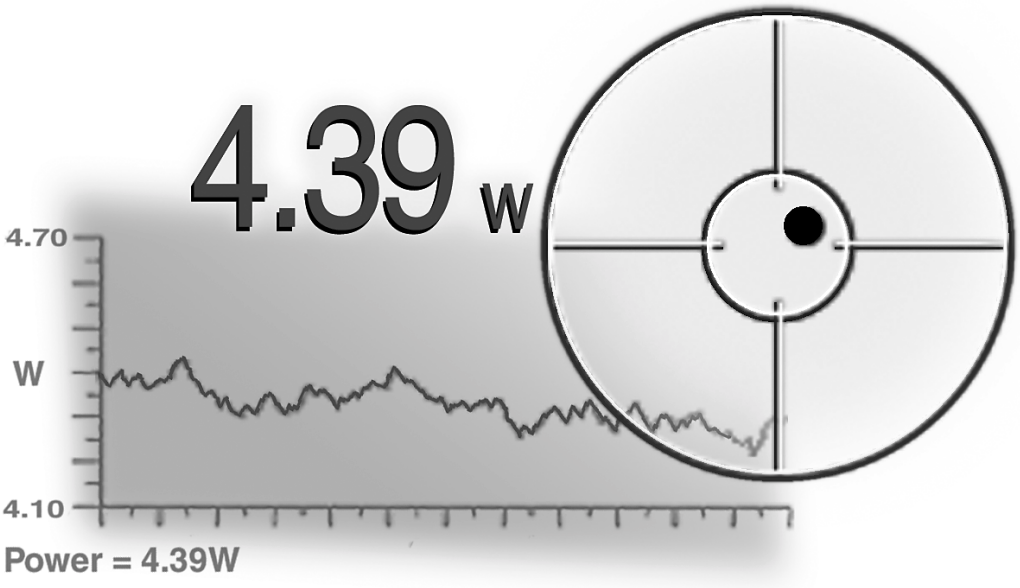
LaserPAD™

Laser Power Analysis Display



User Manual

COHERENT®
AUBURN DIVISION

LaserPAD™
Laser Power Analysis Display
User Manual

COHERENT®
AUBURN DIVISION

A Member of Coherent Photonics Group

Part Number: 0217-834-00 Rev. A

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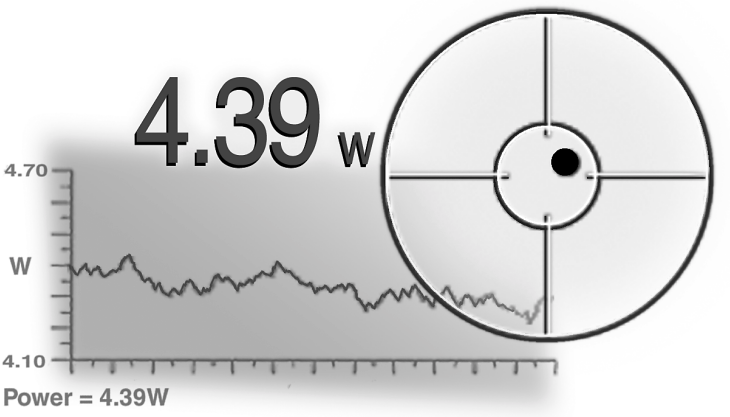
General Description



The LaserPAD Power Analysis Display software combined with the Coherent SmartSensor Interface Module, is a rugged, compact, power analyzer that interfaces with the full line of Coherent "smart" detector heads. LaserPAD provides a unique combination of a high speed graphical bar for laser tuning, a precise digital display, and graphics analysis of power and alignment on a high resolution color display.

The LaserPAD can be used with all lasers commonly manufactured today – from the UV to the IR, with rated power from nanowatts to kilowatts – simply by plugging the appropriate detector head into the SmartSensor Interface Module.

The SmartSensor Interface Module (SSIM) is a unique detector interface. This module will interface with any Coherent Thermal or Semiconductor SmartSensor. The SSIM contains the input amplifiers and the digital converters necessary to accurately analyze CW laser power. When this circuitry is combined with the capability to utilize Coherent SmartSensor technology, you now have a stand alone black box power meter. The serial communication port will transmit the corrected CW laser power and beam position for display and analysis with the LaserPAD software. The serial and USB interface is perfectly suited to communicate with any compatible host computer or OEM application. The SmartSensor Interface Module software can also be updated with the USB port. Please contact Coherent for any OEM application utilizing the SmartSensor Interfaced Module.

Features

Features of the LaserPAD are described below.

CW Power Measurement

The LaserPAD supports CW power measurement. (See Appendix A for a list of heads supported.)

Semiconductor and Thermal Detectors – LaserPAD is compatible with Semiconductor Sensors and the full range of Coherent's patented thermal SmartSensor Heads, providing power measurement capability to 5 KW.

Versatility

More than just a power meter, the LaserPAD also provides complete power trend information, beam position drift measurement, statistics and tuning.

Data Files

The LaserPAD can generate results files for all trending and position stability data. The statistics and data points are saved in a comma delimited format for easy spreadsheet analysis.

Detector Head Hot Swapping

The LaserPAD allows swapping of detector heads while power remains On. After a swap, the SmartSensor Interface Module will reset with the correct settings for the new detector head.

SmartSensor™ Technology

LaserPAD detector heads utilize Coherent's SmartSensor™ Technology. Each SmartSensor has an EEPROM that stores the characteristics and calibration data for the detector. The detector information is read by the SmartSensor Interface Module at start-up. This will eliminate the need to make manual changes associated with unique detector settings.

NOTE: The LaserPAD Software will store user-required entries for Display Average and Wavelength.

Features

Tuning Sensitivity and Feedback

The tune bar and digital needle movement in the LaserPAD gives a fast, smooth feedback and provides the response time necessary for laser tuning.

Digital Precision

The LaserPAD software provides precise digital readout of power as well as indicators for warning or error conditions and graphic analysis of data collection.

Beam Alignment

Thermal disk CW sensors provide a quadrant display of beam position on the detector head. Centering the beam on the detector head achieves maximum accuracy.

Broad Wavelength Range

Coherent SmartSensors cover the spectrum from 0.19 to 10.6 μmeters.

Ease of Use

LaserPAD controls and the simplified menu structure provide ease of use with minimal training. All adjustments for different detector heads are handled automatically using Coherent's SmartSensor Technology.

Portability

The compact, lightweight SmartSensor Interface Module and internal rechargeable battery pack create a system that is easily transported from lab to lab or around the world.

Reliability

The SmartSensor Interface Module is designed to withstand the rigors of travel and regular field use. Coherent's rugged detector head design has been the industry standard for more than 30 years.

Features

Accuracy

The combination of SmartSensor Technology, laser wavelength entry, and accurate beam positioning information create a highly accurate laser measurement system.

Unpacking

The LaserPAD SmartSensor Interface Module and detector heads are shipped in foam inserts. Batteries are installed in the SmartSensor Interface Module prior to shipment. To insure correct battery operation, the batteries require an initial over night charge (approximately 14 hours).

Visually check all cartons for damage before unpacking. If there is no visible damage, remove all items from the cartons and inspect for damage. Advise Coherent of any damage immediately. A Returned Material Authorization will be issued for any damaged instruments (see the last page of this manual for service information).

Software Installation

Description

The LaserPAD software installation CD contains the following items: LaserPAD software installation files, LaserPAD User Manual .pdf file, User Readme file and SSIM software update program. The LaserPAD software installation will work in conjunction with Microsoft® ActiveSync™ software to load LaserPAD on your Pocket PC. The LaserPAD software installation will load the required files into the default (C:\Program Files\LaserPAD) or user specified location on the host PC. When Active Sync‘ is running, the installation will load LaserPAD on your Pocket PC. The SSIM update software will be located in the default or user specified location after the software installation process is complete.

Setup Requirements

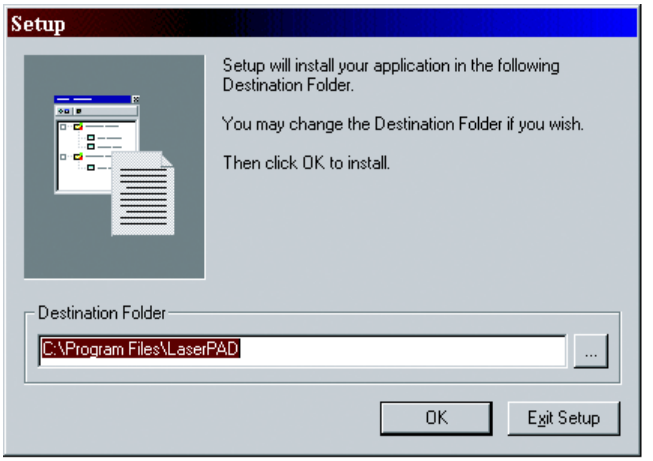
The Pocket PC software installation requires a host computer with ActiveSync™ software installed. The LaserPAD software can be installed with a serial or USB communication cradle. Please review the requirements associated with ActiveSync for further information.

Installation Procedure

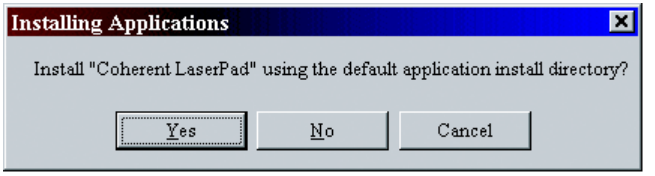
1. Start the host computer with the communication cradle connected.
2. Place the Pocket PC in the communication cradle. Verify that ActiveSync is linked and communicating to the Pocket PC.
3. From the start menu select Run. Type (name of CD drive): \setup.exe (for example E:\setup.exe) and press Enter.

Software Installation

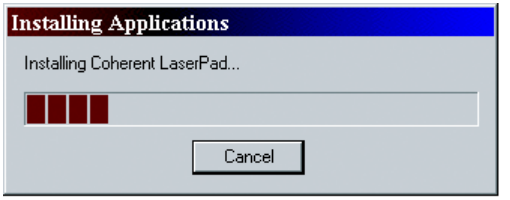
4. The default path for the installation on the host PC will be displayed. You may now change the installation path on your host computer if the default path is not desired.



5. You will now be prompted to install the software in the path selected in the previous step. Click Yes to continue.



6. The setup is now loading the application on the Pocket PC.



Software Installation

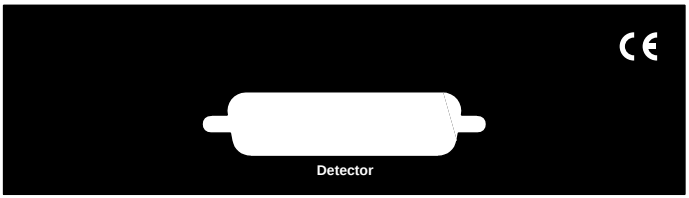
7. When the loading process is complete, you will be prompted to check the Pocket PC screen for any messages.

8. Tap the ***Yes to All*** buttons on the Pocket PC to update the components required for the LaserPAD application. The installation is complete. A Word document named LaserPAD User Manual will also be loaded on the Pocket PC.

NOTE: If the LaserPAD user manual MS Word document is deleted, you can drag a copy from the installation CD to the ActiveSync folder and it will be loaded on the Pocket PC.

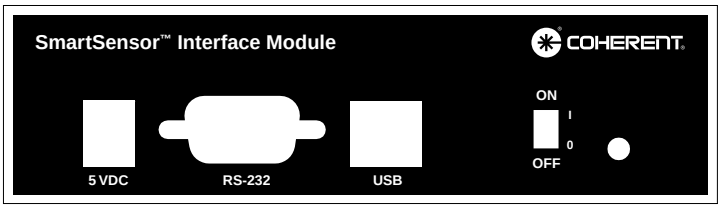
Controls & Connections

Input Panel



Detector Input – Connection to the Coherent SmartSensor Head using a DB-25 connector.

