted municipal waste.

Coherent joins approved compliance organizations to meet its collection and recycling obligations. For further information, please contact:

Email: info@rene-europe.com
Phone: +49 (0) 8266-869806
Website: www.rene-europe.com

This directive is represented by a crossed-out garbage container label, shown in Figure 2-2.

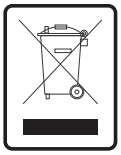


Figure 2-2. WEEE Label

2.1.6 Battery Directive

The batteries used in this product are in compliance with the EU Directive 2006/66/EC (“EU Battery Directive”). For a list of batteries used with the product, refer to Table A-1, ’Batteries Contained in this Product,’ (p. 59).

2.2 Export Control Laws Compliance

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

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

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

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

2.3 Declaration of Conformity

Declaration of Conformity certificates are available upon request.

3 Description

Thank you for purchasing the FieldMaxII-TOP™—a versatile, easy-to-use digital power/energy meter designed for field service and production applications.

Figure 3-1. FieldMax II TOP

3.1 Features

Below is a list of specific features included in the FieldMaxII-TOP meter:

- 73 x 58 mm backlit LCD display
- Fast and effective laser tuning mode
- Works with thermopile, pyroelectric, and optical sensors
- Measures energy up to 300 pps
- Intuitive soft key-driven user interface
- USB 1.1 interface
- Portable AC/DC operation
- Compact, rugged enclosure with stand

The versatile FieldMaxII-TOP measures:

- Power: W, W/cm^2
- Energy: J, J/cm^2
- Frequency: Hz
- Full statistics: max, min, mean, and standard deviation

3.2 Front Panel

The front panel—Figure 3-2, below—includes a liquid crystal display (LCD) and buttons that are used to enter parameters, select modes, and change ranges.

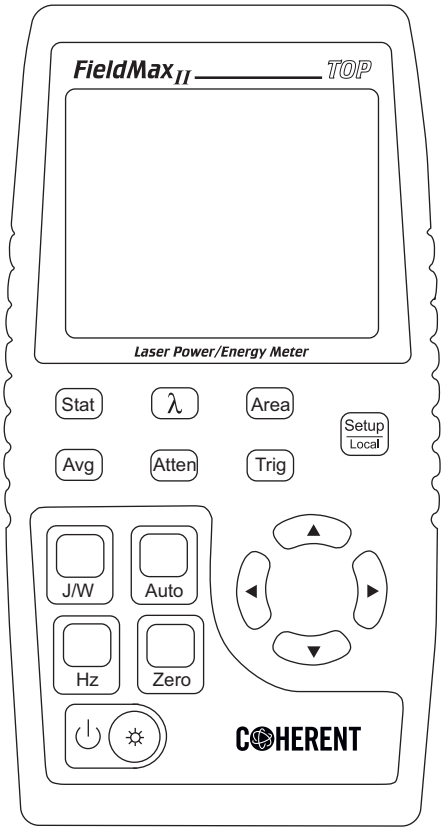
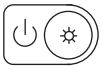


Figure 3-2. Front Panel

3.2.1 Buttons

The following buttons are on the front panel of the FieldMaxII-TOP:

- Setup/Local—starts or ends a parameter edit cycle. This button is also used to cancel the front panel lockout when Remote Control is active.
- Stat—statistics processing parameter
- Wave (λ)—wavelength compensation parameter
- Area—area correction parameter
- Avg—display smoothing parameter
- Atten—attenuation correction parameter
- Trig—trigger level parameter
- J/W—Joules or Watts mode
- Auto—Auto Ranging mode
- Hz—Rep Rate Display mode
- Zero—start batch. When Statistics mode is not active, this button can also be used to zero a sensor (thermopile or optical), or restart a batch (pyroelectric).
-  —Power Switch/Backlight Toggle button
- Up Arrow (▲)—field adjust or range select
- Down Arrow (▼)—field adjust or range select
- Left Arrow (◀)—field select
- Right Arrow (▶)—field select

For detailed information about each of these buttons, refer to ’Operation’ (p. 25).

3.2.2 Display

The LCD display provides visual measurement information. Figure 3-3 shows all the possible segments that may appear on the display.

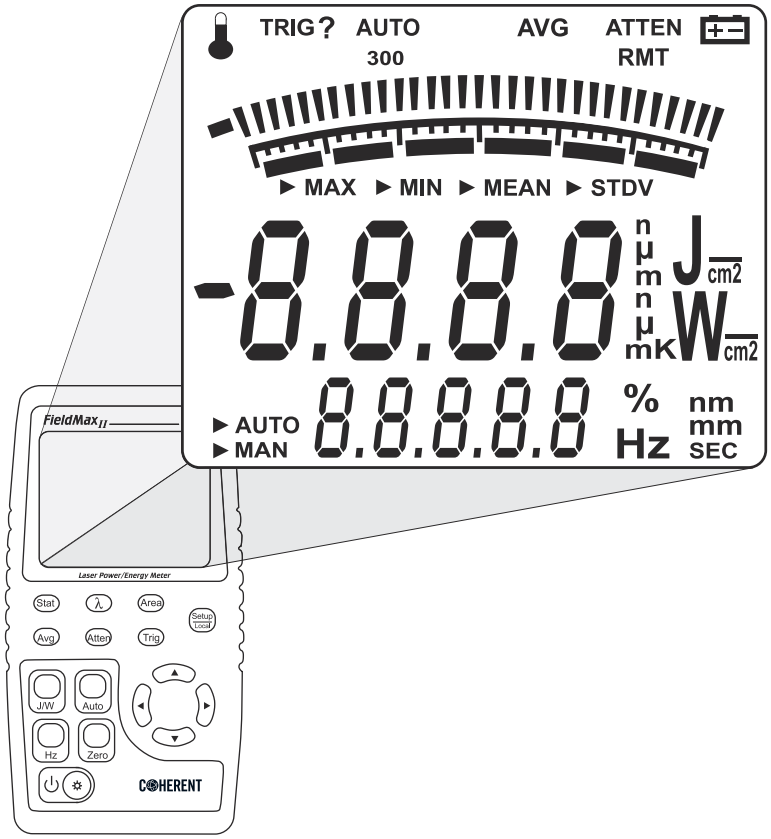


Figure 3-3. LCD Display

NOTICE

The type of sensor being used and the individually-selected settings determine what type of information will actually appear on the display

Information that appears on the display is divided into the groups described in the following list. Figure 3-2 shows the general location of each group).

- Annunciators: Temperature, TRIG,AUTO, Range Hint, AVG, ATTEN, RMT, and Battery
- Digital tuning feature

- Tuning meter scale
- Statistical parameters: MAX, MIN, MEAN, and STDV
- Numeric measurement value—large numeric characters
- Measurement units and engineering prefixes
- Statistical Sampling mode: AUTO and MAN
- Numeric data entry, batch count, parameter settings, and Hertz measurement values
- Data entry units, Hertz units, and current parameter units

For detailed information about these settings, refer to ’Button Functions’ (p. 36).

3.3 Right Side Panel

The right side panel contains the USB and Sensor connectors—refer to Figure 3-4.

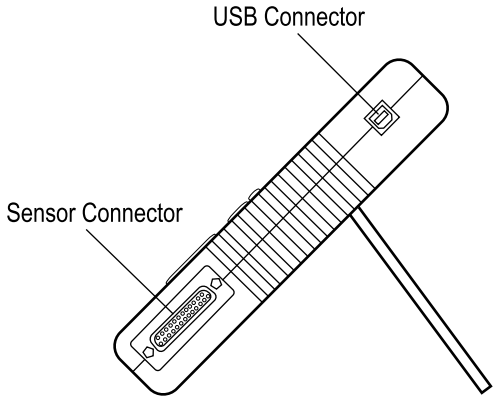


Figure 3-4. Right Side Panel

3.3.1 USB Connector

Attachment of the supplied cable to this standard USB connector allows communication between FieldMaxII-TOP and a computer with a USB interface.

3.3.2 Sensor Connector

Use this connection to attach a DB-25 SmartProbe connector or adapter.

3.4 Left Side Panel

The left side panel contains the Analog Out and Power Jack connectors. Refer to Figure 3-5.

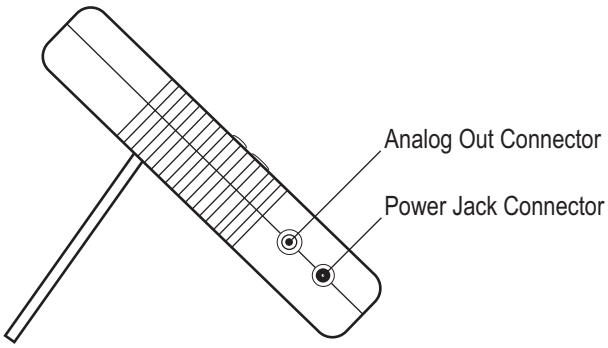


Figure 3-5. Left Side Panel

3.4.1 Analog Out Connector

When power is set to ON, the Analog Out connector outputs a voltage proportional to the current laser measurement. The output voltage is zero (0) volts when the measured energy or power is zero (0) or less. The output voltage is the full-scale output voltage when the measured energy or power is full-scale or over-ranged. The full-scale output voltage (1V, 2V, or 5V) is selected via the host interface. Factory default full-scale output voltage is 2V.

