User Manual

FieldMax-TO

Laser Power Meter

☀ COHERENT

User Manual
FieldMax-TO
Laser Power Meter

COHERENT

7470 SW Bridgeport Rd.
Portland, OR 97224

Technical Support

In the US:

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

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

If there are technical difficulties with your product that cannot be resolved by support mechanisms outlined above, please e-mail or telephone Coherent Technical Support with a

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Preface

This manual contains user information for the FieldMax-TO laser power meter.

U.S. Export Control Laws Compliance

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

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

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

Publication Updates

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

Symbols Used in This Document

This symbol is intended to alert the operator to the presence of dangerous voltages associated with the product that may be of sufficient magnitude to constitute a risk of electrical shock.
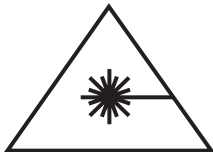
This symbol is intended to alert the operator to the danger of exposure to hazardous visible and invisible radiation.

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

SAFETY

Carefully review the following safety information to avoid personal injury and to prevent damage to this meter or any sensor connected to it. Except for replaceable batteries (discussed under "Battery Replacement" on page 15), there are no user-serviceable parts in the FieldMax-TO meter. For service information, refer to "Obtaining Service" on page 45.

Use only the power cord specified for the meter. The grounding conductor of the cord must be connected to earth ground.
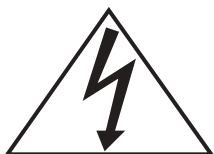
Do not operate the meter if its panels are removed or any of the interior circuitry is exposed.
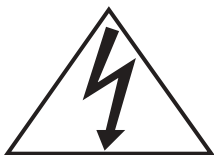
Do not operate the meter in wet or damp conditions, or in an explosive atmosphere.

1

Operate the meter only within the specified voltage range.

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

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

Declaration of Conformity

Declaration of Conformity

We

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

declare that the

FieldMax (TOP, TO, P)

meets the intent of Directive 89/336/EEC for Electromagnetic Compatibility.
Compliance was demonstrated per testing to EN61326 Electromagnetic
Compatibility Product Family Standard for Measurement, Control and Laboratory
Equipment to include the following test specifications as of August 2003:
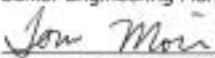
EN55011 Class A Radiated Emissions
EN55011 Class A Conducted Emissions

EN61000-4-2 Electrostatic Discharge – Performance Criteria B
    Unit may respond to an ESD event but will return to normal without user intervention.

EN61000-4-3 Radiated Immunity – Performance Criteria A
EN61000-4-4 Electrical Fast Transient Immunity - Performance Criteria A
EN61000-4-5 Electrical Slow Transient Immunity- Performance Criteria A
EN61000-4-6 Conducted RF Immunity - Performance Criteria A
EN61000-4-11 Power Line Dropout - Performance Criteria A
EN61000-3-3 Conducted Emissions Powerline Fluctuation & Flicker Criteria A
EN61000-4-8 Powerline Frequency Magnetic Field Immunity Criteria A

_____   Date: ___3/5/04___
Senior Engineering Manager, Instruments

_____   Date: ___3/15/04___
General Manager, LMC

QUICK START

This section presents a "mini-tutorial" that explains how to connect a sensor to your FieldMax-TO meter and begin taking measurements within minutes. For in-depth information about the procedure introduced in this section, refer to "Operation" on page 17.
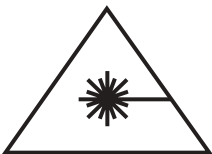
Follow all laser safety procedures. The laser must be blocked or switched OFF before beginning the procedure described in this section.

Power to the FieldMax-TO instrument must be OFF before beginning the procedure described in this section.

Do not exceed the power density limits of the sensor.

Measuring Power With a Thermopile or Optical Sensor

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

① Connect a thermopile or optical sensor to the 25-pin connector.

② Press the Auto button to turn on Auto Ranging.

③ Block the beam and then press the Zero button to set the baseline for your new measurement.