Output Panel



5 VDC Power Input – Connect the provided 5V Power supply. The power supply is designed for the following AC input requirements: 100-240V, ~0.2A, 50-60 Hz. The 5V input also provides battery charging capability for the SmartSensor Interface Module. When the 5V supply is connected to the Interface Module, the battery will be charging regardless of the power switch position. The USB connection does not provide battery charging capability.

NOTE: A fully charged battery will typically operate the SmartSensor Interface Module for 12 hours continuously. Do not exceed this 12 hour cycle without recharging. A low battery condition requires an overnight charging cycle (approximately 14 hours).

RS-232 Input/Output – Connect the Pocket PC serial interface cable to this DB-9 connector.

Controls & Connections

USB Input/Output – Connection for SmartSensor Interface Module to PC based applications.

Power Off/On – Switches input power on and off to the SmartSensor Interface Module. Utilize this switch to reboot the SmartSensor Interface Module if necessary.

Power Indicator LED – The LED will be illuminated when the 5V power is active and the power switch is in the ON position.

SmartSensor Interface Module Software Update

Description

The SmartSensor Interface Module (SSIM) contains the software required to interface with Coherent SmartSensors. The SSIM software will manage the internal circuitry, SmartSensor calibration information, calculations and data transmission. If any function is changed or a feature is added, the SSIM software can be upgraded by the user. The update software is installed during LaserPAD software installation.

System Requirements

The host computer requires an active USB port for the SSIM software update. The software update can be accomplished with the following Windows® operating systems: Windows 98, Windows 2000 and Windows ME.

Software Information

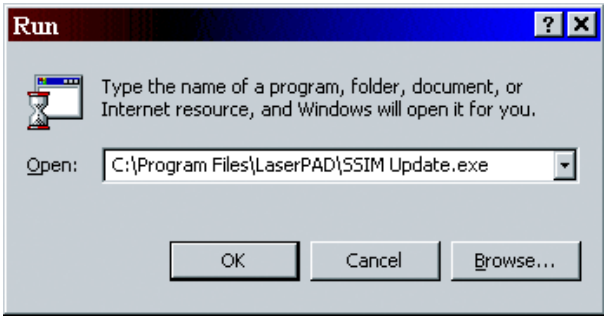
The SSIM software update requires the software update file (ssimx.hex). The x in the file name corresponds to the current revision of the file. The ssim.hex file can be obtained from a floppy disk, E-Mail or the Coherent Product Web Site. The location of the update software is specified during the LaserPAD software installation. The default location is C:\Program Files\LaserPAD.

SSIM Software Update Procedure

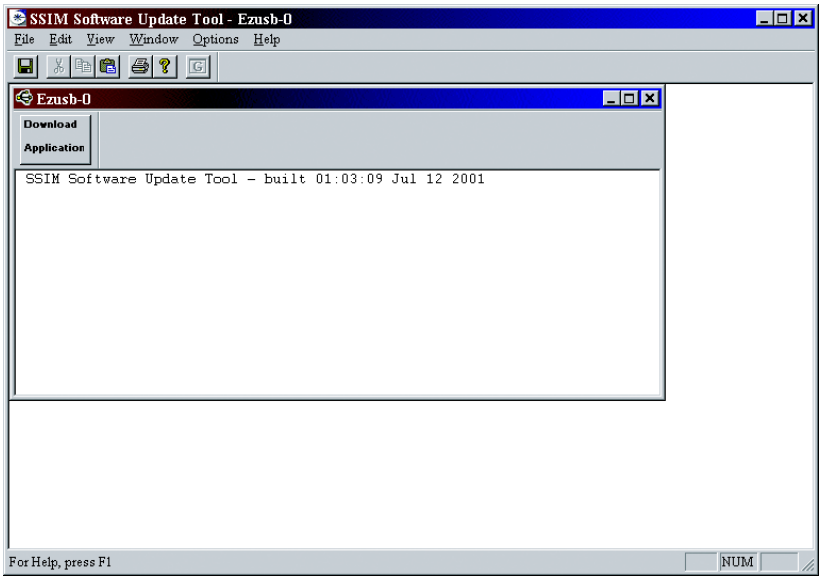
1. With the host PC running, connect a USB cable between the SmartSensor Interface Module (SSIM) and the host PC.
2. Move the SSIM power switch to the ON position. The host PC will detect the SSIM as new hardware. If the proper USB drivers do not reside on the host PC, you may be prompted to load them. The USB drivers are located on the LaserPAD installation CD. Place the LaserPAD installation CD in the host computer CD drive. Type the CD drive letter in the Windows dialog box, which is asking for the location of the USB driver files, and click OK.

SmartSensor Interface Module Software Update

3. To start the SSIM update software, select "Run" from the Windows Start Menu. Type C:\Program Files\LaserPAD\SSIM Update.exe and then click OK. If the LaserPAD software was not installed in the default location, alter the C:\Program Files\LaserPAD appropriate to the user specified location.

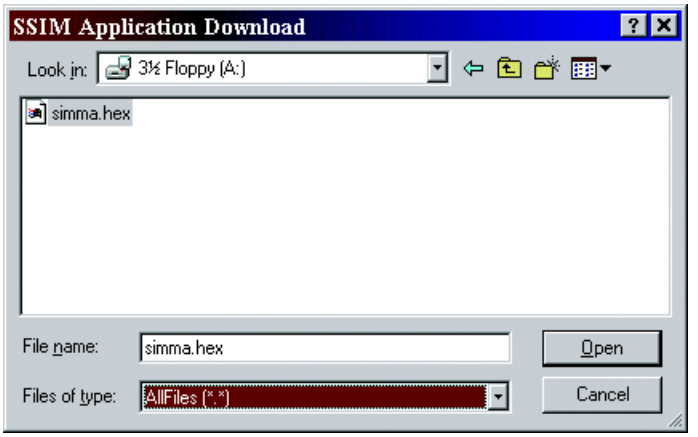


4. The following screen should appear. Click on the large Download Application button on the screen.



SmartSensor Interface Module Software Update

5. When the Download Application button is clicked, a standard Windows Open dialog box will appear. Use this box to specify the location of the ssim.hex file. The example shown below would correspond to a floppy disk update.



6. When the Open button is clicked, the file will be loaded in the SmartSensor Interface Module. This process will take approximately 30 seconds for the update to complete.

NOTE: Do not turn off power to the SmartSensor Interface Module during the software update process.

Start Up

NOTE: To ensure optimum performance of the LaserPAD software, check the list of programs currently running and verify that LaserPAD is the ONLY program that is currently running. Many Pocket PC programs consume the memory necessary to operate the LaserPAD software at optimum levels.

***CAUTION:** You should exit the LaserPAD software when it is not in use. The LaserPAD software utilizes the serial communication port to obtain data from the SmartSensor Interface Module. If you attempt to synchronize your Pocket PC with a host computer and the LaserPAD software running, you will experience a conflict between the LaserPAD software and the synchronization software on the host PC. Check the current list of running programs and verify that the LaserPAD software is NOT running. If the LaserPAD software is not running the Pocket PC should now synchronize with a host computer.*

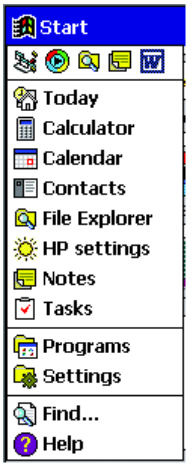
***CAUTION:** Many Pocket PC programs consume memory through normal use. This situation can occur by starting and exiting programs. If the performance of the LaserPAD software does not appear to update at optimum rates, press the mechanical system reset button on the Pocket PC. This button is normally located on the back or bottom edge of the Pocket PC. This reset button does not effect installed programs or data, it will clear memory and allow software to run at optimum levels.*

Start Up Procedure

1. Connect the 5 volt power to the SmartSensor Interface Module. If the SmartSensor Interface Module battery is in a charged condition, it is not necessary to connect the 5 volt supply.
2. Connect the desired Coherent SmartSensor Head to the SmartSensor Interface Module.
3. Connect the RS-232 cable between the SmartSensor Interface Module and the Pocket PC.
4. Move the SmartSensor Interface Power Switch to the ON position.
5. Power up the Pocket PC.

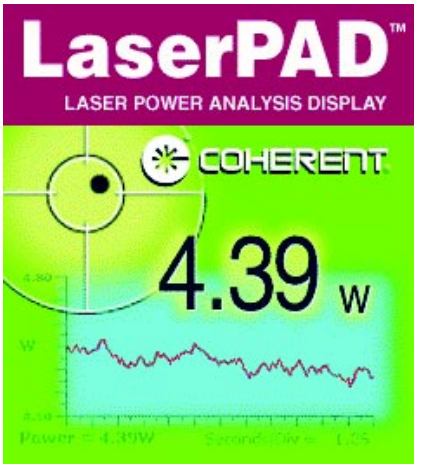
Start Up

6. Select Programs from the Pocket PC Main Menu.



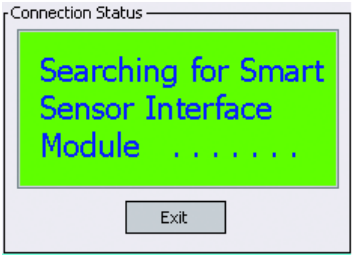
7. Tap on the LaserPAD Icon in the program list.

8. The LaserPAD splash screen should now appear.



Start Up

9. A connection status box will appear on the screen. The LaserPAD software will first connect with the SmartSensor Interface Module. When the module is found, the SmartSensor parameters will be loaded, followed by all of the user settings.



10. When the status box has cleared from the screen, you are ready to begin using the Laser Power Analysis Display and SSIM.

CAUTION: *Insure that the detector head is rated for the power density of the laser. Power density greater than the rating of the sensor will damage the detector head.*

Screens

Operation and use of the LaserPAD is through the various display and analysis screens and the ability they provide to setup and control the system. There are four primary screens. The Setup screen provides basic, system wide control functions.

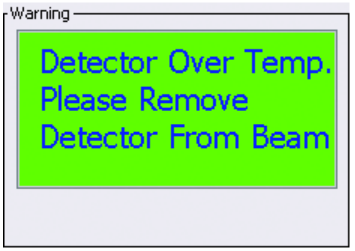
The information displayed on the Home screen is detector head dependent. The other two analysis screens – Tune and Trend - provide controls that are consistent with all detector heads.

NOTE: Please review the table of contents for information appropriate to the detector utilized. Separate sections will be provided for Thermal Quadrant Detectors and Semiconductor Sensors.

Thermal Quadrant Sensor Operation

Coherent Thermal Quadrant SmartSensors measure the flow of energy through an array of thermoelectric cells. These detectors are utilized for measuring medium to high power CW lasers. These sensors have an intrinsically flat spectral absorption from the UV to the far IR. The small variations in absorption over this wavelength range are calibrated into the SmartSensor EEPROM. The patented Coherent thermal quadrant detectors provide the capability to measure position and power simultaneously. Please review the list of supported detectors in Appendix A.

Thermal Quadrant Over Temperature - If the temperature of a thermal sensor exceeds the maximum operating temperature at any time, the screen will go blank and then the **OVER TEMPERATURE** message will appear in the middle of the screen. When the temperature is within limits, normal operation resumes.

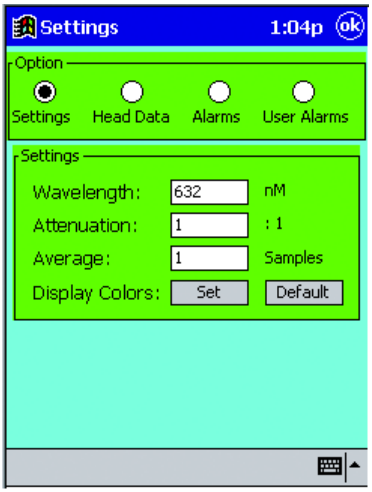


Thermal Quadrant Sensor: **Settings Screen**

The Settings Screen provides access to Global Controls and Settings. The four Radio Buttons at the top of the Setting Screen provide access to groups of similar controls and settings. The Settings Screen can be accessed with the Home Screen Options Menu. The Options Menu will only appear when the Home Screen is active. When the Setting Screen is active click the OK button in the top right hand corner to return to the Home Screen.