3.4.2 Power Jack Connector

The supplied power cord is connected to this jack.

3.5 AC Adapter

Use of an AC adapter prolongs battery life. FieldMaxII-TOP automatically senses when an adapter is used.

When batteries rather than an adapter, are used, the battery annunciator flashes if the battery charge is low.

While in battery operation, if a sensor is not connected to the meter, power is automatically set to OFF after ten minutes.

4 Quick Setup and Getting Started

This section presents a series of ‘mini-tutorials’ that explain how to connect a sensor to a FieldMaxII-TOP meter and to begin taking measurements within minutes. For in-depth information about the procedures introduced in this section, refer to ’Operation’ (p. 25).

In this section:

- ’Install Software and Drivers’ (p. 16)
- ’Install Software and Drivers’ (p. 16)
- ’Measure Average Power With a Pyroelectric Sensor’ (p. 17)
- ’Measure Power With a Thermopile or Optical Sensor’ (p. 18)
- ’Measure Energy With a Pyroelectric Sensor’ (p. 19)
- ’Measure Energy With a Thermopile Sensor’ (p. 20)

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

WARNING!
Power to the FieldMaxII-TOP instrument must be OFF before beginning any of the procedures described in this section.

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

4.1 Install Software and Drivers

4.1.1 Install Software

For complete software installation instructions, refer to the *FieldMax II Software Installation and Quick Start Guide* (PN 1176436), available on the Coherent website.

If that document is unavailable, go to www.coherent.com/resources and download the Fieldmax II Setup software.

4.1.2 USB Driver Installation

When first connecting the meter to a PC with the USB cable, users are prompted through an installation process. USB drivers are automatically installed onto the computer.

Insert the supplied USB drive when prompted.

4.2 Measure Average Power With a Pyroelectric Sensor

The following figure shows how to set up a pyroelectric sensor to take an average power measurement.

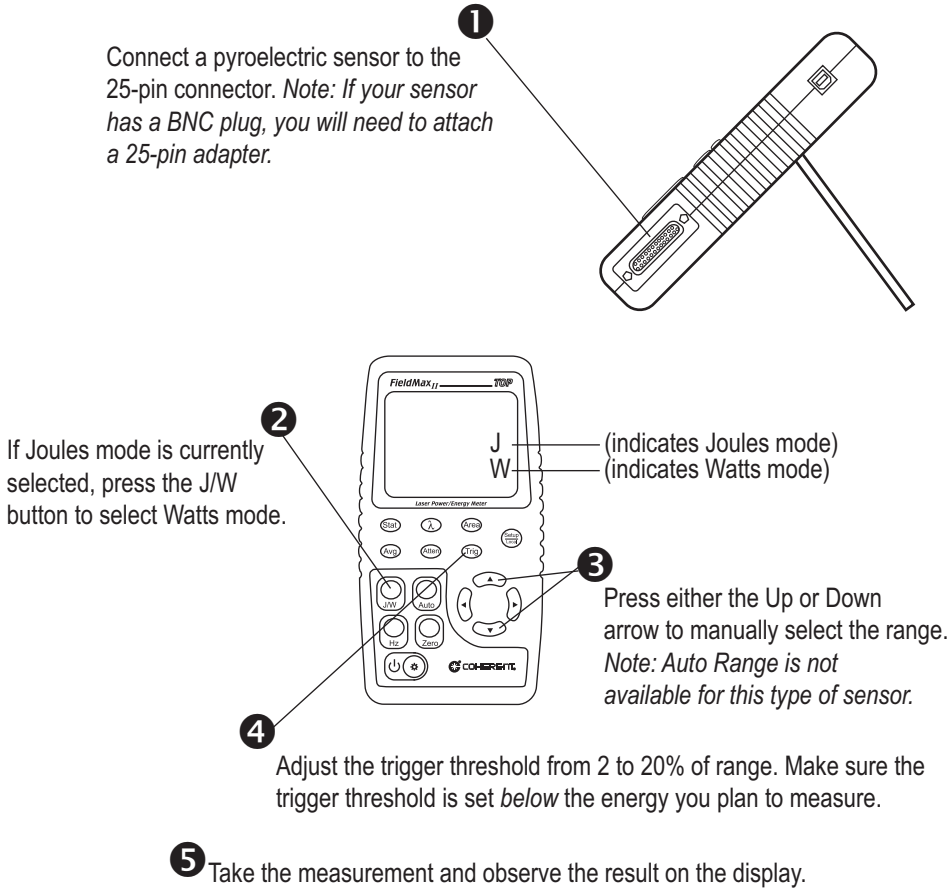


Figure 4-1. Measure Average Power With a Pyroelectric Sensor

4.3 Measure Power With a Thermopile or Optical Sensor

The following figure shows how to take a power measurement with a thermopile or optical sensor.

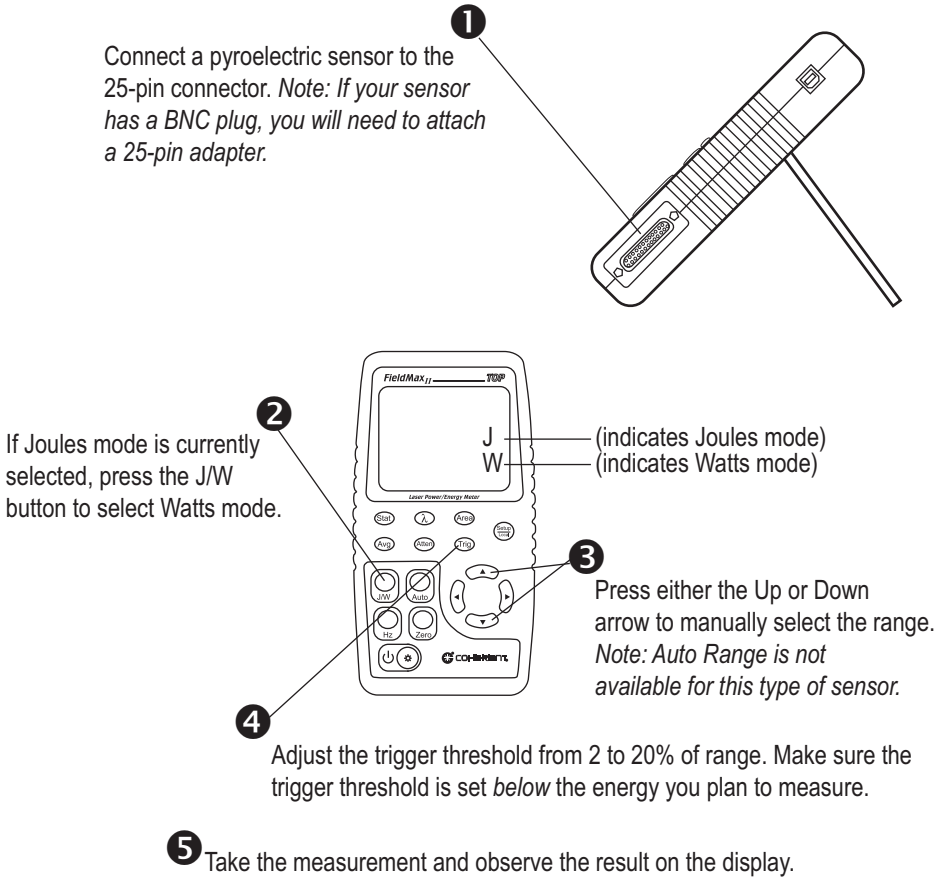


Figure 4-2. Measure Power With a Thermopile or Optical Sensor

4.4 Measure Energy With a Pyroelectric Sensor

The following figure shows how to set up a pyroelectric sensor to take an energy measurement.