④ Unblock the beam, take the measurement, and observe the result on the LCD.
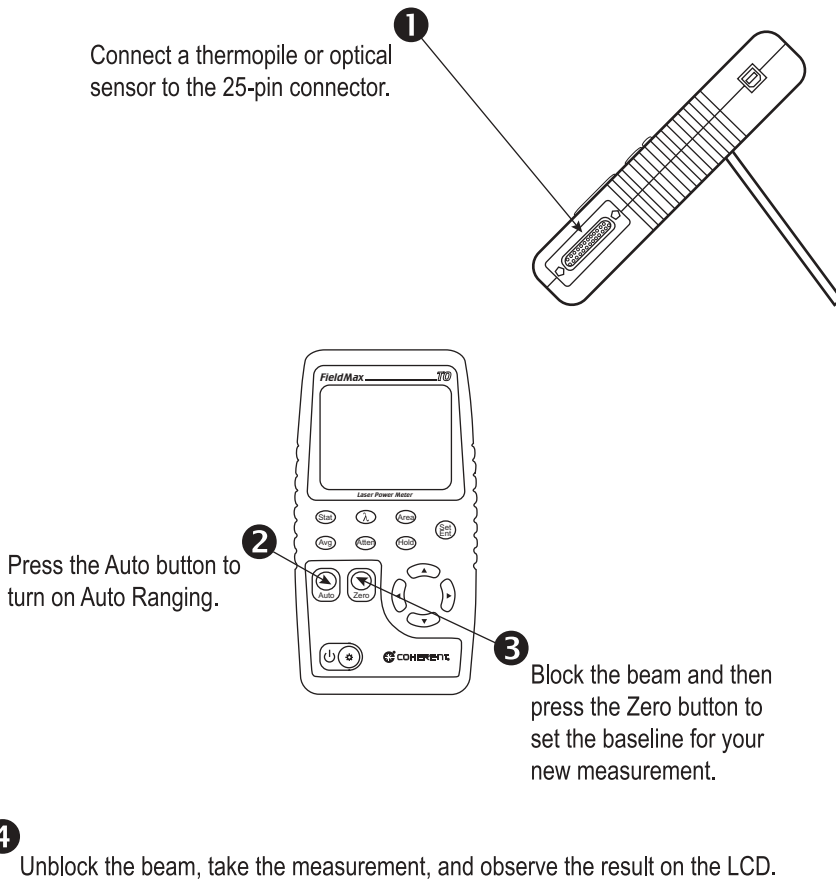
Figure 1. Measuring Power With a Thermopile or Optical Sensor

DESCRIPTION

Thank you for purchasing the FieldMax-TO—a versatile, easy-to-use digital power meter designed for field service and production applications.

This section discusses the following topics:

- Front panel (page 9)

- Right side panel (page 13)

- Left side panel (page 14)

There are also instructions on how to replace the alkaline batteries (page 15) and a brief overview of the AC adapter (page 16).

Here is a list of specific features included in your FieldMax-TO meter:

- 73 x 58 mm backlit LCD display

- Fast and effective laser tuning mode

- Works with thermopile and optical sensors

- Intuitive soft key-driven user interface

- USB 1.1

- Portable AC/DC operation

- Compact, rugged enclosure with stand

The versatile FieldMax-TO measures:

- Power: W, W/cm^2

- Full statistics: max, min, and mean

Front Panel

The front panel (shown in Figure 2) includes a liquid crystal display (LCD) and buttons that are used to enter parameters, select modes, and change ranges.
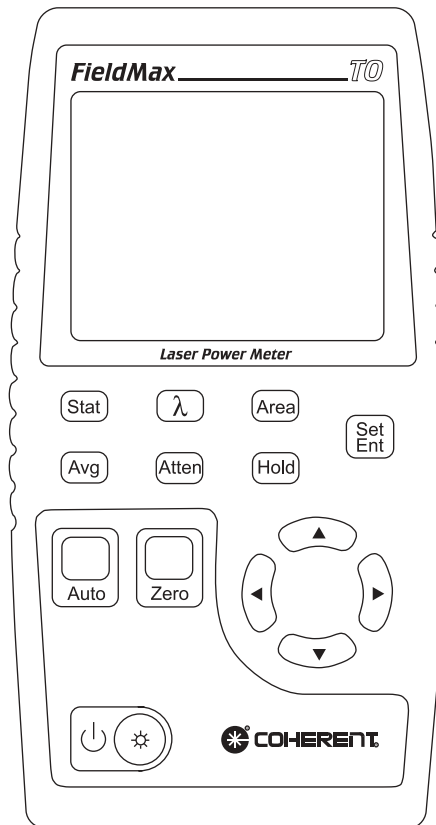
Figure 2. Front Panel

Buttons

The following buttons are on the front panel of the FieldMax-TO:

- Set/Ent—starts or ends a parameter edit cycle

- Stat—statistics processing parameter

- Wave (λ)—wavelength compensation parameter

- Area—area correction parameter

- Avg—display smoothing parameter

- Atten—attenuation correction parameter

- Hold—LCD freeze mode

- Auto—Auto Ranging mode

- Zero—start batch

- ⟨ ⏻ ☀ ⟩—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 information about each of these buttons, refer to "Operation" on page 17.