NOTE: You can also access the Settings Screen by tapping the current Wavelength value on the Home Screen.

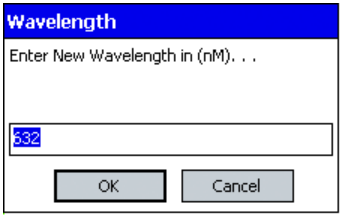
The Settings Radio Button will be active when you enter the Settings Screen. This screen contains global controls that are commonly used.



Thermal Quadrant Sensor: Settings Screen

Wavelength - The wavelength setting is essential to ensure the accuracy provided by Coherent Smart Head Technology. The Thermal Detector Heads contain information to correct for variations in absorber response associated with wavelength. Tapping on the current Wavelength value displayed on the Settings Screen will allow you enter a new value. Each time the LaserPAD software is started, the previous wavelength is restored.

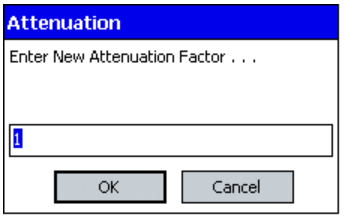
Thermal
Quadrant Sensor:
Settings Screen



Attenuation – Enter the amount of optical attenuation due to beam splitters, attenuators, or other optical elements. All displayed data is automatically multiplied by the current attenuation value.

NOTE: All Trend and Tune data is multiplied by the current attenuation value.

Tap the current attenuation value to enter a new attenuation value. You can enter any value between 0.01 and 9999.99.

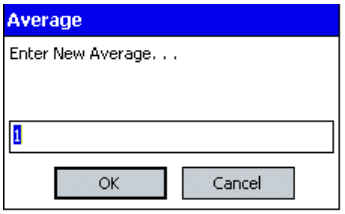


Average – Enter the number of readings to be averaged for the displayed power value. Valid entries range from 1 to 200. Measurements are calculated at 10 Hz (i.e., 10 per second). The display is updated at 3 Hz with the value of the most recent average. The Display Average is the number of 10 Hz measurements to be used in the average using the running average method. The display itself is still updated at 3 Hz.

Thermal Quadrant Sensor: **Settings Screen**

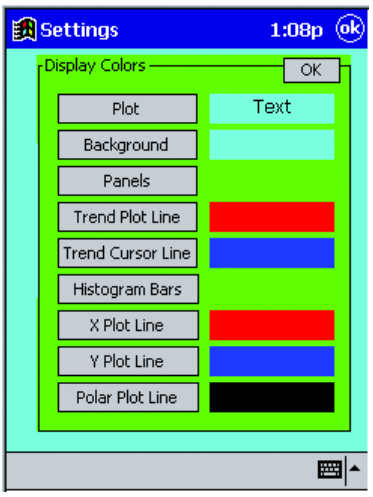
NOTE: Display averaging affects the Trend and Tune functions.

The current display average is restored each time the software is started.



Display Colors – The LaserPAD software provides the capability to change the colors on data displays, panels, background, plot lines, cursors and histogram bars. The display color changes are made to accommodate user preferences or allow data to be viewed with laser safety eyewear. To change a color, tap on the parameter to be changed and select a color from the pallet that appears. The current color settings are restored each time the LaserPAD software starts. The default button on the Settings Screen allows you to restore all of the colors to the standard factory settings.

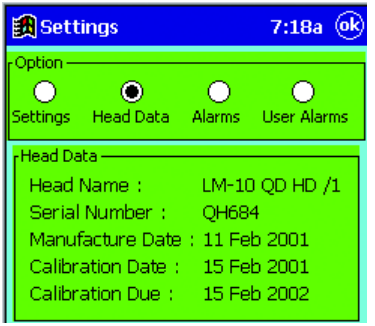
WARNING: *Do not match data colors with background colors. If data appears to be missing from the display, tap the default button on the settings screen.*



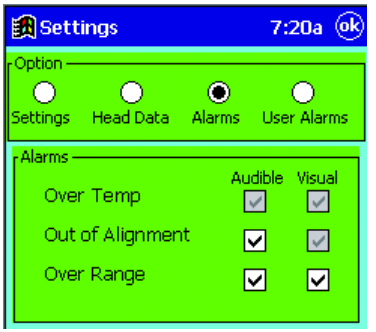
Thermal Quadrant Sensor: **Settings Screen**

Head Data – When the Head Data radio button is selected, the following data associated with the current SmartSensor will be displayed: Head Name, Serial Number, Manufacture Date, Calibration Date and Calibration Due Date.

NOTE: Please note the Calibration Due Date to ensure the continued accuracy of your Coherent SmartSensor.



Alarms – Coherent SmartSensor Technology maintains accuracy within a specified range of temperature, alignment and input power. This range is stored in each detector and monitored by the LaserPAD software. The alarm screen will allow you to activate and deactivate additional prompts when the factory specified ranges have been exceeded. The visual alignment/over range and audible/visual temperature alarms are set to an on condition by the software. Audible Alignment and Over Range settings are accessible to the user. Tap the desired box to set the on or off condition. Each time the software is started, the previous settings are restored.

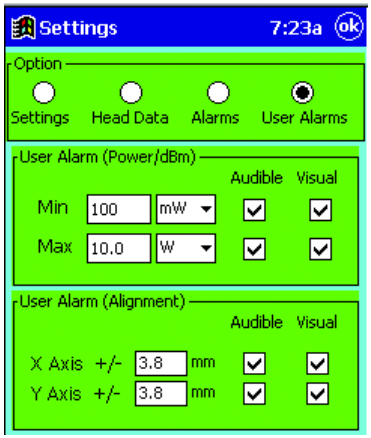


NOTE: Tap the Rng label in the Home Screen Settings Panel for quick access to the Alarm Settings.

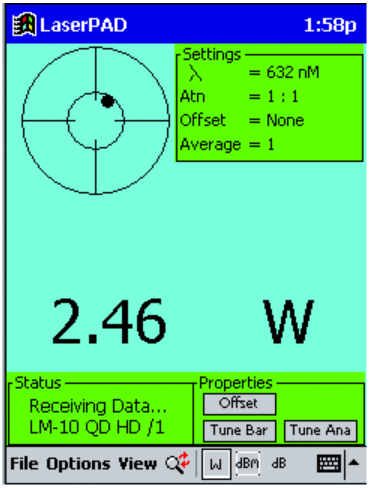
Thermal Quadrant Sensor: **Settings Screen**

User Alarms – The user alarms are custom alarms associated with Power and Alignment. To activate a custom user specified alarm, tap on the audible or visual check box associated with the desired parameter. When a check box is active you can specify the value of the parameter to trigger the user specified alarm. Tap on the current value to enter a new value. The range of values is dependent on the current SmartSensor connected. Each time the software is started, the previous settings are restored.

NOTE: Be sure to specify the proper units for the Power Alarm Settings.



Thermal
Quadrant Sensor:
Home Screen



Thermal Quadrant Sensor: Home Screen

The Home Screen associated with a Quadrant CW SmartSensor Head is different than the Home Screen associated with a Semiconductor SmartSensor. The Settings Panel displays either the default parameters or the current operating parameters for: Display Average, Wavelength, Attenuation and Offset.

NOTE: Tap the current Wavelength Value for quick access the settings screen.

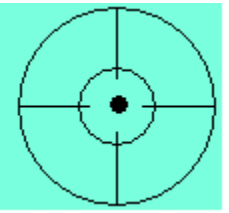
The Home Screen displays current Power and Alignment at a rate of 3 Hz. The Trend, Alignment and Position Stability screens collect and analyze data at a rate of 10 Hz.

NOTE: Check current Wavelength and Attenuation values to ensure valid results. Review the Settings Screen section for further information.

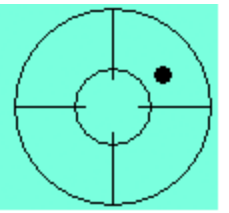
Target – showing the location of the beam on the detector is on the left side of the display. For maximum accuracy, align the detector so that the beam location indicator is within the small inner circle on the target. When the beam location indicator appears outside of the inner circle, an Out of Alignment message will appear. The message will disappear when the proper alignment condition is restored.

Thermal
Quadrant Sensor:
Home Screen

Proper Alignment



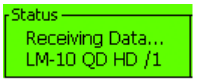
Out of Alignment



NOTE: Tap the target to jump to the Alignment Screen.

Settings Panel – The Settings Panel will display the values selected from the Settings Screen. Active alarm labels will display below the Settings Panel. Alarm labels will appear below the Settings Panel. These labels will appear green when current values are within the specified limits and red when the specified limits have been exceeded.

Status Panel – The Status Panel is located in the lower left corner of the Home Screen. This panel displays the current Coherent SmartSensor connected to the SmartSensor Interface Module. The Status Panel also confirms communication between the Pocket PC and the SmartSensor Interface Module.



Properties Panel

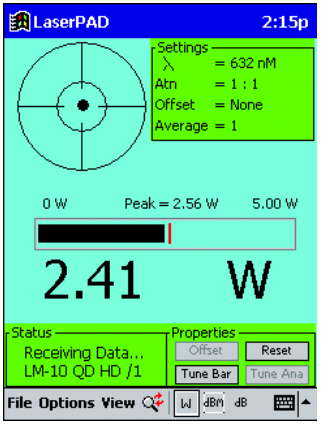
Offset – Tap the OFFSET button to use the current power reading as an offset value (zero reference) to eliminate a constant background reading. When the offset box is first tapped, the screen displays zero and the offset value is shown in the Settings Panel. The second time the box is tapped, the offset is deactivated and the offset value is returned to zero regardless of the power input at the time the box is tapped. The screen reflects a 0 offset (offset = none).

Thermal Quadrant Sensor: **Home Screen**

Tune Bar – Tap on the Tune Bar button to display a digital tune bar on the Home Screen. When the tune bar is active a Reset button will also appear in the Properties Panel. The Tune bar will display current relative scale indicators at each end. When the Tune Bar is active, each new maximum value is displayed as the Peak value above the Tune Bar. A vertical indicator remains at the current peak location on the Tune Bar. The Reset button will reset the Peak value and the corresponding Peak indicator bar. Each new peak value collected will generate an audio beep, move the indicator bar and display a new peak value.

NOTE: To remove the Tune Bar from the Home Screen, tap the Tune Bar button a second time.

NOTE: The Tune Ana button is not active when the Tune Bar button is activated.



File Menu – The File Menu provides the capability to Exit the LaserPAD software and view the current software version. To exit the LaserPAD software, tap the File Menu on the Home Screen. When the menu appears, tap Exit. You can also exit the LaserPAD software by switching the SmartSensor Interface Module to the off position. The connection dialog will appear. Tap the Exit button in the connection dialog to exit the LaserPAD software. The about item in the File Menu will display the current LaserPAD software and firmware version. To display the current version,

Thermal
Quadrant Sensor:
Home Screen

tap file on the LaserPAD Home Screen and then tap About. The current LaserPAD software and firmware version will display on the screen. Tap OK in the About dialog and return to the Home Screen.

Options Menu – The Options menu will provide navigation to the other (Settings, Trend, Alignment, Position Stability) screens in the LaserPAD software. Please review the detail associated with each screen for further information.

View Menu – The View Menu will provide access to the Tune Bar, Tune Needle and Large Display. Review the detail associated with each item listed in this menu.