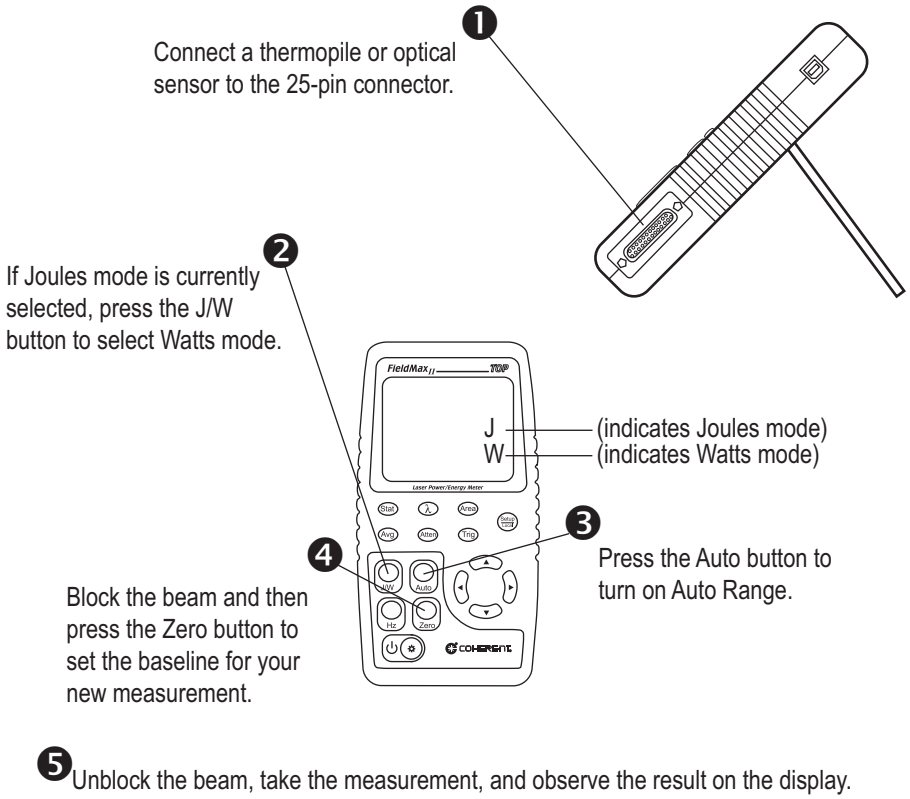


Figure 4-3. Measure Energy With a Pyroelectric Sensor

4.5 Measure Energy With a Thermopile Sensor

4.6 The following figure explains how to take an energy measurement using a thermopile sensor.Special

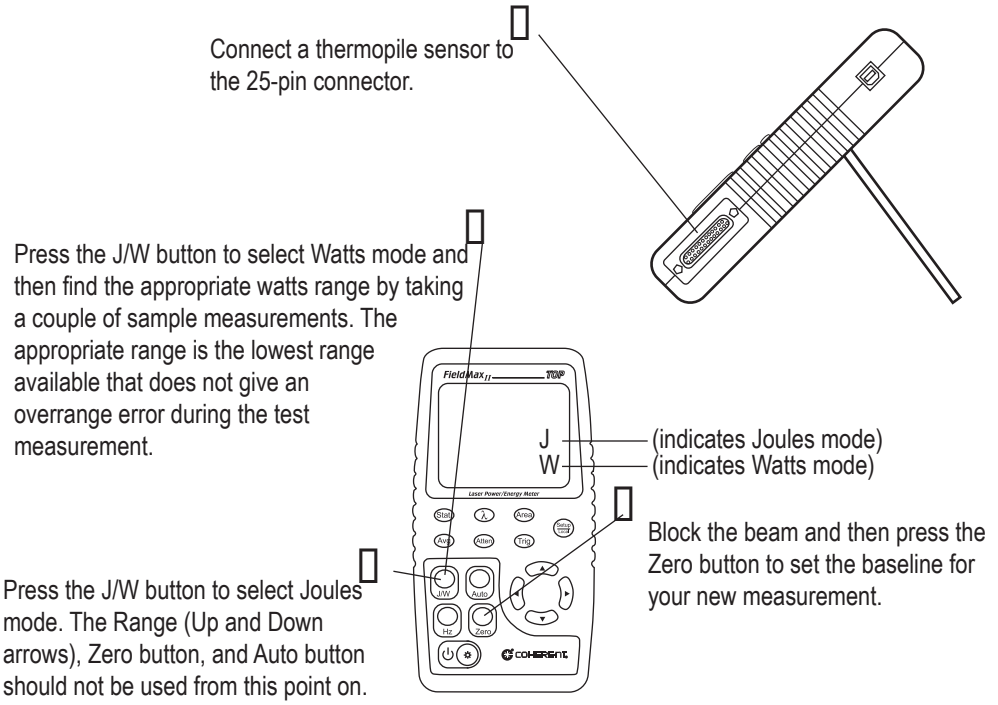


Figure 4-4. Measure Energy With a Thermopile Sensor

Topics

This section gives more information on trigger states and modes of operation.

4.6.1 Trigger States and the Trigger Annunciator

Two segments are dedicated to the indication of the trigger state of the meter. These are the TRIG and the '?' segment that follows it. The trigger state is always used when a pyroelectric sensor is attached.

There are two possible trigger states when a pyroelectric sensor is attached: 'triggered' and 'wait for trigger.' The triggered state indicates that the meter is capturing laser pulses. The wait for trigger state indicates an absence of pulse triggers. When a pulse is captured, the trigger state becomes active and the wait for trigger state becomes inactive. If no pulses are captured within 1.67 seconds since the last pulse was captured, the wait for trigger state becomes active and the triggered state becomes inactive. The TRIG annunciator reads "TRIG" in the triggered state and "TRIG?" in the wait for trigger state.

There are two possible states when a thermopile sensor is attached and Joules mode is active: 'integrating' and 'wait for trigger'. The integrating state indicates that laser power is being integrated to produce a final energy measurement. The wait for trigger state indicates the meter is waiting for a power pulse to integrate. When the meter detects a power pulse trigger, the integrating state becomes active and the wait for trigger state becomes inactive. The integrating state persists until the power signal decays to the point where the tail energy can be predicted. At that point the wait for trigger state becomes active and the integrating state becomes inactive. The TRIG annunciator reads 'TRIG' in the integrating state and 'TRIG?' in the wait for trigger state.

4.6.2 Pulsed Thermopile Joules Mode

(*for long-pulsed lasers only*) When a thermopile sensor is attached, the meter has the capability of measuring energy from a finite duration laser pulse, or from a series of finite duration laser pulses. (Thermopile sensors are typically used to measure laser power and have an extremely slow response time relative to the pulse width of the laser used to generate the power signal.)

The power curve—refer to Figure 4-5, below—is integrated from the pulse start to infinity. The final energy value is algorithmically calculated shortly after peak power is attained.

There is no energy range in long-pulse Joules mode. The level of precision is based upon the range set in Power mode prior to entering Joules mode.

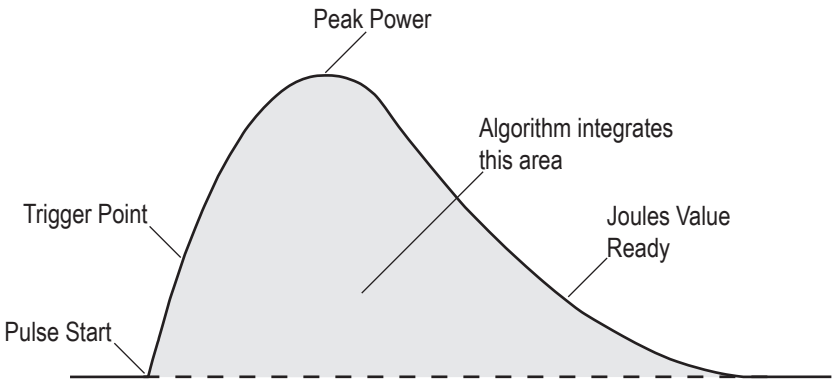


Figure 4-5. Measuring Energy - Pulsed Thermopile Joules Mode

4.6.3 Pyroelectric Watts Mode

Using an attached pyroelectric sensor, FieldMaxII-TOP can measure power from a series of pulses. While the instrument is triggering, power measured during each display interval appears in the numeric display as watts. This is known as *burst power* (see the following paragraph). At least two pulses must be captured in one display cycle (approximately 1/3 second) to calculate power. If the instrument is not triggering, a series of dashes—that indicate 'no power'—appears in the numeric display.

Burst power (see Figure 4-6, below) refers to power in watts, as computed by the sum of the energy pulses received in one display cycle (approximately 1/3 second), and the sum of the time intervals between those pulses. The displayed value represents the power of a continuous stream of pulses that the burst represents.

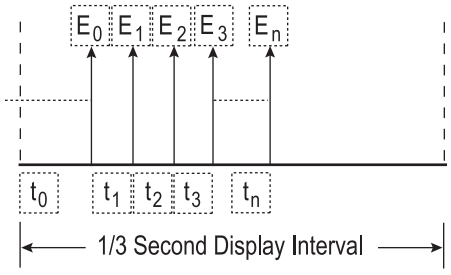


Figure 4-6. Burst Power

NOTICE

The first pulse is used to trigger the calculation and is discarded because its time interval, t_0, is indeterminate.

When n = 0, power is zero. This situation occurs when only one pulse is received in a display period (for example, interval B in Figure 4-7, below). To offset this limitation, a laser pulse rate of at least 6 Hz is required for burst power measurements.

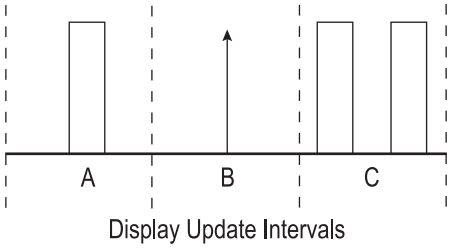


Figure 4-7. Burst Power Limitations

Another limitation occurs on multiple bursts (interval C in Figure 4-7, above). If there are two or more bursts in any display interval, the gap between bursts will appear as lower power and the display will be affected accordingly.

5 Operation

This section gives detailed information about control functions and how they are used operate the Fieldmax II:

- ’Tuning Mode’ (p. 25)
- ’Annunciators’ (p. 28)
- ’Fault Display Indicators’ (p. 30)
- ’Invalid and not Available Data Conditions’ (p. 31)
- ’Setup Parameters’ (p. 31)
- ’Button Functions’ (p. 36)
- ’Statistics Mode’ (p. 38)
- Energy and power measurements (p. 39)
- ’Measurement Display and Range Selection’ (p. 40)
- Pyroelectric-specific information (p. 42)
- Thermopile- and optical-specific information (p. 44)

5.1 Tuning Mode

NOTICE

This mode only works in Manual Ranging mode. For more information about ranging, refer to ’Manual Ranging Mode’ (p. 44) if using a pyroelectric sensor), or ’Auto vs. Manual Ranging Mode’ (p. 44) if using a thermopile or optical sensor).