Display

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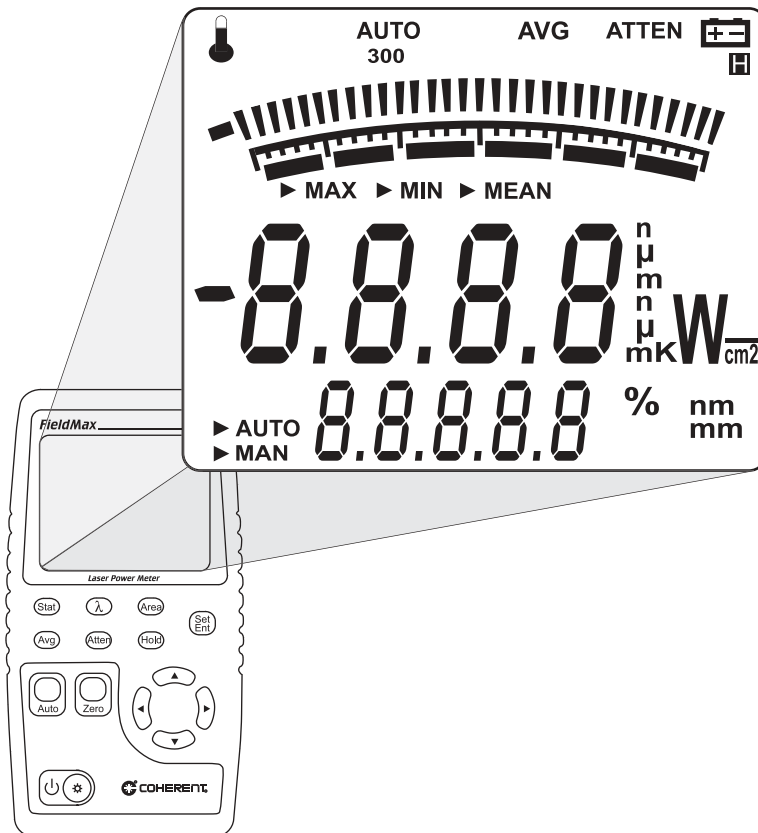
Figure 3. LCD Display

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 on page 11 shows the general location of each group).

- Annunciators: Temperature, AUTO, Range Hint, AVG, ATTEN, and Battery

- Digital tuning feature

- Tuning meter scale

- Statistical parameters: MAX, MIN, and MEAN

- Numeric measurement value—large numeric characters

- Measurement units and engineering prefixes

- Statistical Sampling mode: AUTO and MAN

- Numeric data entry, batch count, and parameter settings

- Data entry units and current parameter units

For detailed information about these settings, refer to "Button Functions" on page 30.

Right Side Panel

The right side panel contains the USB and Sensor connections (refer to Figure 4).

USB Connector

Attaching the cable—shipped with the meter—to this standard USB connector allows communication between FieldMax-TO and a computer with a USB interface.

Sensor Connector

Use this connection to attach a DB-25 SmartProbe connector or adapter.
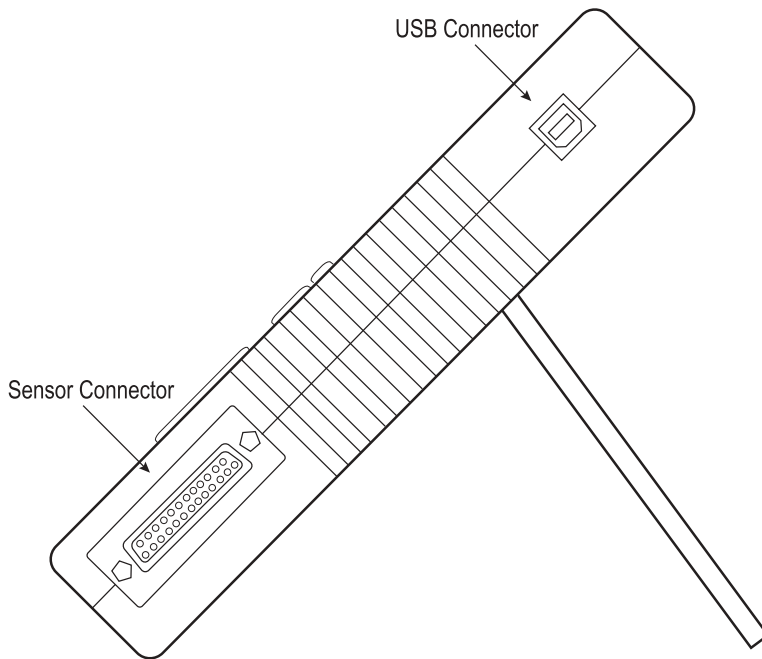
Figure 4. Right Side Panel

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Left Side Panel

The power jack connector is located on this panel (refer to Figure 5).

Power Jack Connector

Connect the supplied power cord to this jack.