Large Display – The LaserPAD software will allow you to display the Home Screen Power in a Large Font. Toggle between Normal Power Font and Large Power Font by tapping the Magnifying Glass Icon on the Pocket PC Command Bar.

NOTE: Tap the Current Power value to toggle between large font and normal font.

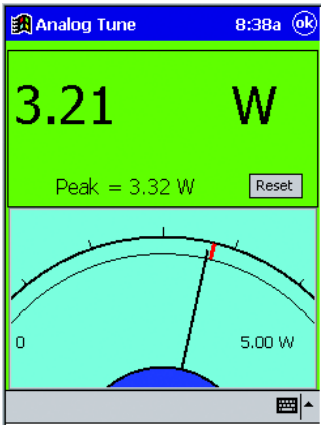
Display Units – The LaserPAD Software provides the ability to display in units of Watts, dBm and dB. To select the desired display type, tap on the appropriate units shown on the Pocket PC Command Bar at the bottom of the screen. The Watts will display from mW to W to KW as necessary. The dBm value is calculated utilizing the following formula: ***dBm = 10 log [current reading (mW)]***. When dB is selected, the current reading will be established as a reference value. All subsequent readings will be measured and displayed relative to the reference value established. To establish a new reference for dB, tap the dB REF button in the

Thermal
Quadrant Sensor:
Home Screen

Properties Panel. The dB display utilizes the following calculation: ***dB = 10 log (current power reading/reference power reading)***.

NOTE: Tap the current display units to cycle through the three display units available (W, dBm, dB).

Thermal
Quadrant Sensor:
Tune Screen

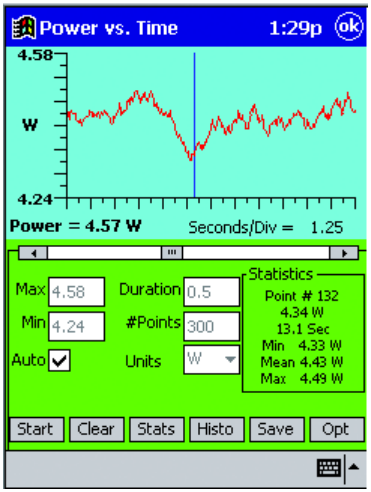


Tune Screen

Tune Needle – The Tune Ana button will display a separate tune screen with the appearance of an Analog Needle. This screen operates in the same manner as the Tune Bar. The current value is displayed in large font at the top of the screen. The Peak value is displayed in a smaller font below the current value. The current scale values are located at each end of the scale radius. A maximum indicator bar remains on the scale at the location indicated by the Peak Value. The reset button will reset the Peak value and the corresponding indicator bar. Each new peak value collected will generate an audio beep, move the indicator bar and display a new peak value. Tap the OK button in the top right hand corner of the screen and return to the Home Screen.

Thermal Quadrant Sensor: **Trend Screen**

NOTE: The trend data is collected by the SmartSensor Interface Module at a maximum rate of 10 Hz. The LaserPAD software may not plot the data at the 10 Hz rate. The plotted data represents the 10 Hz collection rate.



Trend Screen

Trend Screen – The Trend Plot is a display of Power vs Time. The displayed data is a result of the selected vertical scale, number of points and duration of the plot. The duration and the number of points are set before trend data is collected. When a trend run is started, the Stop button will replace the Start button. If a trend run is stopped before the duration is complete, data analysis will be available. When the trend run is stopped or completed, a measurement cursor will appear and provide the capability to analyze individual points. When a trend run is stopped or completed, the data analysis buttons will come into focus. These buttons include Statistics, Histogram and data saving capability. The Trend Plot will also display the Live Power and the data collection interval based on the current trend duration.

NOTE: The trend data will utilize current Offset, Attenuation and Average settings.

NOTE: Tap the current Average Value to enter a new average value.

Thermal Quadrant Sensor:

Trend Screen

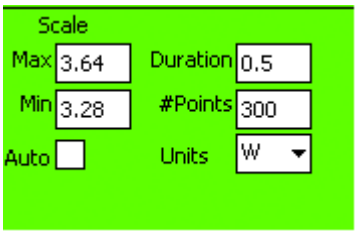
Scale – The vertical scale can be set before and after a trend run. The manual scale can be set to any value desired. If data is collected beyond the range of the manual scale settings, those points will be plotted along the top or bottom of the scale appropriately. When the vertical scale is changed after a trend run, the OK button in the value change dialog will plot the data with the new scale value. See Trend Options for additional Range features.

Auto Scale - If the Auto Scale box is checked, the LaserPAD software will manage the vertical scale appropriate to the range of data collected. The Auto Scale can be removed after data collection for a desired manually scaled display. When the display is toggled between Auto Scale and Manual Scale, any available data will be plotted appropriate to the new setting.

Duration – The Duration box will allow you to set the duration of the trend run before collecting data. A trend run can range in duration from 0.5 minutes to 99 hours (5490 Minutes). The duration is entered in minutes. Entered values will be rounded to the nearest 0.5 minutes.

Number of Points – The number of points selected determines the interval between each point collected. The trend data is collected at a rate of 10 Hz. This data collection rate determines the maximum number of points available for a given duration. For example you can select a maximum of 300 points for a 30 second trend run. The LaserPAD software will also limit the maximum number of points collected to 2000.

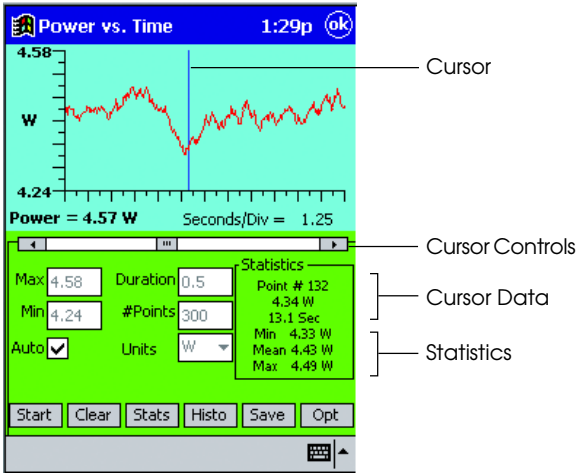
Units – The vertical scale units can be selected appropriate to the data collected. When utilizing manual scale verify the appropriate units are selected. Trend data can be plotted as dBm. If dBm is selected from the Home Screen, the Trend Screen will default to dBm.



Thermal Quadrant Sensor: **Trend Screen**

Statistics Panel/Measurement Cursor – The Statistics Panel contains current statistical trend information. The measurement cursor information is also displayed in this panel. The vertical bar displayed in the trend plot corresponds to the current measurement cursor data. The measurement cursor is active when static results are displayed. When a trend run is in progress, the measurement cursor is not available. When the trend duration is complete or the Stop button is tapped, the measurement cursor can be utilized on the displayed data. A scroll bar will appear below the trend plot when the measurement cursor is active. The measurement cursor results will appear in the Statistics Panel. The measurement cursor is controlled by dragging the center section of the scroll bar or by tapping the arrows at either end of the scroll bar. The cursor results appear as the top three values displayed in the Statistics Panel. The top value in the Statistics Panel corresponds to the current cursor location, relative to the number of points collected. The second value displayed corresponds to the Power value associated with the current cursor location. The third value in the Statistics Panel corresponds time associated with the displayed cursor power value. The remaining three values (Min, Mean and Max) correspond to statistics generated by the current trend points collected.

Thermal
Quadrant Sensor:
Trend Screen



Trend Control Buttons

Start - The Start Button will clear current data and begin a new trend run utilizing the current setup parameters. When the trend run begins, the Start button will change to a Stop button. The Stop button will stop the trend run and generate statistics based on the data currently collected. All functions associated with a complete trend run will be available if the run is stopped before completion.

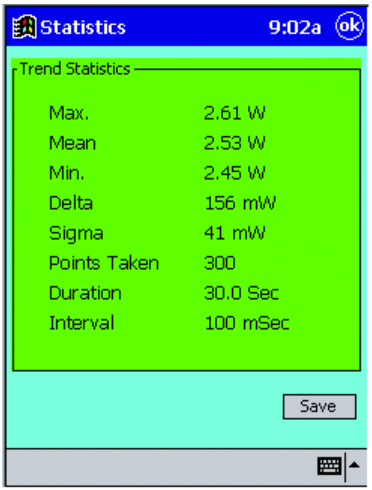
Clear – The Clear button will clear all data, statistics and histograms associated with data that is currently available. The Clear button will clear data only and does not effect the current settings.

Statistics – Tap the Stats Button to bring up a separate screen displaying all statistics associated with the current data. The Stats button is not available when a trend run is in progress or current data has been cleared. The statistics will display the minimum and maximum point collected and the mean average of all points collected. The delta value is the difference between the minimum and maximum point and can be displayed with higher precision than the minimum and maximum points. The Sigma value is the standard deviation of all points collected. The standard deviation is calculated in the following manner, where X is the array of points and N is the number of points.

$$\sqrt{\frac{\left[\sum X^2 - \left(\sum X\right)^2\right]}{N-1}}$$

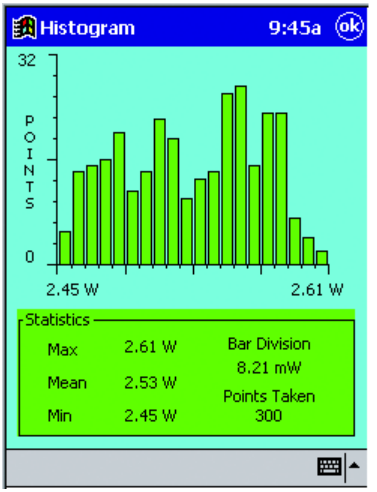
Thermal Quadrant Sensor: **Trend Screen**

The Points Taken, Duration and Interval shown on the Statistics screen are a result of the setup parameters established before the data was collected. The Save button will operate in the same fashion as the Save button on the Trend Screen. Review the section on saving data for further detail. The OK button on the Statistics Screen will return to the Trend Screen.



Histogram – Tap the Histo Button on the Trend Screen to display a separate screen containing a Power Trend Histogram and the associated data. The Power Trend Histogram is constructed by dividing the trend delta value by 20. This result will determine the bar division on the histogram. The vertical scale is constructed by taking the bar with the maximum number of points and adding 5 to set the vertical scale. The Maximum, Minimum, Mean, Calculated Bar Division and the Number of Points collected will also be displayed on the Histogram Screen. The OK button will return the display to the Trend Screen.

Thermal
Quadrant Sensor:
Trend Screen



Save Trend Data – Tap the Save button on the Trend Screen to save the current data. The Save button will generate a comma delimited text file. This format will allow you to view the trend data with Windows Notepad or analyze the data with Microsoft Excel. The Pocket PC will display the data with Pocket Word. To view the data with Pocket Excel, the Trend Text File will have to be exported to a host computer. Open the file with Microsoft Excel and save the data as an Excel Workbook. Export the data in workbook form to the Pocket PC. The data will now be available for analysis utilizing Pocket Excel. Each Trend Data File contains the appropriate setup information, statistics and a complete array containing each data point collected.

Thermal
Quadrant Sensor:
Trend Screen

Example Trend Data File

Trend Information
7/23/2001 9:55

Test 1

10600 nM

Average	1
Attenuation	1
Max	4.20 mW
Mean	389 mW
Min	3.42 mW
Delta	mW
Sigma	mW
Points	103
Duration	0 mSec
Interval	200 mSec

Points Displayed in Watts

Point	Data	Time
1	0.392	100 mSec
2	0.398	301 mSec
3	0.402	503 mSec
4	0.405	704 mSec
5	0.403	905 mSec
6	0.401	1.1 Sec
7	0.4	1.3 Sec
8	0.398	1.5 Sec
9	0.396	1.7 Sec
10	0.393	1.9 Sec
11	0.395	2.1 Sec
12	0.398	2.3 Sec
13	0.399	2.5 Sec
14	0.4	2.7 Sec

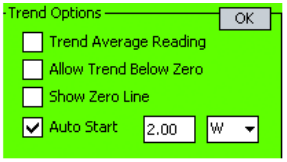
NOTE: To display data properly with Microsoft® Excel™, select tab, space and comma deliminated on the second page of the Excel Import Wizard.