As shown in Figure 5-1, below, tuning is visually displayed on the LCD using tuning needles and zone indicator bars.

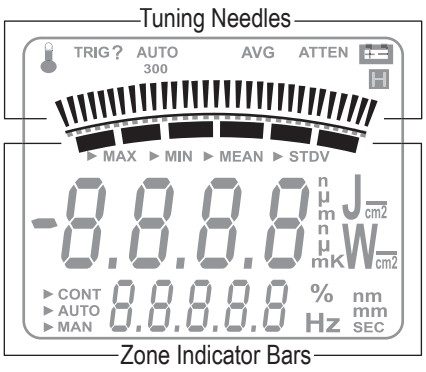


Figure 5-1. Location of Tuning Needles and Zone Indicator Bars

5.1.1 Tuning Needles

Tuning needles—which divide a given tuning zone into thirty 'increments'—are used to bring laser output to a peak. As the top or bottom of a zone is reached, the tuning needles automatically move to the center of the next zone (see Figure 5-2). Zone indicator bars show when this happens. Refer to 'Zone Indicator Bars' (p. 26) for more information.

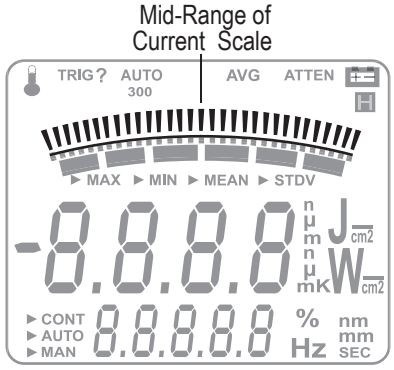


Figure 5-2. Current Scale Mid-Range

5.1.2 Zone Indicator Bars

Zone indicator bars are a series of six segments, as shown in Figure 5-3, below:

These bars act as visual indicators while the tuning needles automatically move through zones, and also provide a relative indication of where the measurement falls within the active range.

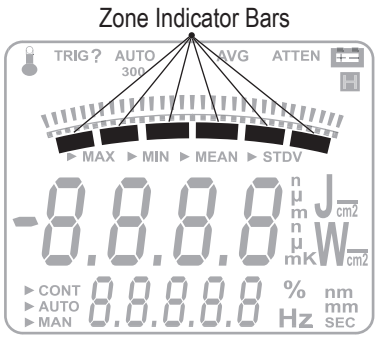


Figure 5-3. Zone Indicator Bars

Zone indicator bars always appear in pairs, with each overlapping zone representing 1/3 of full scale. Figure 5-4 shows how the five zone indicator bars correlate to full scale measurement on the tuning meter scale.

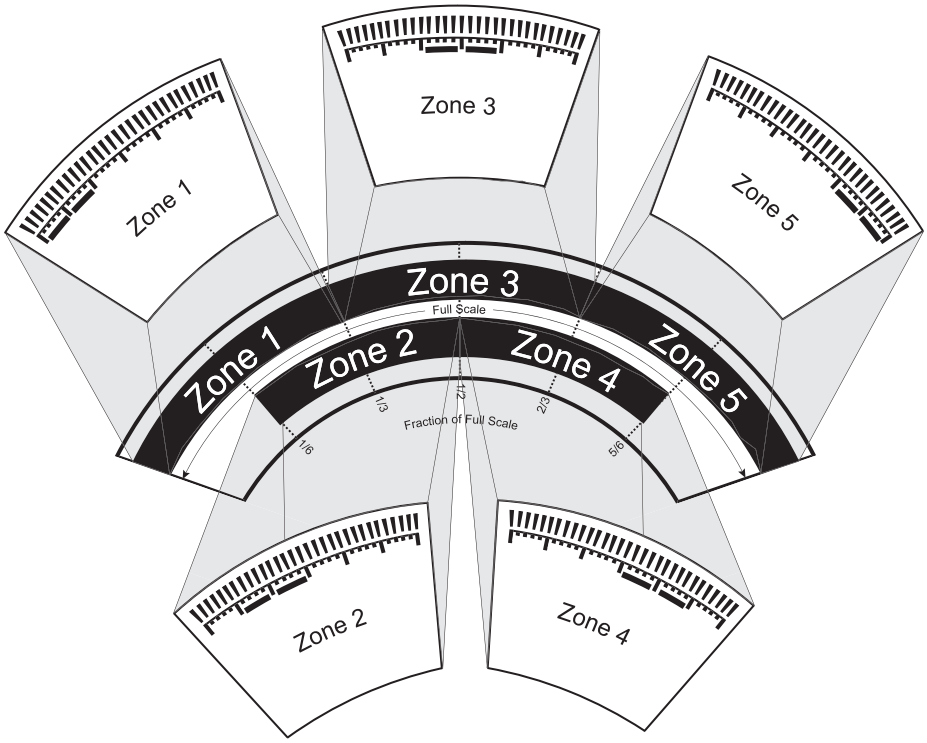


Figure 5-4. Comparison of Zone Indicator Bars to Full Scale Measurement

Figure 5-5 shows an example of how the zone indicator bars overlap on a 30-watt scale:

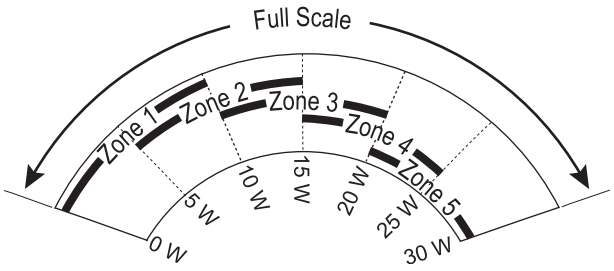


Figure 5-5. Tuning Mode Example - Full Scale

5.2 Annunciators

Annunciators refers to the icon-type symbols that appear on the LCD. Figure 3-3 (p. 10) shows all the annunciators on the FieldMaxII-TOP meter. The update rate for all annunciators is 3 times per second.

5.2.1 Temperature

(*thermopile sensors only*) The Temperature annunciator flashes whenever the meter detects a sensor over-temperature condition. This annunciator is not visible unless a sensor over-temperature condition exists.

5.2.2 TRIG

Whenever a trigger is detected, ‘TRIG’ displays in the TRIG annunciator position. ‘TRIG?’ displays in the absence of a trigger.

The TRIG annunciator applies under the following conditions:

- A pyroelectric sensor is attached.
- A thermopile sensor is attached and Joules mode is active.

5.2.3 AUTO

(*thermopile and optical sensors only*) The AUTO annunciator displays the state of the auto ranging of the meter. Auto Ranging is active when “AUTO” displays. If Auto Ranging is not active, or a pyroelectric sensor is attached to the meter, the AUTO annunciator is not visible.

5.2.4 Range Hint

The Range Hint annunciator—towards the top of the LCD, just above the tuning needles—displays ‘3,’ ‘30,’ or ‘300’. These numbers represent the full-scale range currently selected by the user. Range Hint is discussed in more detail under ’Measurement Display and Range Selection’ (p. 40).

5.2.5 AVG

When AVG (display smoothing) is active, display values are averaged (by samples) for pyroelectric sensors, and (by time) for thermopile and optical sensors. “AVG” displays when averaging is active. Nothing displays in this position if averaging is not active.

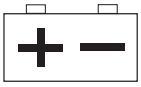
5.2.6 ATTEN

The ATTEN annunciator indicates if attenuation correction is applied to the measurement value. ‘ATTEN’ displays whenever attenuation is active.

5.2.7 RMT

The RMT annunciator indicates that the FieldMaxII meter is currently in Remote Control mode. Remote Control is discussed under ’Setup/Local’ (p. 31).

5.2.8 Battery



The Battery annunciator flashes whenever the batteries need to be replaced.

The Battery annunciator only appears when the meter is running on battery power, not the AC adapter.

5.3 Fault Display Indicators

FieldMaxII-TOP is capable of detecting internal and user-induced faults. When a fault is detected, the letters ‘Er’, followed by a numeric fault code, appear on the display—refer to Table 5-1, below. Users can dismiss a fault code by pressing any button, or by correcting the cause of the fault.

Table 5-1. Fault Codes

Error condition	Fault code
Unrecognized sensor	1
Sensor communication failure	2
Sensor error	3
Sensor error	4
Sensor/firmware version mismatch (sensor format version exceeds capability of the instrument firmware—firmware upgrade needed)	5
Sample rate fault	6
Hardware fault (detectable hardware error)	20
Bad zero[a]	40
Data overflow (result of an arithmetic operation that is greater than can be held in the allocated storage)	41
Wrong type of sensor is attached to the instrument	42

a. For more information about the bad zero fault code, refer to ’Zero Button’ (p. 36).

As an example, ‘Er 4’ appears on the display if there is a sensor error. The fault can be dismissed by removing the sensor from the meter, or by pressing any button.

Attaching an unrecognized sensor to the meter creates a special fault condition. This condition is characterized by displaying a sensor fault (1 through 5).

5.4 Invalid and not Available Data Conditions

The update rate for invalid or not available data conditions is three times per second.

5.4.1 Invalid Data

Invalid data is obtained whenever the meter over-ranges. When invalid data is sensed, the letters “OL” (overload) appear on the display. If ‘OL’ appears while in Auto mode, no further action needs to be taken. If ‘OL’ appears while in Manual mode, start a new batch by pressing the Zero button. All data used to generate a batch result must be valid.