Power Jack Connector
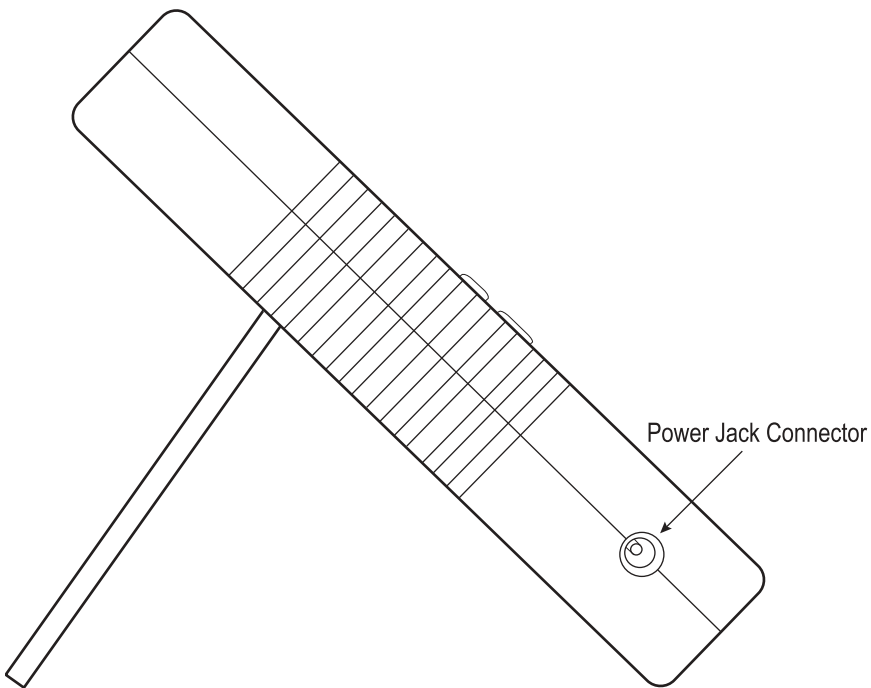
Figure 5. Left Side Panel

Battery Replacement

FieldMax-TO uses six 1.5 V alkaline batteries, or a 90-to-260 VAC, 50/60 Hz AC adapter (refer to "AC Adapter" on page 16 for more information about the adapter). Figure 6 illustrates how to replace the batteries.

❶ Lay the meter face down on a flat surface and open the stand.

❷ Loosen the screw that secures the battery cover to the meter.

❸ Take off the battery cover.

❹ Replace the old batteries and then put back the battery cover, tightening the screw to secure it to the meter.
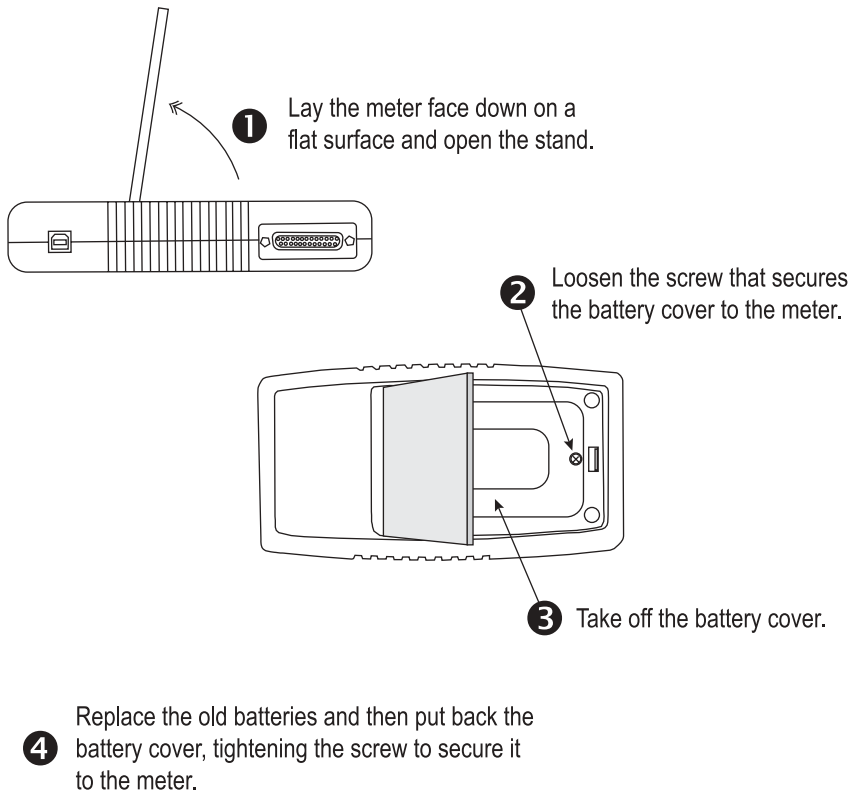
Figure 6. Battery Replacement

AC Adapter

Using an AC adapter prolongs battery life. FieldMax-TO 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.

- The backlight is automatically turned off after three seconds.

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

OPERATION

This section discusses the following topics:

- Tuning mode (page 18)

- Annunciators (page 22)

- Fault displays (page 24)

- Invalid and not available data conditions (page 25)

- Setup parameters (page 26)

- Button functions (page 30)

- Statistics mode (page 33)

- Measurement display and range selection (page 33)

Tuning Mode

This mode only works with manual range (that is, Auto Ranging is turned off). For more information about ranging, refer to "Auto vs. Manual Ranging Mode" on page 36.