Thermal Quadrant Sensor:

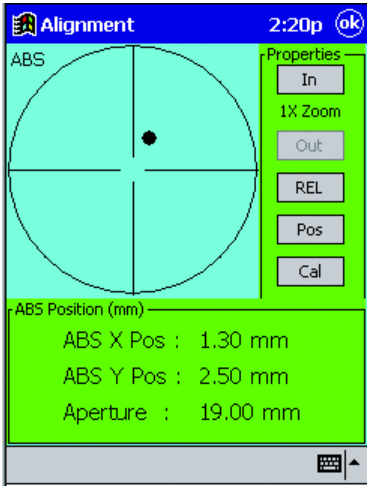
Trend Screen

Trend Options Button – Tap the Opt button on the Trend Screen to access a variety of Trend Options.

Trend Options – The Trend Average Reading function will utilize the Display Average Process to collect the trend data. When the Trend Average box is checked the data collection will utilize the current average value set. Activating this box will provide the opportunity to change the current Average value. The Trend Below Zero function will collect data with a negative value. The Auto Start function will allow the user to specify a threshold power to start a trend run. When this function is active you can specify the threshold power. When the threshold power or greater is collected, the trend run would begin. The data collection will not stop if the power falls below the specified threshold.



Thermal
Quadrant Sensor:
Alignment Screen



Alignment Screen

Alignment Screen – The Align screen displays the position of the beam on the detector and allows use of quadrant thermal detector heads for optical system alignment. The displayed target at 1X resolution represents the clear aperture of the detector with aperture size shown in mm just below the target. Tap the Pos button to bring up the Position Stability Screen. Tap the OK button in the upper right corner of the Alignment Screen to return to the Home Screen.

Zoom – Tap the IN or OUT Zoom Button to increment the resolution on the display target. The OUT button reduces the current target resolution by a factor of two with each button tap. The IN button increases the current target resolution by a factor of two with each button tap. The current resolution will change the size of the displayed target aperture. The current size of the display aperture is shown along with the current X and Y position values in the lower data panel.

Absolute and Relative Modes - Tap the REL / ABS button to toggle the representation between Absolute and Relative modes. The condition of the button will display the mode that is ***NOT*** currently active. When the Alignment Screen is operating in Absolute mode, the display will reflect the actual position of the beam on the detector. When the Alignment Screen is operating in Relative mode, the display will reflect the position of the beam relative to the position stored when the REL button is tapped. When the REL button is tapped the target will display as centered and the

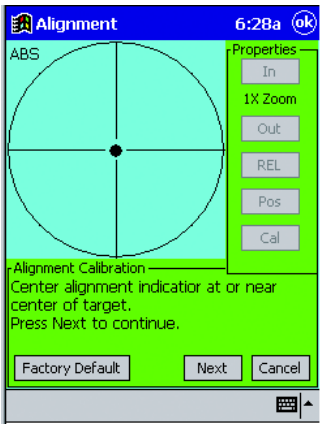
Thermal Quadrant Sensor: **Alignment Screen**

displacement values will indicate zero. The subsequent changes in beam position will be displayed as a displacement relative to the target center instead of the actual position on the detector sensor. The current mode, Rel or Abs, appears on the border of the data panel and adjacent to the target. The default mode is Absolute.

Alignment Calibration – The LaserPAD software contains a routine to increase the Alignment Screen accuracy. The factory settings reflect default levels of accuracy. The Alignment Screen accuracy can be improved with the use of a micrometer translation stage. Begin the calibration process by mounting the Coherent SmartSensor on a micrometer translation stage. Center the beam on the sensor by utilizing the 4x resolution on the Alignment Screen.

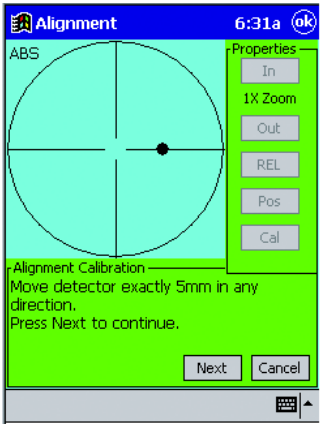
1. Tap the Cal button on the Alignment Screen.

2. Verify that the beam is centered on the SmartSensor.

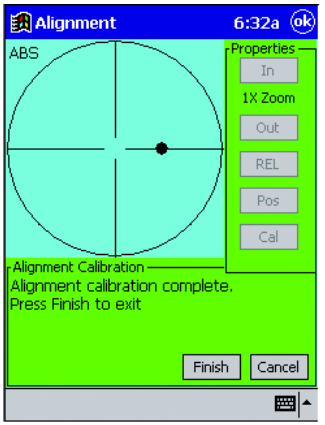


Thermal Quadrant Sensor: **Alignment Screen**

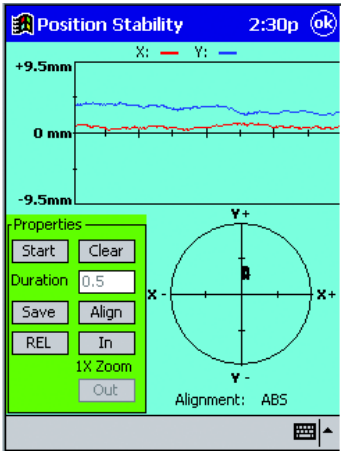
3. Translate the SmartSensor exactly 5.00 mm by using the translation stage. Tap the next button.



4. Tap the Finish button to store the new alignment calibration values. The values on the Alignment and Position Stability screen will now be displayed relative to the 5.00 mm displacement calibration. These values will be updated each time the calibration routine is executed.



Thermal
Quadrant Sensor:
Position Stability Screen

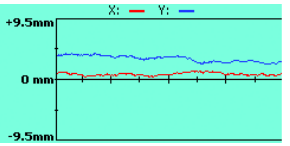


Thermal Quadrant Sensor: Position Stability Screen

Position Stability Screen – The Position Stability Screen will plot position data as a function of time. The upper portion of the screen will display the data in strip chart form. A polar representation of the position stability data will be displayed below the strip chart. The Position Stability Screen also contains various controls to collect and display data.

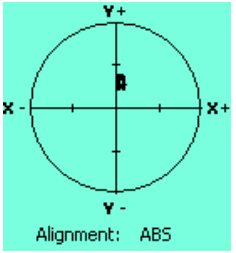
NOTE: The Alignment Screen Mode (Absolute or Relative) controls the operation of the Position Stability Screen.

Strip Chart Display – The top of the Position Stability Screen will display the collected data in strip chart form. The X and Y data will be displayed on the same Strip Chart. The color of the X and Y plot can be selected utilizing the Settings Screen. To change the X and Y color, tap the OK button and return to the Home Screen. Tap the Options Menu and then tap settings. Tap the Set display colors button to enter the color settings screen. The X and Y plot colors can be changed in this screen. The Strip chart scale is set with the zoom buttons on the Position Stability Screen. Tap the In button to increase the resolution on the strip chart. Tap the Out button to decrease the resolution on the strip chart. If data is plotted as a straight line at the top or bottom of the strip chart, tap the Out button to decrease the screen resolution.



Thermal Quadrant Sensor: Position Stability Screen

Polar Plot – The Polar Plot will display the position stability data in polar form. Before the Position Stability Run begins, the Polar Plot will display in the same form as the Alignment Screen. The dot will indicate the beam position and the current polar plot resolution will display on the strip chart. When the Position Stability Run begins, the Polar Plot will display the displacement variation accumulated as the run progresses. Each point on the Polar Plot will display as a position. Multiple X and Y location points of equal value, will display as a single point. When the Position Stability Run is complete, the Polar Plot will display the complete range of displacement over the run duration.



Properties Panel

Start - The Start button will start a Position Stability run and clear the data currently displayed. When the Start button is tapped, the Position Stability Run will begin and the button will now read Stop.

Clear - The Clear button will clear the data currently displayed without starting the Position Stability Run. The Clear button can be utilized to clear the data and display the Alignment Dot on the Polar

Thermal Quadrant Sensor: **Position Stability Screen**

Plot. This condition will allow you to adjust the detector position before starting another Position Stability Run.

Duration – The duration setting will dictate the length of time for the Position Stability Run. The duration can be set in .5 minute increments between 0.5 minutes and 99 Hours (5940 Minutes). The Position Stability Run will collect points at 10 Hz to a maximum of 2000 points. When a duration is set to be greater than 200 minutes the interval will be adjusted to maintain the 2000 point maximum.

Save – The Save button will allow you to save the points collected in the Position Stability Run. When the Save button is tapped, you will be prompted to save a single line of header information if desired. The header information will be attached to the top of the file. The data file contains the interval and duration information and each pair of X and Y data points collected. The file will be in delimited text format for spreadsheet analysis.

Example Position Stability Run Data File

Position Data Points
7/19/01 6:42
Test 1

Points Taken: 300
Duration: 1.0 Min
Interval: 200 ms
Points displayed in mm

X	Y
5.68	2.27
5.68	2.27
5.87	2.46
6.06	2.65
5.87	2.46
5.87	2.27
6.06	2.27
6.06	2.46
5.87	2.46
5.87	2.65
6.06	2.65
6.06	2.84
5.87	3.03
5.68	3.03
5.49	3.22
5.68	3.03
5.68	3.03
5.87	3.03
5.87	3.22

Thermal Quadrant Sensor: **Position Stability Screen**

NOTE: To display data properly with Microsoft® Excel™, select tab, space and comma deliminated on the second page of the Excel Import Wizard.

Align - The Align button can be utilized to jump to the Alignment Screen. The Alignment Screen contains a Trend button for return to the Position Stability Screen.

Zoom In and Zoom Out - The Zoom In and Zoom Out buttons are utilized to set the display scale. When the zoom buttons are utilized before a Position Stability Run, the Alignment Dot can be utilized to adjust the detector position. When a run has been stopped or completed, the Zoom buttons can be utilized to adjust the display of current data. When the current zoom level is changed, a Replot button will appear. The Replot button will allow you to set the desired zoom level without waiting for the data to Replot each time the zoom level is changed.

Semiconductor Sensor Operation

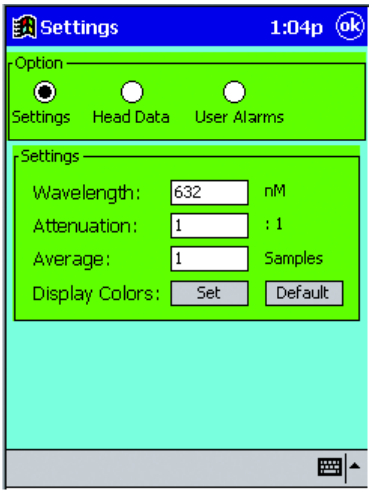
Coherent Semiconductor sensors are highly sensitive detectors for the spectral regions from 250 nm to 1065 nm (Silicon) and 800 nm to 1800 nm (Germanium). The response of a Semiconductor Sensor will vary greatly with wavelength and a precise knowledge of the laser source wavelength is critical for accurate measurements. The semiconductor material can saturate with small input beam diameters above 10 mW. Please review Appendix A and B to confirm the safe operating region. Semiconductor Sensors can also utilize a calibrated attenuator. Please call Coherent for additional attenuation information. Coherent Semiconductor Sensors do not provide position sensing information. The appearance of the Home Screen and Options Menu will be different than the Quadrant Thermal Sensors.