5.4.2 Not Available Data

Measurement data may be unavailable at certain times during meter operation. When data is not available, a series of dashes appears in the measurement area of the display. The following conditions will generate unavailable data:

- Meter is powered on and no pulse triggers are detected with a pyroelectric sensor.
- Function mode (Joules or Watts) is changed and no pulse triggers are detected with a pyroelectric sensor.
- Statistics mode is entered and batch data has not been compiled.

5.5 Setup Parameters

This section explains how to select and set user-definable parameters.

5.5.1 Setup/Local

The Setup/Local button serves several purposes:

1. If an edit cycle is not in progress, pressing the Setup/Local button initiates an edit cycle. If the next button pressed represents an edit parameter (STAT, WAVE, AREA, ATTEN, TRIG, or AVG button), Edit mode is entered and the parameter for the applicable button may be

edited using the edit buttons. Additional presses of the Setup/Local button—without first pressing an edit parameter button—are ignored.

2. If a parameter has not been selected, pressing the Setup/Local button cancels an edit cycle.
3. If Edit mode is active and a parameter has been selected, pressing the Setup/Local button commits the adjusted edit parameter to the instrument.
4. Setup/Local is used to cancel the front panel lockout when Remote Control is active.

NOTICE

Remote Control is active when the instrument is connected to a host computer via a USB connection and is communicating with a host application program. While the instrument is in Remote Control mode, all front panel buttons—except Power/Backlight and Setup/Local—are disabled. Pressing the Setup/Local button while in Remote Control mode cancels Remote Control and returns the instrument to Local (all instrument functions available) mode.

The Setup/Local button is also used to edit user-defined parameters. Pressing this button initiates a parameter edit cycle.

A *parameter edit cycle* consists of:

- Pressing the Setup/Local button to begin the cycle.
- Pressing the parameter button (Stat, Wave (λ), Area, Avg, Atten, or Trig) that needs to be edited. If an edit cycle has been initiated, successive presses of the same edit parameter button will be ignored.
- Using the arrow buttons to select the appropriate field and adjust the data value.
- Pressing the Setup/Local button a second time to end the cycle and commit the new data value.

5.5.2 Stat Button

A press of the Stat button will:

- Enter Statistics mode—if Statistics mode is not active and the button is pressed for less than two seconds.
- Exit Statistics mode.

- Enter Edit mode and select the statistics parameters to be edited (Batch Size and Restart mode) after edit cycle initiation (if Setup/Local is pressed beforehand). Batch size is 2 to 99,999 pulses (thermopile sensors in Joules mode, or pyroelectric sensors), or 1 to 99,999 seconds (thermopile sensors in Watts mode, or optical sensors).

- View the statistics parameters if the button is pressed for two seconds or more.

5.5.3 Wave Button

λ Users can configure FieldMaxII-TOP to automatically account for any difference between the laser wavelength and the calibration wavelength. In the case of optical sensors, this compensation is necessary because the sensor contains calibration data from a number of different wavelengths. Thermopile and optical sensors include wavelength compensation information that is used in this mode.

After pressing Setup/Local, the Wave button is used to enter Edit mode and set the wavelength. If an edit cycle has not been initiated, pressing the Wave button will display the wavelength value. The available wavelength range is 1.00 to 99,999 nm. The actual range is sensor-dependent.

NOTICE
If Wavelength compensation information is not programmed into the sensor, users will not be able to change the wavelength data value.

5.5.4 Area Button

This mode allows the measurement of laser energy in terms of fluence, and laser power in terms of average power density.

NOTICE
Area calculation returns an *average* power density reading for both Flat and Gaussian profiles.

The parameter is entered as a diameter and assumes a circular beam or aperture. The range for Area mode is 0.01 to 999.99 mm.

Pressing the Area button will:

- Toggle the state of Area Correction mode, if the button is pressed for less than one second. Refer to ’Area Correction and Zeroing’ (p. 34) for more information about Area Correction mode.

- Enter Edit mode and select the beam diameter, if Setup/Local is pressed beforehand.
- View the beam diameter, if the button is pressed for one second or more.

5.5.4.1 Area Correction and Zeroing

(*thermopile and optical sensors only*)

NOTICE
It is important to zero the sensor before using Area Correction, as explained in the following procedure.

1. Enter Area Correction by pressing the Area button for less than one second.
2. Set Auto Ranging by pressing the Auto button.
3. Block the sensor beam.
4. Allow the sensor to enter a steady (cool-down) state. If using a thermopile sensor, this steady state can be determined by watching the display numbers on the LCD. At first the numbers will decrease quickly but, as the sensor cools, the numbers decrease more slowly—the slower the decrease, the cooler the sensor, and the cooler the sensor, the more accurate the area correction reading will be. Optical sensors do not require a cool-down period.
5. Press the Zero button.

The sensor is now zeroed. For more information about zeroing, refer to ’Zero the Sensor’ (p. 45).

5.5.5 Avg Button

Average mode enables display smoothing, which suppresses variations in the display reading that can make it difficult to read.

NOTICE
Display values are averaged either by time (for thermopile or optical sensors), or by pulses (for pyroelectric sensors).

Users can change the size of the display smoothing window. With an attached thermopile or optical sensor, the window size is 1 to 60 seconds. Using a pyroelectric sensor, the window size is 2 to 1,000 pulses.

Averaging displays live measurements while the first batch is being acquired. Following the first batch, each reading appears on the display as an average of the batch (window) size. Example: Using a 10-second batch size, the first ten seconds are measured live. The next reading that appears on the display is an average of the measurements taken during the 1- to 10-second time frame, followed by a reading that is the average of the measurements taken during the 11- to 20-second time frame, etc.

The Avg button is used to:

- Toggle the state of Average mode (if the button is pressed for less than one second).
- Enter Edit mode and select the display smoothing window size (if Setup/Local is pressed beforehand).
- View the display smoothing window size (if the button is pressed for one second or more).

5.5.6 Atten Button

Attenuation mode allows for true measurements using an attenuator that has a known attenuation factor. When Attenuation Correction mode is enabled, the measured value is adjusted to indicate the measurement at the attenuator and not the sensor. The range for this mode is 0.01 to 999.99.

Here's an example of how to determine the attenuation correction factor that needs to be set in the FieldMaxII-TOP meter: If a 1 W laser beam is focused through an attenuator that has an attenuation factor of 50%, then, to get a true laser measurement value, the correction factor in the FieldMaxII-TOP instrument needs to be set to 2. In other words, since only half the power of the beam is transmitted through the attenuator, the measured result must be doubled to obtain a true laser measurement.

The Atten button is used to initiate several activities:

- Toggle the state of Attenuation Correction mode, if the button is pressed for less than one second.
- Enter Edit mode and select the attenuation factor, if Setup/Local is pressed beforehand.
- View the attenuation factor, if the button is pressed for one second or more.

5.5.7 Trig Button

After pressing the Setup/Local button, the Trig button is used to enter Edit mode and select the trigger level parameter that will be edited. If an edit cycle has not been initiated, pressing the Trig button will display the trigger level parameter. Trigger has a range of 2 to 20% of full scale. Refer to 'Internal Triggering Mode' (p. 42) for details of the trigger function

5.6 Button Functions

5.6.1 J/W

The main function of this button is to toggle between Joules and Watts mode. *Only Watts mode can be active when an optical sensor is attached.*

5.6.2 Auto

(*thermopile and optical sensors only*) Pressing the Auto button instructs the FieldMaxII-TOP to select the best measurement range for the incoming signal.

5.6.3 Hz Button

(*pyroelectric sensors only*) Pressing the Hz button toggles the Pulse Frequency Display mode. If Hz mode is on, the pulse frequency displays in the parameter edit region of the display. If Hz mode is off, the pulse frequency does not display. If the pulse frequency is >300 Hz, the displays shows a series of three dashes, followed by the letters, “Hz.”

5.6.4 Zero Button

(*thermopile and optical sensors only*) Pressing the Zero button causes the analog circuitry to zero its internal settings by running a zero cycle. If Auto Ranging is not active, the meter will zero the currently-selected range. If Auto Ranging is active, the meter will zero all available ranges for the attached sensor. When a zero procedure is in process, no other button events are queued or activated until the procedure ends. The zero procedure is immediately terminated if the sensor is disconnected or if an error is encountered.

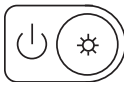
Normally, the Zero button is pressed with the laser blocked from the connected sensor. If a finite power level is present at the sensor, the instrument will attempt to null it out. A *bad zero* fault code appears if a given power input is too large to null on the sensitive ranges.

If the bad zero fault code appears:

- Press any soft button to dismiss the error
- Select a new range
- Press the Zero button

The secondary function of the Zero button is to manually start a batch while in Statistics mode.

5.6.5 Power Switch and Backlight Toggle Button



The combination Power Switch and Backlight Toggle button serves a dual purpose. It sets power on/off to the meter, and toggles the backlight.

- When the meter is off, the power-on state is activated by pressing the button for one second.
- A press of the button for one second while in the power-on state sets the meter to OFF.
- When the meter is in the power-on state, the backlight state is toggled by pressing the button for less than one second.
- The backlight is always off when power is first applied to the meter.