As shown in Figure 7, tuning is visually displayed on the LCD using tuning needles and zone indicator bars.
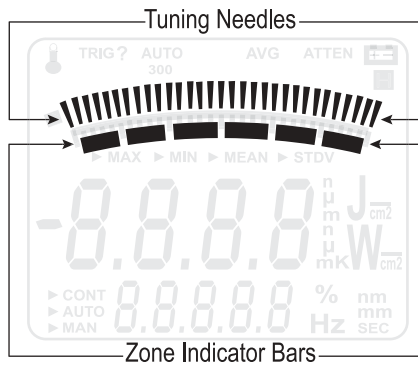
Figure 7. Location of Tuning Needles and Zone Indicator Bars

Tuning Needles

Tuning needles—which divide a given tuning zone into thirty "increments"—are used to peak a laser output. As the top or bottom of a zone is reached, the tuning needles automatically move to the center of the next zone (see Figure 8). Zone indicator bars let you know when this happens (refer to "Zone Indicator Bars" on page 20 for more information).
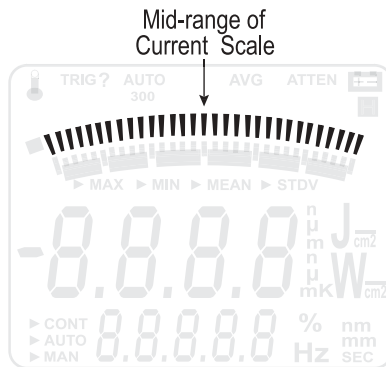
Figure 8. Current Scale Mid-Range

Zone Indicator Bars

Zone indicator bars are a series of six segments, as shown in Figure 9:
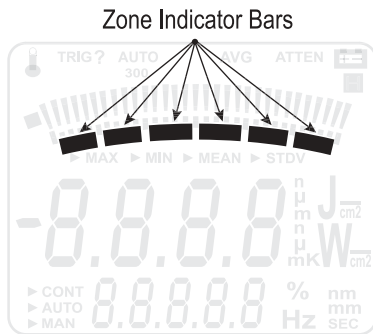
Figure 9. Zone Indicator Bars

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.

Zone indicator bars always appear in pairs, with each overlapping zone representing 1/3 of full scale. Figure 10 shows how the five zone indicator bars correlate to full scale measurement on the tuning meter scale.
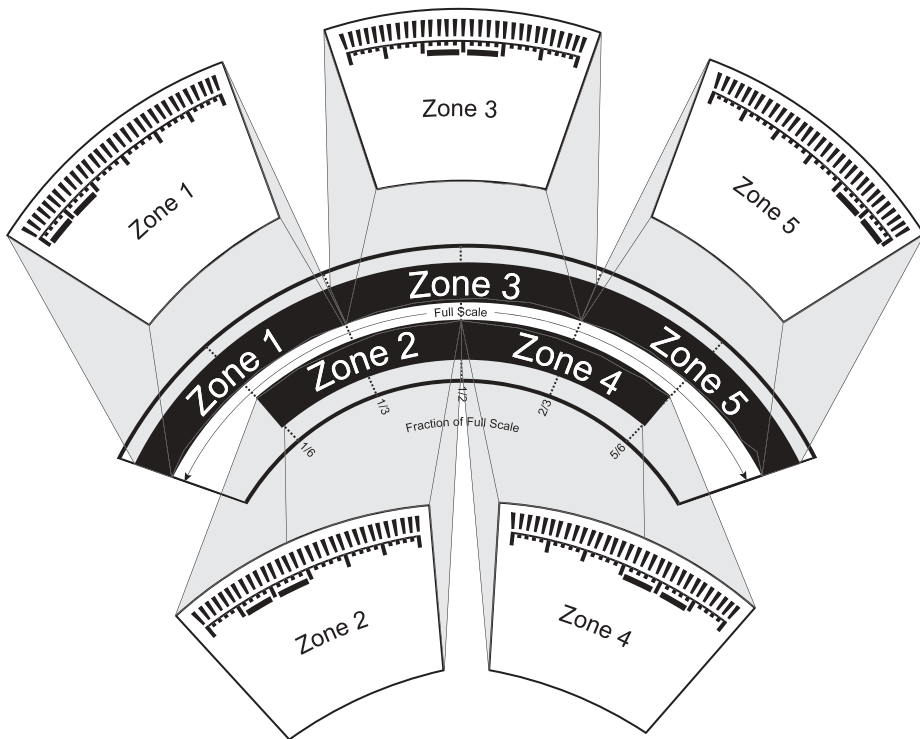
Figure 10. Comparison of Zone Indicator Bars to Full Scale Measurement