Semiconductor Sensor: Settings Screen

The Settings Screen provides access to Global Controls and Settings. The three Radio Buttons at the top of the Setting Screen provide access to groups of similar controls and settings. The Settings Screen can be accessed with the Home Screen Options Menu. The Options Menu will only appear when the Home Screen is active. When the Setting Screen is active click the OK button in the top right hand corner to return to the Home Screen.

NOTE: You can also access the Settings Screen by tapping the current Wavelength value on the Home Screen.

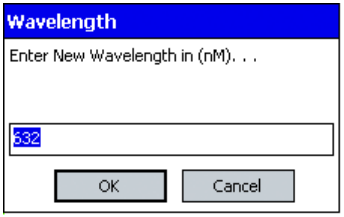
The Settings Radio Button will be active when you enter the Settings Screen. This screen contains global controls that are commonly used.



Semiconductor Sensor: Settings Screen

Wavelength – The wavelength setting is essential to ensure the accuracy provided by Coherent SmartSensor Technology. The output of a semiconductor sensor is highly sensitive to variations in wavelength. It is critical to set the exact wavelength when utilizing a Semiconductor SmartSensor. Tapping on the current Wavelength value displayed on the Settings Screen will allow you enter a new value. Each time the LaserPAD software is started, the previous wavelength is restored.

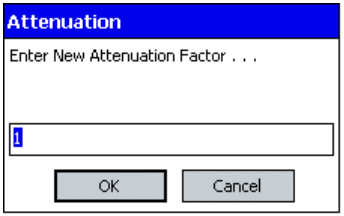
Semiconductor
Sensor:
Settings Screen



Attenuation - Enter the amount of optical attenuation due to beam splitters, attenuators, or other optical elements. All displayed data is automatically multiplied by the current attenuation value.

NOTE: All Trend and Tune data is multiplied by the current attenuation value.

Tap the current attenuation value to enter a new attenuation value. You can enter any value between 0.01 and 9999.99.

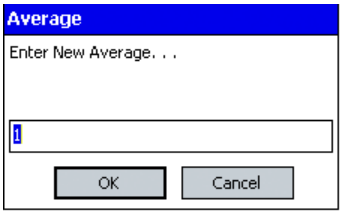


Average - Enter the number of readings to be averaged for the displayed power value. Valid entries range from 1 to 200. Measurements are calculated at 10 Hz (i.e., 10 per second). The display is updated at 3 Hz with the value of the most recent average. The Display Average is the number of 10 Hz measurements to be used in the average using the running average method. The display itself is still updated at 3 Hz.

NOTE: Display averaging affects the Trend and Tune functions.

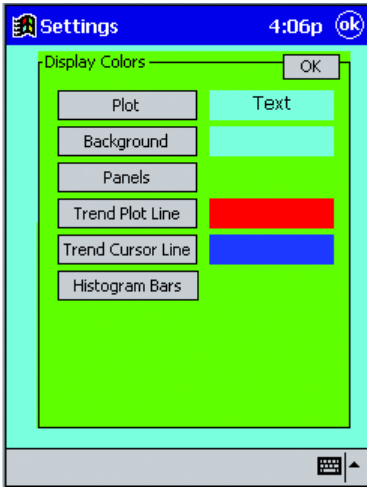
The current display average is restored each time the software is started.

Semiconductor
Sensor:
Settings Screen



Display Colors – The LaserPAD software provides the capability to change the colors on data displays, panels, background, plot lines, cursors and histogram bars. The display color changes are made to accommodate user preferences or allow data to be viewed with laser safety eyewear. To change a color, tap on the parameter to be changed and select a color from the pallet that appears. The current color settings are restored each time the LaserPAD software starts. The default button on the Settings Screen allows you to restore all of the colors to the standard factory settings.

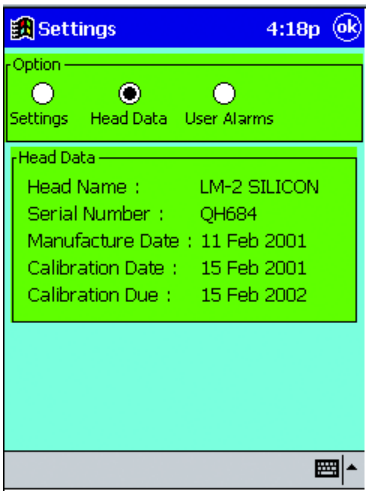
WARNING: *Do not match data colors with background colors. If data appears to be missing from the display, tap the default button on the settings screen.*



Semiconductor Sensor: Settings Screen

Head Data - When the Head Data radio button is selected, the following data associated with the current SmartSensor will be displayed: Head Name, Serial Number, Manufacture Date, Calibration Date and Calibration Due Date.

NOTE: Please note the Calibration Due Date to ensure the continued accuracy of your Coherent SmartSensor.

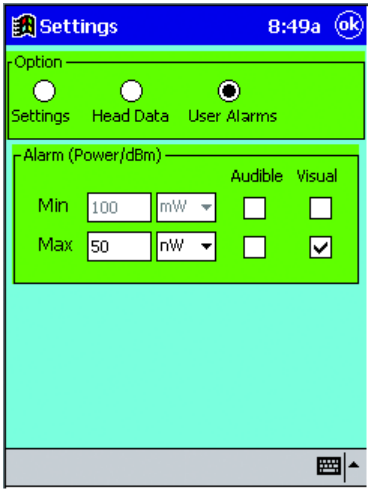


Alarms – Coherent Semiconductor Sensors maintain accuracy within a specified range of input power. This range is stored in each detector and monitored by the LaserPAD software. The alarm screen will allow you to activate and deactivate additional prompts when the factory specified ranges have been exceeded. The visual over range is set to an on condition by the software. Audible Over Range settings are accessible to the user. Tap the desired box to set the desired on or off condition. The user alarms are custom alarms associated with Power. To activate a custom user specified alarm, tap on the audible or visual check box associated with the desired parameter. When a check box is active you can specify the value of the parameter to trigger the user specified alarm. Tap on the current value to enter a new value. The range of values is dependent on the current Smart-Sensor connected. Each time the LaserPAD software is started, the previous settings are restored.

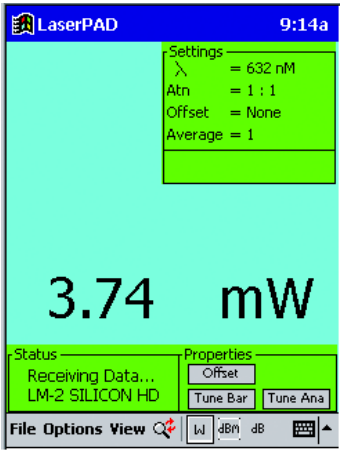
Semiconductor Sensor:

Settings Screen

NOTE: Be sure to specify the proper units for the Power Alarm Settings.



Semiconductor
Sensor:
Home Screen



Semiconductor Sensor: Home Screen

The Home Screen associated with a Semiconductor SmartSensor Head is different than the Home Screen associated with a Quadrant CW SmartSensor. The Settings Panel displays either the default parameters or the current operating parameters for: Display Average, Wavelength, Attenuation and Offset.

NOTE: Tap the current Wavelength Value for quick access the settings screen.

The Home Screen displays current Power at a rate of 3 Hz. The Trend screen collects and analyzes data at a rate of 10 Hz.

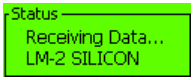
NOTE: Check current Wavelength and Attenuation values to ensure valid results. Review Settings Screen section for further information.

Settings Panel – The Settings Panel will display the values selected from the Settings Screen. Active alarm labels will display below the Settings Panel. Alarm labels will appear below the Settings Panel. These labels will appear green when current values are within the specified limits and red when the specified limits have been exceeded.

Semiconductor Sensor:

Home Screen

Status Panel – The Status Panel is located in the lower left corner of the Home Screen. This panel displays the current Coherent SmartSensor connected to the SmartSensor Interface Module. The Status Panel also confirms communication between the Pocket PC and the SmartSensor Interface Module.



Properties Panel

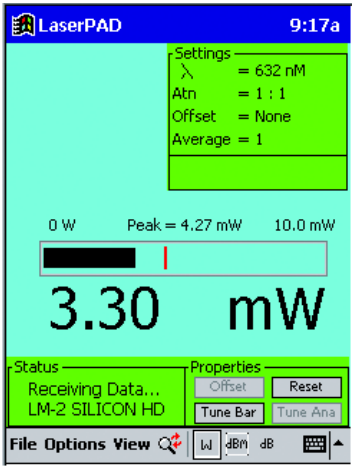
Offset – Tap the OFFSET button to use the current power reading as an offset value (zero reference) to eliminate a constant background reading. Utilize the light shield provided with the Semiconductor Sensor to reduce background light for low power readings. When the offset box is first tapped, the screen displays zero and the offset value is shown in the Settings Panel. The second time the box is tapped, the offset value is returned to zero regardless of the power input at the time the box is tapped and the screen reflects a 0 offset.

Tune Bar – Tap on the Tune Bar button to display a digital tune bar on the Home Screen. When the tune bar is active a Reset button will also appear in the Properties Panel. The Tune bar will display current relative scale indicators at each end. When the Tune Bar is active, each new maximum value is displayed as the Peak value above the Tune Bar. A vertical indicator remains at the current peak location on the Tune Bar. The Reset button will reset the Peak value and the corresponding Peak indicator bar. Each new peak value collected will generate an audio beep, move the indicator bar and display a new peak value.

NOTE: To remove the Tune Bar from the Home Screen, tap the Tune Bar button a second time.

Semiconductor
Sensor:

Home Screen



File Menu – The File Menu provides the capability to Exit the LaserPAD software and view the current software version. To exit the LaserPAD software, tap the File Menu on the Home Screen. When the menu appears, tap Exit. You can also exit the LaserPAD software by switching the SmartSensor Interface Module to the off position. The connection dialog will appear. Tap the Exit button in the connection dialog to exit the LaserPAD software. The about item in the File Menu will display the current LaserPAD software and firmware version. To display the current version, tap file on the LaserPAD Home Screen and then tap About. The current LaserPAD software and firmware version will display on the screen. Tap OK in the About dialog and return to the Home Screen.

Semiconductor Sensor:

Home Screen

Options Menu – The Options menu will provide navigation to the Settings screen in the LaserPAD software. Please review the detail associated with each screen for further information.

View Menu – The View Menu will provide access to the Tune Bar, Tune Needle and Large Display. Review the detail associated with each item listed in this menu.

Large Display – The LaserPAD software will allow you to display the Home Screen Power in a Large Font. Toggle between Normal Power Font and Large Power Font by tapping the Magnifying Glass Icon on the Pocket PC Command Bar.

NOTE: Tap the Current Power value to toggle between large font and normal font.

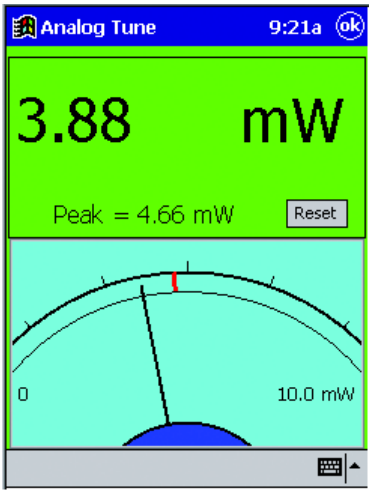
Display Units – The LaserPAD Software provides the ability to display in units of Watts, dBm and dB. To select the desired display type, tap on the appropriate units shown on the Pocket PC Command Bar at the bottom of the screen. The Watts will display from nW to mW as necessary. The dBm value is calculated utilizing the following formula: ***10 log [current reading (mW)]***. When dB is selected, the current reading will be established as a reference value. All subsequent readings will be measured and displayed relative to the reference value established. To establish a new reference for dB, tap the dB REF button in the Properties Panel. The dB display utilizes the following calculation: ***dB = 10 log (current power reading/reference power reading)***.