5.6.6 Up and Down Arrows

These buttons serve a dual purpose. When Edit mode is active, the buttons are used to adjust the currently-selected edit field. When Edit mode is not active, the buttons are used to select the measurement range and automatically cancel Auto Range mode, if Auto Range mode is active.

5.6.7 Left and Right Arrows

This button pair has a dual purpose. When the Edit mode is active, the buttons allow users to select the edit field of the currently-selected edit parameter. When the Edit mode is not active and Statistics mode is active, the buttons are used to select the statistical parameter of interest (MAX, MIN, MEAN, or STDV). These buttons are nonfunctional when Edit mode and Statistics mode are not active.

5.7 Statistics Mode

FieldMaxII-TOP can be configured to display statistical data instead of instantaneous measurements. Statistical data for a pyroelectric sensor is generated on a pulse-by-pulse basis. Using a thermopile or optical sensor, statistical data is generated over time.

NOTICE

An exception to the above statement: When using a thermopile sensor with the instrument in Joules mode, energy is measured as integrated power from individual laser pulses.

Selecting Auto mode restarts the batch count used to take a reading. If the instrument is not in Auto mode, the batch count must be manually restarted by pressing the Zero button.

NOTICE

Pressing and holding the Stat button displays the current instrument mode: Auto or Manual.

For more information on selecting parameters while in Statistics mode, refer to 'Left and Right Arrows' (p. 38).

The tuning needles and zone indicator bars are not present in Statistics mode.

5.7.1 Invalid Data

A statistical batch requires valid data for every data point in the batch. If a batch collection of data is in process and invalid data is measured, the batch is considered contaminated and the batch immediately ends with no batch result computed. If the Restart mode is Auto, a new batch is immediately restarted. The error that caused the contaminated batch is displayed

5.8 .Energy and Power Measurements

Energy (joules) measurements are taken using pyroelectric sensors (for pulsed laser) or thermopile sensors (for long-pulsed laser). The user interface behaves in a slightly different manner, depending on which type of sensor being used. Energy measurements cannot be taken with an optical sensor.

NOTICE

When using a thermopile sensor in long pulse Joules mode, energy is measured as integrated power from individual laser pulses. For more information, refer to 'Pulsed Thermopile Joules Mode' (p. 47).

Power (watts) measurements are taken using either pyroelectric sensors (for pulsed laser), or thermopile and optical sensors (for continuous laser).

NOTICE

A speedup algorithm is used while power measurements are taken with a thermopile sensor. This algorithm is applied to the tuning needles to provide faster response while tuning a laser. Refer to 'Tuning Mode' (p. 25). To improve accuracy, speedup is not applied to the numeric measurements.

As with energy measurements, there are slight variations in the user interface, depending on which type of sensor being used.

Table 5-2, below, describes the measured information on the numeric display for various sensor types and mode settings.

Table 5-2. Numeric Display Information (Sheet 1 of 2)

Sensor Type	J Mode	W Mode
Thermopile	• Energy from a laser pulse by integrating power • Meter and Range Hint unavailable • Auto Range disabled	CW and average power
	Statistics mode: MAX, MIN, MEAN	*Statistics mode*: MAX, MIN, MEAN

Table 5-2. Numeric Display Information (Sheet 2 of 2)

Sensor Type	J Mode	W Mode
Optical	Function not available	CW power
		Statistics mode: MAX, MIN, MEAN
Pyroelectric	Energy per pulse	• Average power delivered by repeating pulses • Range Hint unavailable
	Statistics mode: MAX, MIN, MEAN,STDV[a]	*Statistics mode*: MEAN

a. In this mode, standard deviation is only available if the batch size is 200 or less.

5.9 Measurement Display and Range Selection

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

Measurement range is selected in decade steps. Range selection—shown in Table 5-3, and Table 5-4—is dependent on the sensor type and characteristics, as well as user-determined measurement settings.

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

Over-ranging refers to a meter setup condition in which the sensor output signal is greater than the maximum allowable level for the selected range. An 'OL' (overload) appearing on the display signifies an over-range condition. Over-ranging generates invalid data.Table 5-3 indicates the display format for different full-scale range settings when in Joules mode.

NOTICE

When area correction is enabled in Joules or Watts mode, a '/cm^2' will be appended to the units.

Table 5-3. Full Scale Range Settings - Joules Mode

Full Scale Measurement	Display Format
3 nJ	X.YYY nJ
30 nJ	XX.YY nJ
300 nJ	XXX.Y nJ
3 µJ	X.YYY µJ
30 µJ	XX.YY µJ
300 µJ	XXX.Y µJ
3 mJ	X.YYY mJ
30 mJ	XX.YY mJ
300 mJ	XXX.Y mJ
3 J	X.YYY J
30 J	XX.YY J
300 J	XXX.Y J

The Range Hint annunciator displays the full-scale range value with the engineering prefix and units omitted. For example, when the range is 30 J, the Range Hint annunciator displays ‘30’. Note that it also displays ‘30’ when the selected range is 30 mJ, 30 µJ, or 30 nJ. For more information about the Range Hint annunciator, refer to ’Range Hint’ (p. 29).Table 5-4 indicates the display format for different full-scale range settings when in Watts mode.

Table 5-4. Full Scale Range Settings - Watts Mode

Full Scale Measurement	Display Format
3 nW	X.YYY nW
30 nW	XX.YY nW
300 nW	XXX.Y nW
3 µW	X.YYY µW
30 µW	XX.YY µW

Table 5-4. Full Scale Range Settings - Watts Mode (Continued)

Full Scale Measurement	Display Format
300 μW	XXX.Y μW
3 mW	X.YYY mW
30 mW	XX.YY mW
300 mW	XXX.Y mW
3 W	X.YYY W
30 W	XX.YY W
300 W	XXX.Y W
3 kW	X.YYY kW
300 kW	XX.YY kW

The Range Hint annunciator displays the full-scale range value with the engineering prefix and units omitted. For example, when the range is 30 kW, the Range Hint annunciator displays ‘30’. Note that it also displays ‘30’ when the selected range is 30 W, 30 mW, 30 μW, or 30 nW. For more information about the Range Hint annunciator, refer to ’Range Hint’ (p. 29).

5.10 Pyroelectric-Specific Information

Information in this section pertains exclusively to pyroelectric sensors. If using a thermopile or optical sensor, refer to ’Thermopile and Optical-Specific Functions’ (p. 44).

5.10.1 Internal Triggering Mode

For greatest accuracy and repeatability, FieldMaxII-TOP must trigger reliably for each laser pulse. *Internal triggering* refers to extracting an artificial trigger from the incoming signal.

To successfully extract an internally-generated trigger, set the meter range so that the incoming signal is at least 5% of the full scale. Set the trigger level at least 2% above the noise level and at least 2% below the peak height.

For example, with a peak height of 300 mJ, set the meter to a range of 3 J. A peak will occur at 10% of full scale, well above the 5% level. The trigger level should not be set higher than 8%. If the noise level is 5% of full scale (approximately 150 mJ), the trigger level should not be set lower than 7%.

In the example shown in Figure 5-6, the internal trigger threshold has been set to 8% (shown as a dashed line). Pulse A will definitely not generate a reliable trigger. Pulse B may generate a trigger, but not reliably. Pulses C and D will definitely generate reliable triggers.

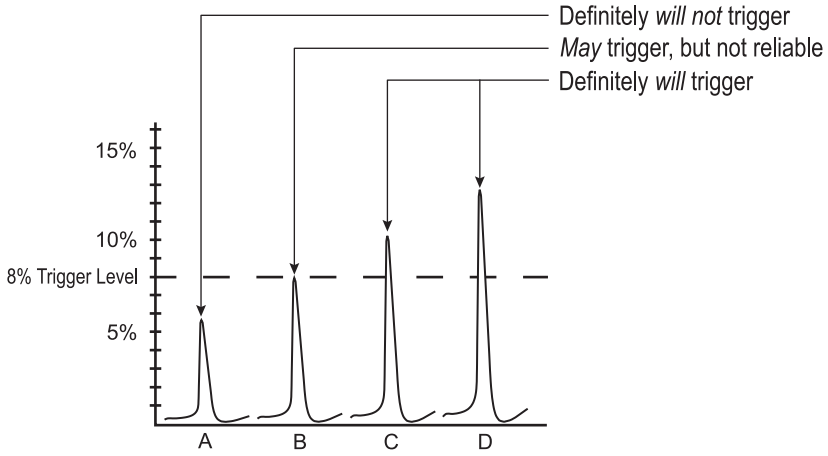


Figure 5-6. Internal Trigger Threshold

A full-scale signal on one range may not trigger on the next higher range unless the trigger level is set to less than 10%. For example, a near full-scale signal of 280 mJ on the 300 mJ range is less than 10% of full scale on the next higher range (3 J), and would therefore not trigger the reading. To obtain reliable triggering in this instance, adjust the trigger level to less than 8%.

The trigger is synchronous with the leading edge of the pulse, but the actual peak is determined algorithmically by sampling the input signal near the trigger. From the trigger point forward, the algorithm searches for peaks and from the trigger point back, it searches for a baseline.

5.10.2 Hz Display Mode

If desired, pulse frequencies can be displayed when a pyroelectric sensor is attached to the meter. For more information, refer to 'Hz Button' (p. 36).