Figure 11 shows an example of how the zone indicator bars overlap on a 30-watt scale:
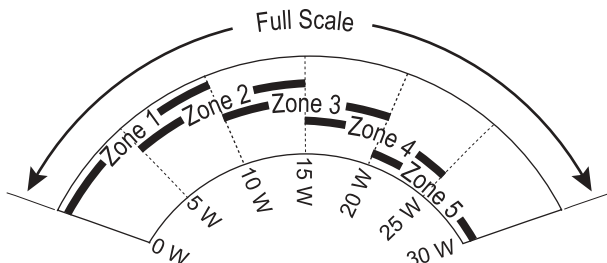
Figure 11. Tuning Mode Example - Full Scale

Annunciators

Annunciators refers to the icon-type symbols that appear on the LCD (Figure 3 on page 11 shows all the annunciators on the FieldMax-TO meter). The update rate for all annunciators is 3 times per second.

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.

AUTO

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, the AUTO annunciator is not visible.

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" on page 33.

AVG

When AVG (display smoothing) is active, display values are averaged by time. "AVG" displays when averaging is active. Nothing displays in this position if averaging is not active.

ATTEN

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

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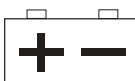
The Battery annunciator flashes whenever the batteries need to be replaced.

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

Hold

The Hold annunciator toggles between freezing the power reading and associated indicators on the LCD, and displaying live measurements.

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Fault Displays

FieldMax-TO is capable of detecting internal and user-induced faults. When a fault is detected, the letters "Er"—followed by a numeric fault code (see Table 1)—appear on the display. You can dismiss a fault code by pressing any button, or by correcting the cause of the fault.

Table 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" on page 30.

As an example, "Er 4" appears on the display if there is a sensor error. You can dismiss the fault 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).

Invalid and Not Available Data Conditions

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

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.

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 condition will generate unavailable data:

•   Statistics mode is entered and batch data has not been compiled.

Setup Parameters

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

Set/Ent

User-defined parameters are edited by pressing the Set/Ent button which, in turn, initiates a parameter edit cycle.

A *parameter edit cycle* consists of:

- Pressing the Set/Ent button to begin the cycle.

- Pressing the parameter button (Stat, Wave (λ), Area, Avg, Atten, or Hold) 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 Set/Ent button a second time to end the cycle and commit the new data value.

Stat

Pressing 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 Set/Ent is pressed beforehand). Batch size is 1 to 99,999 seconds.

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

Wave

λ You can configure FieldMax-TO 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 Set/Ent, 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.

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

Area

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

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," below, for more information about Area Correction mode.

- Enter Edit mode and select the beam diameter, if Set/Ent is pressed beforehand.

- View the beam diameter, if the button is pressed for one second or more.

Area Correction and Zeroing

It is important that you zero the sensor before using Area Correction. The following procedure explains how to do that.

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 you are 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 "Zeroing" on page 36.

Avg

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

Display values are averaged by time.

The FieldMax-TO uses a boxcar averaging method, with a boxcar length of 32 samples.

Pressing the Avg button toggles the state of Average mode.

Atten

Attenuation mode allows you to get 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 1.00 to 999.99.

Here's an example of how to determine the attenuation correction factor that needs to be set in the FieldMax-TO 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

FieldMax-TO 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 Set/Ent is pressed beforehand.

- View the attenuation factor, if the button is pressed for one second or more.

Hold

Pressing the Hold button toggles between freezing the power reading and associated indicators on the LCD, and displaying live measurements.

Button Functions

Auto

Pressing the Auto button instructs the FieldMax-TO to select the best measurement range for the incoming signal.

Zero

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.

Power Switch and Backlight Toggle Button
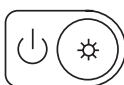
The combination Power Switch and Backlight Toggle button serves the dual purpose of turning power on/off to the meter, and toggling the backlight.

• When the meter is off, the power-on state is activated by pressing the button for one second.

• Pressing the button for one second while in the power-on state turns the meter 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.

- The backlight automatically turns off after three seconds if the meter is powered by batteries.

- The backlight is immediately turned off when the AC adapter is unplugged from the meter.

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.

Left and Right Arrows

This button pair has a dual purpose. When the Edit mode is active, the buttons allow you 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, or MEAN). These buttons are nonfunctional when Edit mode and Statistics mode are not active.

Statistics Mode

FieldMax-TO can be configured to display statistical data instead of instantaneous measurements. Statistical data is generated over time.

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.

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" on page 32.

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.

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 2 on page 34) is dependent on the sensor type and characteristics, as well as user-determined measurement settings.

FieldMax-TO 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 2 indicates the display format for different full-scale range settings.