NOTE: Tap the current display units to cycle through the three display units available (W, dBm, dB).

Semiconductor Sensor:

Tune Screen

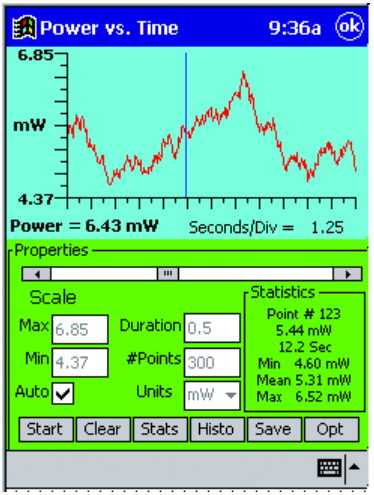
Tune Needle – The Tune Ana button will display a separate tune screen with the appearance of an Analog Needle. This screen operates in the same manner as the Tune Bar. The current value is displayed in large font at the top of the screen. The Peak value is displayed in a smaller font below the current value. The current scale values are located at each end of the scale radius. A maximum indicator bar remains on the scale at the location indicated by the Peak Value. The reset button will reset the Peak value and the corresponding indicator bar. Each new peak value collected will generate an audio beep, move the indicator bar and display a new peak value. Tap the OK button in the top right hand corner of the screen and return to the Home Screen.



Semiconductor Sensor: Tune Screen

Semiconductor Sensor:
Trend Screen

NOTE: The trend data is collected by the SmartSensor Interface Module at a maximum rate of 10 Hz. The LaserPAD software may not plot the data at the 10 Hz rate. The plotted data represents the 10 Hz collection rate.



Semiconductor Sensor: Trend Screen

Trend Screen – The Trend Plot is a display of Power vs Time. The displayed data is a result of the selected vertical scale, number of points and duration of the plot. The duration and the number of points are set before trend data is collected. When a trend run is started, the Stop button will replace the Start button. If a trend run is stopped before the duration is complete, data analysis will be available. When the trend run is stopped or completed, a measurement cursor will appear and provide the capability to analyze individual points. When a trend run is stopped or completed, the data analysis buttons will come into focus. These buttons include Statistics, Histogram and data saving capability. The Trend Plot will also display the Live Power and the data collection interval based on the current trend duration.

NOTE: The trend data will utilize current Offset, Attenuation and Average settings.

NOTE: Tap the current average value to enter a new average value.

Semiconductor Sensor:

Trend Screen

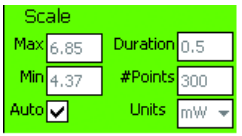
Range – The vertical scale can be set before and after a trend run. The manual scale can be set to any value desired. If data is collected beyond the range of the manual scale settings, those points will be plotted along top or bottom of the scale appropriately. When the vertical scale is changed after a trend run, the OK button in the value change dialog will plot the data with the new scale value. See Trend Options for additional Range features.

Auto Scale – If the Auto Scale box is checked, the LaserPAD software will manage the vertical scale appropriate to the range of data collected. The Auto Scale can be removed after data collection for a desired manually scaled display. When the display is toggled between Auto Scale and Manual Scale, any available data will be plotted appropriate to the new setting.

Duration – The Duration box will allow you to set the duration of the trend run before collecting data. A trend run can range in duration from 0.5 minutes to 99 hours (5940 Minutes). The duration is entered in minutes. Entered values will be rounded to the nearest 0.5 minutes.

Number of Points – The number of points selected determines the interval between each point collected. The trend data is collected at a rate of 10 Hz. This data collection rate determines the maximum number of points available for a given duration. For example you can select a maximum of 300 points for a 30 second trend run. The LaserPAD software will also limit the maximum number of points collected to 2000.

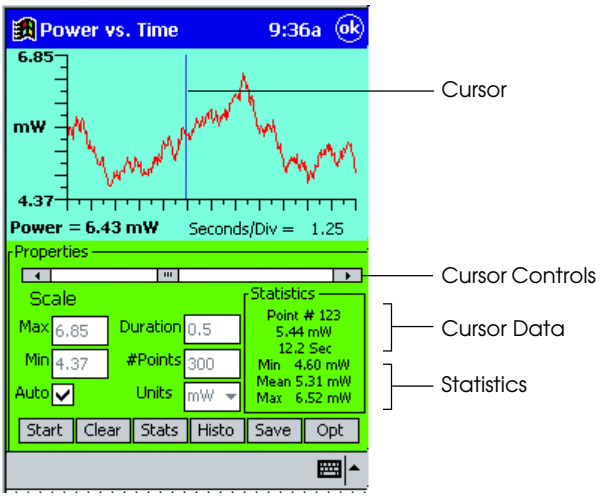
Units – The vertical scale units can be selected appropriate to the data collected. When utilizing manual scale verify the appropriate units are selected. Trend data can be plotted as dBm. If dBm is selected from the Home Screen, the Trend Screen will default to dBm.



Semiconductor Sensor:

Trend Screen

Statistics Panel/Measurement Cursor – The Statistics Panel contains current statistical trend information. The measurement cursor information is also displayed in this panel. The vertical bar displayed in the trend plot corresponds to the current measurement cursor data. The measurement cursor is active when static results are displayed. When a trend run is in progress, the measurement cursor is not available. When the trend duration is complete or the Stop button is tapped, the measurement cursor can be utilized on the displayed data. A scroll bar will appear below the trend plot when the measurement cursor is active. The measurement cursor results will appear in the Statistics Panel. The measurement cursor is controlled by dragging the center section of the scroll bar or by tapping the arrows at either end of the scroll bar. The cursor results appear as the top three values displayed in the Statistics Panel. The top value in the Statistics Panel corresponds to the current cursor location, relative to the number of points collected. The second value displayed corresponds to the Power value associated with the current cursor location. The third value in the Statistics Panel corresponds time associated with the displayed cursor power value. The remaining three values (Min, Mean and Max) correspond to statistics generated by the current trend points collected.



Semiconductor Sensor:

Trend Screen

Trend Control Buttons

Start – The Start Button will clear current data and begin a new trend run utilizing the current setup parameters. When the trend run begins, the Start button will change to a Stop button. The Stop button will stop the trend run and generate statistics based on the data currently collected. All functions associated with a complete trend run will be available if the run is stopped before completion.

Clear – The Clear button will clear all data, statistics and histograms associated with data that is currently available. The Clear button will clear data only and does not effect the current settings.

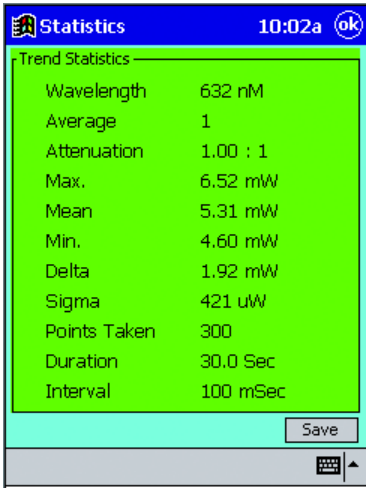
Statistics – Tap the Stats Button to bring up a separate screen displaying all statistics associated with the current data. The Stats button is not available when a trend run is in progress or current data has been cleared. The statistics will display the minimum and maximum point collected and the mean average of all points collected. The delta value is the difference between the minimum and maximum point and can be displayed with higher precision than the minimum and maximum points. The Sigma value is the standard deviation of all points collected. The standard deviation is calculated in the following manner, where X is the array of points and N is the number of points.

$$\sqrt{\frac{\left[\sum X^2 - \left(\sum X\right)^2\right]}{N-1}}$$

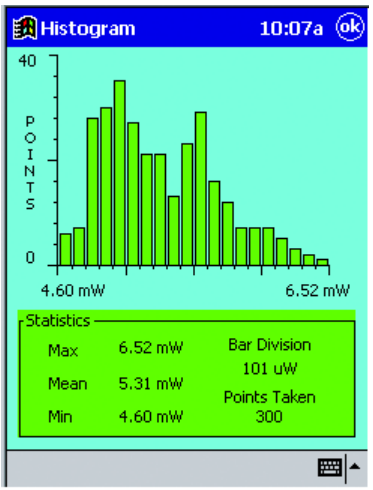
The Points Taken, Duration and Interval shown on the Statistics screen are a result of the setup parameters established before the data was collected. The Save button will operate in the same fashion as the Save button on the Trend Screen. Review the section on saving data for further detail. The OK button on the Statistics Screen will return to the Trend Screen.

Semiconductor
Sensor:

Trend Screen



Histogram – Tap the Histo Button on the Trend Screen to display a separate screen containing a Power Trend Histogram and the associated data. The Power Trend Histogram is constructed by dividing the trend delta value by 20. This result will determine the bar division on the histogram. The vertical scale is constructed by taking the bar with the maximum number of points and adding 5 to set the vertical scale. The Maximum, Minimum, Mean, Calculated Bar Division and the Number of Points collected will also be displayed on the Histogram Screen. The OK button will return the display to the Trend Screen.



Semiconductor Sensor:

Trend Screen

Save Trend Data – Tap the Save button on the Trend Screen to save the current data. The Save button will generate a comma delimited text file. This format will allow you to view the trend data with Windows Notepad or analyze the data with Microsoft Excel. The Pocket PC will display the data with Pocket Word. To view the data with Pocket Excel, the Trend Text File will have to be exported to a host computer. Open the file with Microsoft Excel and save the data as an Excel Workbook. Export the data in workbook form to the Pocket PC. The data will now be available for analysis utilizing Pocket Excel. Each Trend Data File contains the appropriate setup information, statistics and a complete array containing each data point collected.

Example Trend Data File

Trend Information
7/23/2001 9:55

Test 1

632.8 nM
Average 1
Attenuation 1
Max 4.20 mW
Mean 3.89 mW
Min 3.42 mW
Delta .78 mW
Sigma .12 mW
Points 103
Duration 30 Sec
Interval 100 mSec

Points Displayed in Watts

Point	Data	Time
1	0.004	100 mSec
2	0.004	301 mSec
3	0.004	503 mSec
4	0.004	704 mSec
5	0.004	905 mSec
6	0.004	1.1 Sec
7	0.004	1.3 Sec
8	0.004	1.5 Sec

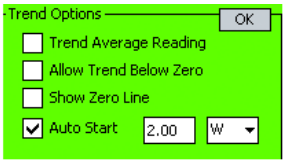
NOTE: To display data properly with Microsoft® Excel™, select tab, space and comma deliminated on the second page of the Excel Import Wizard.

Semiconductor Sensor:

Trend Screen

Trend Options Button – Tap the Opt button on the Trend Screen to access a variety of Trend Options. These options are split into Trend Options and Auto Scale Options.

Trend Options – The Trend Average Reading function will utilize the Display Average Process to collect the trend data. When the Trend Average box is checked the data collection will utilize the current average value set. Activating this box will provide the opportunity to change the current Average value. The Trend Below Zero function will collect data with a negative value. The Auto Start function will allow the user to specify a threshold power to start a trend run. When this function is active you can specify the threshold power. When the threshold power or greater is collected, the trend run would begin. The data collection will not stop if the power drops below the specified threshold.



Specifications

Ranges: Microprocessor controlled. Display ranges determined by EEPROM in SmartSensor heads. No range limitation on display.

Display: > 3 Hz update rate (3 significant digits)

Communication: RS-232 Serial Communication between Pocket PC and SmartSensor Interface Module.

Trending Data: 10 Hz update rate 2000 points maximum

Display Accuracy: ± 1% (must be added to detector accuracy for total system accuracy)

Display Average: User selectable 1 - 200

CW Thermal Detector: Provides CW Power and Beam Position Data. See Appendix A for accuracy specifications and input beam limitations.