5.10.3 Manual Ranging Mode

(thermopile or optical sensors only) Manual ranging requires the user to select the range. Refer to 'Up and Down Arrows' (p. 37) for more information about manual ranging.

5.11 Thermopile and Optical-Specific Functions

Information in this section is exclusively about thermopile and optical sensors. If a pyroelectric sensor is used, refer to 'Pyroelectric-Specific Information' (p. 42).

5.11.1 Auto vs. Manual Ranging Mode

Auto Ranging (Auto) enables FieldMaxII-TOP to automatically select the range (gain) when a thermopile or optical sensor is attached to the meter. While in Auto Ranging mode, the tuning needles represent a zero-to-full scale movement (as compared to Tuning mode, where the zones overlap). Refer to Figure 5-7, below.

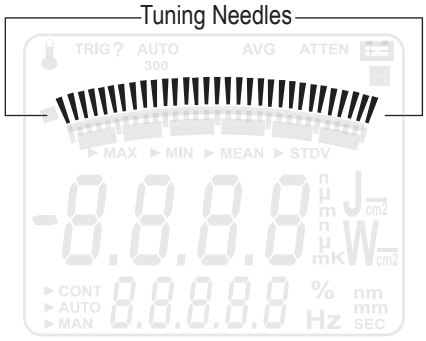


Figure 5-7. Auto Ranging

NOTICE

Manual ranging requires the range to be selected by the user. Refer to 'Up and Down Arrows' (p. 37) for more information.

5.11.2 Zero the Sensor

Thermopile and optical sensors require periodic zeroing. Zeroing happens when a meter attempts to null out any signal coming from the sensor and establish a zero-power baseline. If Auto Ranging is active, the sensor is zeroed for every available range. If Auto Ranging is not active, the sensor is zeroed at the current range only. Under typical operating conditions, the zero procedure takes about one second for each range.

When starting the zeroing procedure, the large numerals on the LCD are replaced by an animated set of dashes. Unless there is an error, the normal measurement mode resumes once the zeroing procedure ends.

5.11.3 Negative Power Display

A negative power reading indicates the sensor needs to be zeroed. Two areas of the display are affected by a negative power reading: the digital tuning feature and the numeric measurement display.

The digital tuning feature always displays the absolute value of measured power. If the power is negative, the minus sign segment is set to ON. The inertia of a mechanical meter will be mimicked for negative, as well as positive, power readings.

6 Special Topics

This section gives more information on trigger states and modes of operation.

6.1 Trigger States and the Trigger Annunciator

Two segments are dedicated to the indication of the trigger state of the meter. These are the TRIG and the '?' segment that follows it. The trigger state is always used when a pyroelectric sensor is attached.

There are two possible trigger states when a pyroelectric sensor is attached: 'triggered' and 'wait for trigger.' The triggered state indicates that the meter is capturing laser pulses. The wait for trigger state indicates an absence of pulse triggers. When a pulse is captured, the trigger state becomes active and the wait for trigger state becomes inactive. If no pulses are captured within 1.67 seconds since the last pulse was captured, the wait for trigger state becomes active and the triggered state becomes inactive. The TRIG annunciator reads 'TRIG' in the triggered state and 'TRIG?' in the wait for trigger state.

There are two possible states when a thermopile sensor is attached and Joules mode is active: 'integrating' and 'wait for trigger'. The integrating state indicates that laser power is being integrated to produce a final energy measurement. The wait for trigger state indicates the meter is waiting for a power pulse to integrate. When the meter detects a power pulse trigger, the integrating state becomes active and the wait for trigger state becomes inactive. The integrating state persists until the power signal decays to the point where the tail energy can be predicted. At that point the wait for trigger state becomes active and the integrating state becomes inactive. The TRIG annunciator reads 'TRIG' in the integrating state and 'TRIG?' in the wait for trigger state.

6.2 Pulsed Thermopile Joules Mode

(*applies for long-pulsed lasers only*) When a thermopile sensor is attached, the meter has the capability of measuring energy from a finite duration laser pulse, or from a series of finite duration laser pulses. (Thermopile sensors are typically used to measure laser power and have an extremely slow response time relative to the pulse width of the laser used to generate the power signal.)

The power curve—refer to Figure 6-1, below—is integrated from the pulse start to infinity. The final energy value is algorithmically calculated shortly after peak power is attained.

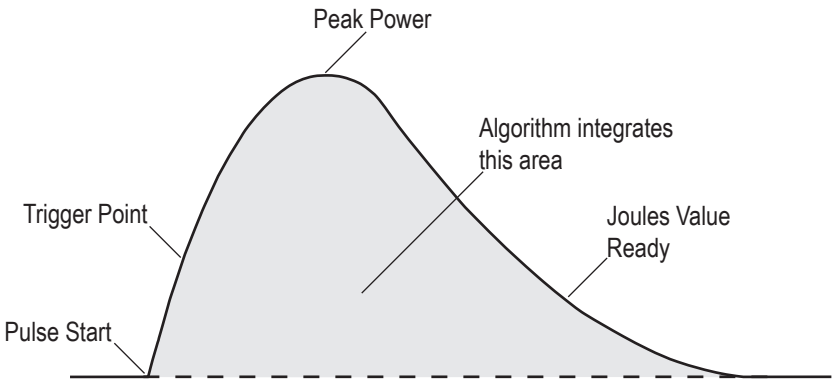


Figure 6-1. Measuring Energy - Pulsed Thermopile Joules Mode

There is no energy range in long-pulse Joules mode. The level of precision is based upon the range set in Power mode prior to entering Joules mode.

6.3 Pyroelectric Watts Mode

When an attached pyroelectric sensor is used, FieldMaxII-TOP can measure power from a series of pulses. While the instrument is triggering, power measured during each display interval appears in the numeric display as watts. This is known as *burst power* (see the following paragraph). At least two pulses must be captured in one display cycle (approximately 1/3 second) to calculate power. If the instrument is not triggering, a series of dashes—that indicate 'no power'—appears in the numeric display.

Burst power (see Figure 6-2, below) refers to power in watts, as computed by the sum of the energy pulses received in one display cycle (approximately 1/3 second), and the sum of the time intervals between those pulses. The displayed value represents the power of a continuous stream of pulses that the burst represents.

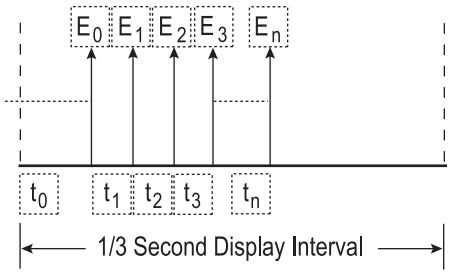


Figure 6-2. Burst Power

NOTICE

The first pulse is used to trigger the calculation and is discarded because its time interval, t_0, is indeterminate.

When n = 0, power is zero. This situation occurs when only one pulse is received in a display period (for example, interval B in Figure 6-3, below). To offset this limitation, a laser pulse rate of at least 6 Hz is required for burst power measurements.

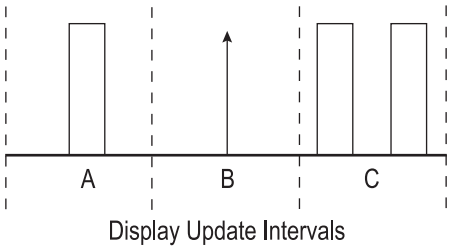


Figure 6-3. Burst Power Limitations

Another limitation occurs on multiple bursts (interval C in Figure 6-3, above). If there are two or more bursts in any display interval, the gap between bursts will appear as lower power and the display will be affected accordingly.

7 Host Interface

7.1 Overview

The host interface is intended for use with a National Instruments LabVIEW virtual instrument (VI) that accesses an ActiveX DLL called FieldMax2Lib.dll. The DLL handles communication and data transmission between the FieldMaxII and host applications written in LabVIEW.

A Getting Started introduction and LabVIEW examples are available at https://www.coherent.com/resources

8 Calibration and Warranty

8.1 Calibration

Coherent laser power and energy meters are precision instruments, capable of delivering very accurate measurements, as well as providing many years of useful service. To maintain this high level of performance, it is important to have measurement systems serviced and re-calibrated.

A large percentage of Coherent calibrations are performed within five business days, and expedited service is available, to minimize customer downtime.

8.1.1 Scope of Calibration

Calibration of a Coherent power and energy laser measurement product includes:

- Calibration to original uncertainty levels
- Minor repairs (see more information, below)
- Extended 12 month warranty, on eligible products
- Fast calibration turnaround time.

Minor repairs includes fixing manufacturer's defects, hardware updates, firmware, software updates, damaged connectors, and other small repairs. Detector element replacement due to laser damage and damage caused by negligent use is not covered – for customer caused damage, an additional repair service charge is applied.

This level of service results in an overall lower cost of ownership, with many owners realizing a lifetime warranty for their products.

8.1.2 Re-certify Once Per Year

To maintain this high level of performance, and to ensure compliance with your quality and ISO certification, it is important to have measurement systems serviced and re-certified once per year.

Extended use of laser power and energy meters and sensors, as well as environmental factors, can have an adverse effect on accuracy and also result in wear and/or damage to parts critical to optimum performance.

8.1.3 Coherent Calibration Facilities and Capabilities: ISO 17025 Accredited

Coherent calibration facilities contain the widest possible range of light sources from 193 nm to 10,600 nm, with powers ranging nanowatts to kilowatts.