Table 2. Full Scale Range Settings

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
300 μW	XXX.Y μW
3 mW	X.YYY mW
30 mW	XX.YY mW
300 mW	XXX.Y mW

Table 2. Full Scale Range Settings (Continued)

FULL SCALE MEASUREMENT	DISPLAY FORMAT
3 W	X.YYY W
30 W	XX.YY W
300 W	XXX.Y W
3 kW	X.YYY kW
30 kW	XX.YY kW

When area correction is enabled, turning on the watts/cm^2 segment will express watts units with a "cm^2" appended.

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" on page 23.

Manual Ranging Mode

Manual ranging requires the user to select the range. For more information about manual ranging, refer to "Up and Down Arrows" on page 32.

Auto vs. Manual Ranging Mode

Auto Ranging (Auto) enables FieldMax-TO to automatically select the range (gain). 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 12.
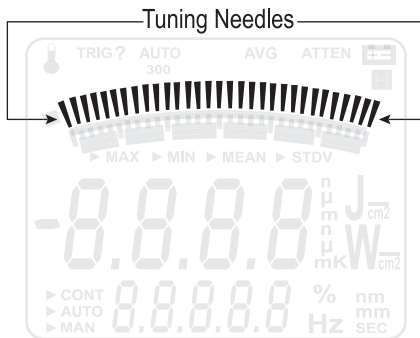

Figure 12. Auto Ranging

Manual ranging requires the range to be selected by the user. For more information, refer to "Up and Down Arrows" on page 32.

Zeroing

Thermopile and optical sensors require periodic zeroing. Zeroing occurs 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.

SPECIAL TOPICS

This section discusses the following topics:

- Negative power display (this page)

- Digital tuning feature use in Statistics mode (this page)

- ActiveX installation (page 40)

- USB driver installation (page 40)

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 turned on. The inertia of a mechanical meter will be mimicked for negative, as well as positive, power readings.

Digital Tuning Feature Use in Statistics Mode

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

ActiveX Installation

Included with the software is a set of ActiveX tools that enables a programmer to quickly and efficiently communicate with FieldMax. This ActiveX control program—and its accompanying tutorial—are shipped with every FieldMax-TO. View the Readme file on the accompanying CD for ActiveX installation instructions.

USB Driver Installation

When first connecting the meter to a PC with the USB cable, you will be prompted through an installation process. USB drivers will be automatically installed onto your computer. Insert the CD into your CD drive when prompted.

CALIBRATION AND WARRANTY

This section discusses the following topics:

- Calibration (this page)
- Coherent calibration facilities and capabilities (page 42)
- Limited warranty (page 43)
- Extended lifetime warranty (page 43)
- Warranty limitations (page 44)
- Obtaining service (page 45)
- Product shipping instructions (page 47)

Calibration

Coherent laser power and energy meters are precision instruments, capable of delivering very accurate measurements, as well as providing many years of useful service. To maintain this high level of performance, it is important to have your measurement system serviced and recalibrated once a year.

Coherent Calibration Facilities and Capabilities

As the largest laser manufacturer in the world, Coherent has been able to build state-of-the-art calibration facilities containing the widest possible range of laser types and technologies. This enables us to perform instrument and sensor calibration under virtually any combination of wavelength, power, and operating characteristics. Sensors are calibrated against NIST-traceable working standard sensors which are, in turn, calibrated against NIST-calibrated golden standard sensors. These working and golden standards are maintained with the utmost care, recalibrated annually, and verified even more regularly. We maintain multiple NIST-calibrated standards at many laser wavelengths to support the growing calibration needs of our customers. Optical calibration is a core competency at Coherent and we strive to continually improve our methods, precision, and repeatability. Additionally, most of the calibrations are performed with highly automated systems, thus reducing the possibility of human error to nearly zero. Strict quality inspections during many stages of calibration and testing assure a precise and accurate instrument that is NIST traceable and CE marked. The benefit to our customers is that instruments calibrated by Coherent will consistently perform as expected under their actual use conditions. We are a registered ISO 9001:2000 company, our products are NIST traceable, and our calibration labs are fully ANSI Z540 compliant.

In addition to the technological advantage, we also strive to deliver the best service in the industry, with a knowledgeable and responsive staff, and rapid turnaround.

Limited Warranty

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

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

Extended Lifetime Warranty

Coherent, Inc. (the "Company") offers original purchasers (the "Customer") purchasing laser power and energy meters and sensors products ("Products") an extended, lifetime warranty program, which includes all parts and labor. In order to qualify for this warranty, a Customer must return the Product to the Company for recalibration and recertification (traceable to NIST and MIL-STD-45662A) within one year from the date of purchase, and annually thereafter. The Company will recertify the Product, provide software upgrades, and perform any needed repairs, for a fixed service fee (as established by the Company from time to time and in effect at the time of service).

If the Product fails and is returned to the Company within one year following the date of recalibration service, the Company will, at its option, repair or replace the Product or any component found to be defective. This warranty applies only to the original purchaser and is not transferable.

If the Product is not returned for recalibration or service prior to the one-year anniversary, the lifetime warranty program expires. The lifetime warranty program may be reinstated, at Coherent's option, after completion of a fee-based product evaluation and repair, and subsequent recalibration and recertification service.

Warranty Limitations

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

- Damage caused by improper installation, handling, or use.

- Laser damage (including sensor elements damaged beyond repair).

- Failure to follow recommended maintenance procedures.

- Unauthorized product modification or repair.

- Operation outside the environmental specifications of the product.

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

THIS WARRANTY IS EXCLUSIVE IN LIEU OF ALL OTHER WARRANTIES WHETHER WRITTEN, ORAL, OR IMPLIED. COHERENT SPECIFICALLY DISCLAIMS THE IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. IN NO EVENT SHALL

THE COMPANY BE LIABLE FOR ANY INDIRECT, INCIDENTAL, OR CONSEQUENTIAL DAMAGES IN CONNECTION WITH ITS PRODUCTS.

Obtaining Service

In order to obtain service under this warranty, Customer must notify the Company of the defect before the expiration of the warranty period and make suitable arrangements for the performance of service. The Company shall, in its sole discretion, determine whether to perform warranty service at the Customer's facility, at the Company's facility or at an authorized repair station.

If Customer is directed by the Company to ship the product to the Company or a repair station, Customer shall package the product (to protect from damage during shipping) and ship it to the address specified by the Company, shipping prepaid. The customer shall pay the cost of shipping the Product back to the Customer in conjunction with annual recalibration and repair; the Company shall pay the cost of shipping the Product back to the Customer in conjunction with product failures within the first twelve months of time of sale or between annual recalibrations.

A Returned Material Authorization number (RMA) assigned by the Company must be included on the outside of all shipping packages and containers. Items returned without an RMA number are subject to return to the sender.

For the latest Customer Service information, refer to our website: www.coherent.com.

Detailed instructions on how to prepare a product for shipping are shown under "Product Shipping Instructions" on page 47.

Table 3. Coherent Service Centers

LOCATION	PHONE	FAX	E-MAIL
USA	1.800.343.4912	971.327.2778	info_service@coherent.com
Europe	+49 (6071) 9680	971.327.2778	info_service@coherent.com
International	971.327.2700	971.327.2778	info_service@coherent.com

Product Shipping Instructions

To prepare the product for shipping to Coherent:

1. Contact Coherent Customer Service (refer to Table 3 on page 46) for a Return Material Authorization number.

2. Attach a tag to the product that includes the name and address of the owner, the person to contact, the serial number, and the RMA number you received from Coherent Customer Service.

3. Wrap the product with polyethylene sheeting or equivalent material.

4. If the original packing material and carton are not available, obtain a corrugated cardboard shipping carton with inside dimensions that are at least 6 in (15 cm) taller, wider, and deeper than the product. The shipping carton must be constructed of cardboard with a minimum of 375 lb (170 kg) test strength. Cushion the instrument in the shipping carton with packing material or urethane foam on all sides between the carton and the product. Allow 3 in (7.5 cm) on all sides, top, and bottom.

5. Seat the shipping carton with shipping tape or an industrial stapler.

6. Ship the product to:

    Coherent, Inc.
    7470 SW Bridgeport Rd.
    Portland, OR 97224
    Attn: RMA # (*add the RMA number you received from Coherent Customer Service*)

APPENDIX A: SPECIFICATIONS

Table 4 lists specifications for the FieldMax-TO.

Table 4. Specifications

PARAMETER	DESCRIPTION
ELECTRICAL/MECHANICAL	

Battery Operating Time[a] (approx)
   Continuous measurements in Pyroelectric mode
   Continuous measurements in Thermopile or Optical mode with passive sensor
   Shelf life when not used
	(Six 1.5 V AA alkaline batteries)
	24 hr
	
	36 hr
	
	8 yr

Calibration Accuracy	±1%
Digital Output	USB 1.1
Digital Tuning Needle	100 mS (tau) 20 Hz (update rate)
Instrument Power	Six 1.5 V AA alkaline batteries, or 90-to-260 VAC, 50/60 Hz AC
Linearity	±1%
Measurement Resolution	±1% of full scale

Table 4. Specifications (Continued)

PARAMETER	DESCRIPTION
ENVIRONMENTAL	
Altitude	<2,000 m (operating) <12,000 m (storage)
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)	1.00 to 999.99
Batch Size (Statistics parameter)	1 to 99,999 seconds
Measurement Range (full scale, sensor-dependent)	3 nW to 300 kW (thermopile sensors) 3 nW to 300 kW (optical sensors)
Window Size (Avg parameter)	1 to 60 seconds
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 4. Specifications (Continued)

PARAMETER	DESCRIPTION
MISCELLANEOUS	
Regulations Met	CE

a. Coherent recommends a Panasonic AM-3PI AA battery.

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