Coherent Wilsonville, Oregon, and its satellite sites, are fully accredited to ISO/IEC 17025:2017 by ANAB - The ANSI National Accreditation Board. ANAB is a signatory of the International Accreditation Forum (IAF) and International Laboratory Accreditation Cooperation (ILAC) multilateral recognition arrangements. ANAB has signed the MRAs of the InterAmerican Accreditation Cooperation (IAAC) and the Asia Pacific Accreditation Cooperation (APAC). Accreditation to ISO/IEC 17025 is the formal recognition that a calibration laboratory is technically competent to carry out specific calibrations.

A detailed discussion of the Scope of Accreditation and the Technical Requirements of ISO 17025 Accreditation can be found on the Coherent ISO 17025:2017 Accreditation web page.

In addition, Coherent team delivers the industry's best service, with a knowledgeable and responsive staff, and rapid turnaround.

8.2 Limited Warranty

Coherent, Corp. (the “Company”) warrants its laser power and energy meters and sensors products (“Products”) to the original purchaser (the “Customer”) that the product is free from defects in materials and workmanship and complies with all specifications, active at the time of purchase, for a period of twelve (12) months.

Coherent, Corp. will, at its option, repair or replace any product or component found to be defective during the warranty period. This warranty applies only to the original purchaser and is not transferable.

8.3 Warranty Limitations

The foregoing warranties shall not apply, and Coherent reserves the right to refuse warranty service, should malfunction or failure result from:

- Damage caused by improper installation, handling or use.
- Laser damage (including sensor elements damaged beyond repair).
- Failure to follow recommended maintenance procedures.

- Unauthorized product modification or repair.
- Operation outside the environmental specifications of the product.

Coherent assumes no liability for Customer-supplied material returned with Products for warranty service or recalibration.

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, OR IMPLIED. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL THE COMPANY BE LIABLE FOR ANY INDIRECT, INCIDENTAL OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS PRODUCTS.

9 Extended Warranty Program

Coherent, Corp. (the “Company”) offers original purchasers (the “Customer”) purchasing laser power and energy meters and sensors products (“Products”) an extended twelve (12) month Warranty program, which includes all parts and labor.

To qualify for this Warranty, a Customer must return the Product to the Company for recalibration and recertification.

- The Company will re-certify the Product, provide software upgrades, and perform any needed repairs, and recalibrate the Product, for a fixed service fee (as established by the Company from time to time and in effect at the time of service).

- If the product cannot be re-certified due to damage beyond repair, parts obsolescence, or other reasons, the Customer may be informed that an Extended Warranty program is not available for the Product.

If the Product fails and is returned to the Company within one year following the date of recalibration and recertification service, the Company will, at its option, repair or replace the Product or any component found to be defective. If the Product must be replaced and the Product is no longer available for sale, Coherent reserves the right to replace with an equivalent or better Product. This Warranty applies only to the original purchaser and is not transferable.

For information about calibration and recertification services, refer to ’Calibration’ (p. 53).

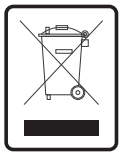
Appendix A: Maintenance

A.1 Battery Replacement

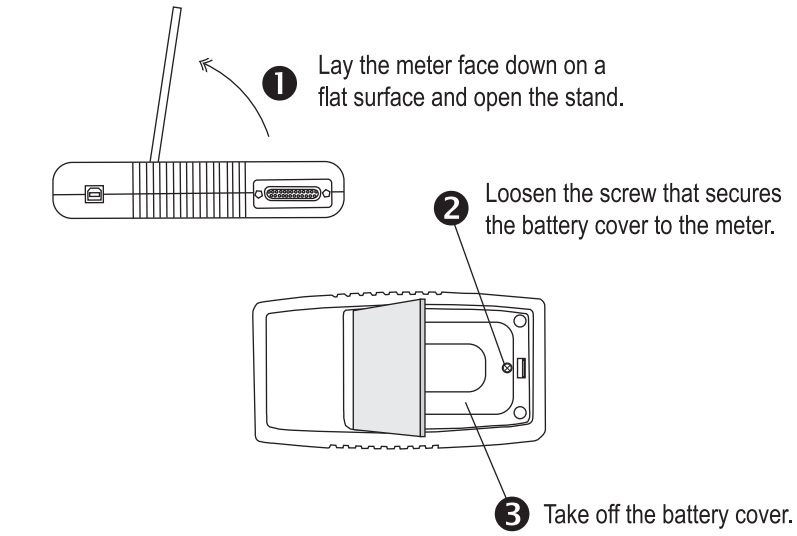
FieldMaxII-TOP uses a rechargeable battery pack (standard), six 1.5V alkaline batteries, or a 90-to-260 VAC, 50/60 Hz AC adapter—refer to “AC Adapter” (p. 12) for more information. Figure A-1 (p. 60) illustrates how to replace the optional alkaline batteries.

Table A-1. Batteries Contained in this Product

Description	Type
7.2V rechargeable battery pack	NiMH
(optional) 1.5V AA	Alkaline



Dispose of batteries according to local regulations. Do not dispose as normal waste. Consult local waste authorities for guidance.



4 Replace the old batteries and then put back the battery cover, tightening the screw to secure it to the meter.

Figure A-1. Optional Alkaline Battery Replacement

Appendix A: Service & Support

This section provides information about technical support, service and shipping instructions.

A.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
- Serial number
- A description of the problem
- Any corrective steps that have been attempted

A.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: LSMsupport@coherent.com
- Website: www.Coherent.com

For further assistance, please contact Coherent Technical Support:

- By phone: 1-(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.

A.1.2 International Support

If located outside the U.S., visit www.Coherent.com for technical assistance, or contact a 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.

A.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 Shipping Instructions” next.
- 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.

A.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 B: Specifications

Table B-1, below, shows the specifications for the FieldMaxII-TOP.

Table B-1. Specifications

Parameter	Description
Electrical/Mechanical	
Analog Output	1, 2, or 5V full-scale (user-adjustable) 100 ohm source impedance
Battery Operating Time* (approx) Thermopile Pyroelectric * Without a backlight	*Rechargeable* *Alkaline* 16 hr. 48 hr. 8 hr. 24 hr.
Calibration Accuracy	± 1%
Digital Output	USB 1.1
Digital Tuning Needle	100 mS (tau) 20 Hz (update rate)
Power Requirements	*AC operation*: 90-to-260 VAC, 50/60 Hz *DC power input*: 12 VDC, 1.25A, center-positive *Battery operation*: rechargeable battery pack (standard) or six optional 1.5V AA alkaline batteries (battery specifications are listed earlier in this table under "Battery Operating Time")
Pyroelectric Input (maximum voltage input)	18V
Internal Trigger	2 to 20% full scale (selectable)
Linearity	± 1%
Measurement Resolution	± 0.1% of full scale
Environmental	
Altitude	4,500 m (operating) < 12,000 m (storage)

Table B-1. Specifications (Continued)

Parameter	Description
Relative Humidity	< 90% (5 to 40° C) (operating) < 95% (0 to 70° C) (storage)
Temperature	5 to 40° C (operating) -20 to 70° C (storage)
Ranges	
Area Parameter (entered as a diameter)	0.01 to 999.99 mm
Attenuation (Attenuation parameter)	0.01 to 999.99
Batch Size (Statistics parameter) Thermopile sensor in watts mode, or optical sensor Thermopile sensor in joules mode, or pyroelectric sensor	 1 to 99,999 seconds 2 to 99,999 pulses
Measurement Range (full scale, sensor-dependent) Energy Mode Power Mode	 3 nJ to 300 kJ (thermopile sensors, long pulse) 3 nJ to 300 kJ (pyroelectric sensors) 3 nW to 300 kW (thermopile sensors) 3 nW to 300 kW (optical sensors) 3 nW to 300 kW (pyroelectric sensors)
Rep Rate	± 1 Hz (accuracy) 300 Hz (maximum) 1 Hz (resolution)
Window Size (Avg parameter) Thermopile or Optical sensor Pyroelectric sensor	 1 to 60 seconds 2 to 99,999 pulses
Physical Characteristics	
Dimensions (h x w x d) (approx)	8 in. (20 cm) 4 in. (10 cm) 1.5 in. (4 cm)
Display	58 x 73 mm fixed-segment LCD with backlight
Weight (approx, including batteries)	1.1 lb. (0.5 kg)

Table B-1. Specifications (Continued)

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FieldMaxII-TOP™ User Manual

Part No. 1086235 Rev. AH

COHERENT

部件名称 Part Name	产品中有害物质的名称及含量 有害物质 Hazardous Substances						
	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 (Cr(VI))	多溴联苯 (PBB)	多溴二苯醚 (PBDE)	
印刷电路板组装 Printed Circuit Board Assembly	X	O	O	O	O	O	20
电源 Power Supply	X	O	O	O	O	O	
电源线 Power Cord	X	O	O	O	O	O	

本表格依据 SJ/T 11364 的规定编制
O: 表示该有害物质在该部件所有均质材料中的含量均在 GB/T 26572 规定的限量要求以下。
X: 表示该有害物质至少在该部件的某一均质材料中的含量超出 GB/T 26572 规定的限量要求。

Download software and manuals at https://www.Coherent.com/

1083265 AH

FieldMaxII-TOP™ User Manual

Part No. 1086235 Rev. AH