Semiconductor Sensor: Provides CW Power Data. See Appendix A for accuracy specifications and input beam limitations.

Memory: Retains configuration information when turned off (wavelength values, display information, etc.).

Operating Temperature: 5° C to 40° C

Safety Features: Visual sensor over-temperature, alignment and sensor over-range warning.

Size: 5.25" long x 5" wide x 1.26" thick (13.3 cm x 12.7 cm x 3.2 cm).

Weight: 0.88 lbs. (0.400 Kg), with batteries.

AC wall plug input requirements: 100-240V, ~0.2 A, 50-60 Hz

DC Operation: 6V Internal rechargeable battery pack. Recharged automatically during AC operation. Battery life: 12 hours typical. Complete recharge cycle is 14 hours.

Appendix A:
Supported Coherent SmartSensors™

NOTE: Call Coherent for an updated list of detectors if the desired detector is not shown.

Thermal SmartSensors

Catalog Number	Name	Power			Aperture (mm)	Notes	Spectral Range (μm)	Accuracy (± %)	For Single Shot Use with Ultima and FieldMaster-GS			Sensor Coating (note m)
		Max (W)	Min (W) (note f)	Resolution (W)					Max Pulse Length (s)	Max Joules	Min Joules	
Standard Thermal Sensors: 6000 W/cm² maximum CW power density												
33-7832	LM-200XL HTD	200	1.0	0.1	55	c	0.25-10.6	4	0.34	95	0.50	HTD
33-7857	LM-200 HTD	200	0.2, 0.1	0.01	19	k	0.25-10.6	5	0.12	10	0.07	HTD
33-7840	LM-200 HTD	200	0.2, 0.1	0.01	19	t	0.25-10.6	5	0.12	10	0.07	HTD
33-7865	LM-200B HTD	200	0.2, 0.1	0.01	19	c, w	0.25-10.6	5	0.12	10	0.1	HTD
33-7873	LM-150 FS HTD	150	0.1	0.01	19	r	0.25-10.6	5	0.12	10	0.07	HTD
33-7881	LM-100XL HTD	100	1.0	0.1	40		0.25-10.6	4	0.34	50	0.50	HTD
33-7899	LM-100 HTD	100	0.1	0.01	19		0.25-10.6	2	0.12	10	0.07	HTD
33-0472	LM-100B HTD	100	0.1	0.01	38	c, w	0.25-10.6	4	0.34	50	0.1	HTD
33-7915	LM-45 HTD	45	0.1	0.01	19		0.25-10.6	2	0.12	10	0.07	HTD
33-7923	LM-10 HTD	10	0.01	0.001	16		0.25-10.6	2	0.11	10	0.05	HTD
33-7931	LM-3 HTD	3	0.01	0.001	19		0.25-10.6	2	0.11	10	0.05	HTD
High Power Thermal Sensors: 2500 W/cm² maximum CW power density												
33-1132	LM-5000	5000	300	1.0	55	a,e,g	0.25-10.6	5	0.34	95	1.0	H
33-1124	LM-2500	2500	150	1.0	55	a,e,g	0.25-10.6	5	0.34	95	1.0	H
33-1116	LM-1000	1000	2.0,10	0.1, 1.0	38	b,g	0.25-10.6	5	0.18	45	0.25	H
Volume Absorbers for High Peak Power: 1 GW/cm² at 10 ns maximum peak power density												
33-1017	LM-80V	80	0.5, 0.1	0.01	38	h	0.19-6.0	4	0.4	45	0.25	V
33-0993	LM-30V	30	0.1	0.01	19	h	0.19-6.0	3.5	0.17	10	0.07	V
Excimer Special Coated Sensors: 2000 W/cm² maximum power density												
33-1108	LM-200XLE	200	1.0	0.1	55	c	0.19-0.35	4	0.24	45	0.50	UV
33-1033	LM-100E	100	0.5, 0.1	0.01	40		0.19-0.35	5	0.34	50	0.25	UV
33-4508	LM-100EB	100	0.5, 0.1	0.01	38	c, w	0.19-0.35	5	0.34	50	0.25	UV
High Sensitivity Thermal Sensors: 400 W/cm² maximum power density												
33-0928	LM-1	1.0	0.001	0.0001	9		0.25-2.5	5	0.11	1.0	0.15 mJ	P
33-7956	LM-1 IR	1.0	0.001	0.0001	9		1.0-10.6	5	0.11	1.0	0.15 mJ	P
Special Purpose Sensors: 2500 W/cm² maximum CW power density												
33-1215	Beam Finder	1000	2.0	0.1	35	b,d,e	0.3-10.6	5	0.6	45	0.25	H
33-7907	LM-20 HTD	20	0.1	0.01	19	p	0.25-10.6	2	0.12	10	0.07	HTD

Notes on page 60.

All SmartSensors are supplied with a 1.8 m (6 ft) cable (unless otherwise noted), stand and NIST traceable Calibration Certificate.

(a) 7.5 liter/min cooling water required. Maximum temperature deviation 3%/min. Maximum flow deviation 2%/min.

(b) 4 liter/min cooling water required. Maximum temperature deviation 3%/min. Maximum flow deviation 2%/min.

(c) 1 liter/min cooling water required. Maximum temperature deviation 3%/min. Maximum flow deviation 2%/min.

(d) Designed for system integration for measurement of power and position, for use on the Ultima only (supplied with 6 m (20 ft) cable and cooling hoses).

(e) Supplied with 6 m (20 ft) cable.

(f) Value to the left is for Ultima LabMaster and FieldMaster-GS, value to the right is for FieldMaster.

(g) Single shot pulse readings only available on Ultima LabMaster.

(h) Damage limit: Pulse 1 GW/cm^2, measured at 1.06 µm, (10 ns pulse). Varies with wavelength, derate by 50% 0.26-0.35 µm, by 90% below 0.26 µm, Maximum Average Power Density 30 W/cm^2.

(k) Must be used with 110 VAC power for internal fan cooling for powers above 50 Watts.

(m) See coating specifications and maximum power density limits on page 22 of the Power & Energy Meters Catalog.

(p) Designed for system integration, must be mounted to a heat sink.

(r) Intermittent duty (2 min @ 150 W; 5 min @ 100 W; 20 min @ 40 W). See page 24 of the Power & Energy Meters Catalog for further details.

(t) Must be used with 220 VAC power for internal fan cooling for powers above 50 Watts.

(w) These sensors require water cooling to operate at the maximum specified power ratings. They can also be operated using convection and conduction cooling methods. See details on cooling methods and associated power ratings in the OEM sensor section, pages 28-31 of the Power & Energy Meters Catalog.

Semiconductor SmartSensors

Catalog Number	Name	Power			Aperture (mm)	Spectral Range (µm)	Accuracy (±%)	Maximum Power Density (W/cm^2)	Max Powe with Attenuator (W)
		Max (mW)	Min (µW)	Resolution (nW)					
33-0951	LM-2 UV	30	0.01	1.00	6.0	0.25-0.4	8	0.3	NA
33-0936	LM-2 VIS	50	0.01	1.00	7.9	0.4-1.064	5	1.0	5.0
33-0944	LM-2 IR	10	0.5 z	1.00	5.0	0.8-1.55	4.5	0.5	5.0

All SmartSensors are supplied with a 1.8 m (6 ft) cable, stand and NIST traceable Calibration Certificate.

(z) 1 µW for FieldMaster.

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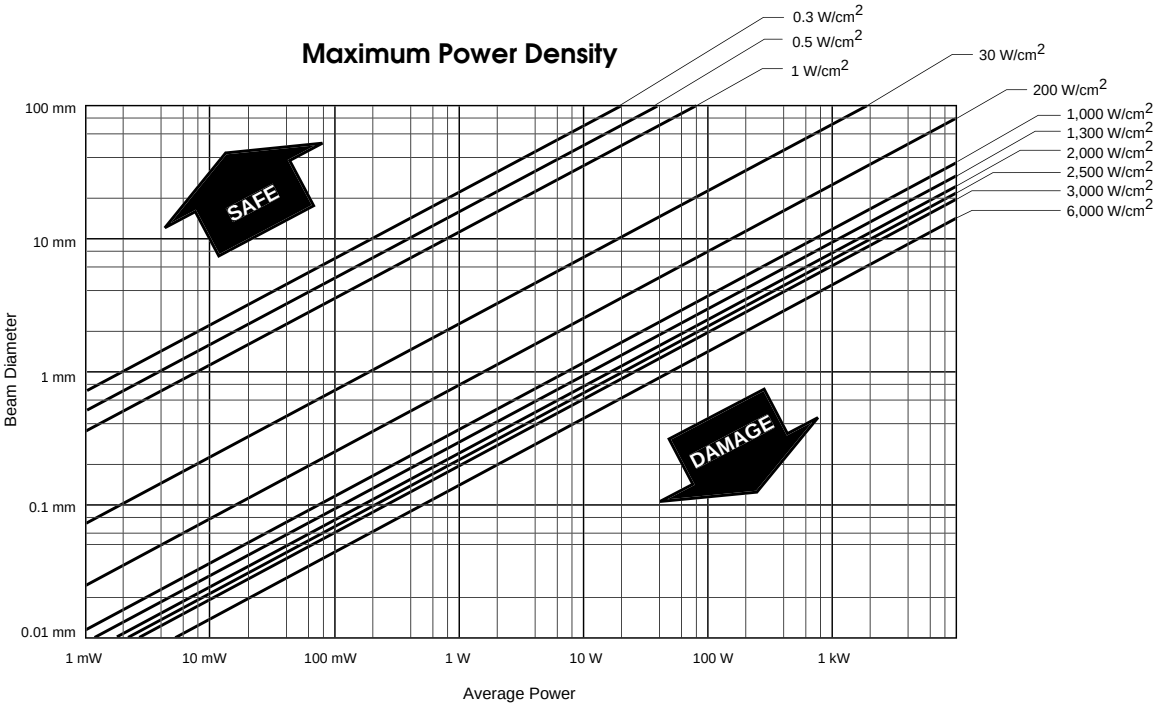
Appendix B:
Safe Detector Operating Region



Variation of beam diameter and power for average power densities of thermal and semiconductor sensors. Safe operating limit above damage threshold lines.

Appendix C

SmartSensor™ Interface Module Circuit and Operation Description

Each power (detector) head contains a temperature sensor, electrically erasable programmable read only memory (EEPROM) and either a photodiode or thermopile detector. At power On, the program interrogates the EEPROM to determine which type of detector is present.

Amplifier gains and analog switches (mux) are adjusted to match the information received from the EEPROM. The 16-bit analog-to-digital converter (A/D) switches between channels 1 and 2 to measure either sensor output or temperature. This data is then sent through the Interface to the Microprocessor.

The program in the Microprocessor controls the mux, amplifier gains, and A/D converter channels. The memory and serial communication are selectively reached by the Microprocessor through the Decoder. The Decoder interprets the Microprocessor address lines to determine which device the Microprocessor wants to talk to.

The thermoelectric detector heads have four outputs that determine beam position and laser power. The Microprocessor scans the mux through the four outputs and the temperature signal to arrive at a power reading (with the Gain Amplifier set to provide maximum signal strength). The A/D then converts the outputs for the Microprocessor.

Photodiode detector heads have one output. They use a current-to-voltage converter to precondition the output before it reaches the Gain Amplifier. The A/D then converts the output for the Microprocessor.

The Microprocessor reads the A/D output and computes the power based on the data loaded from the SmartSensor EEPROM. The quadrant output from a Thermal SmartSensor provides position information to the Microprocessor. The Microprocessor organizes the power and position information for RS-232 serial transmission. The LaserPAD software receives the power and position data stream at a rate of 10 Hz. The LaserPAD software utilizes the 10 Hz input stream to update the screen and collect data appropriately. All displayed data represents a 10 Hz collection rate regardless of the update rate of the graphical screen.

Rechargeable batteries are provided. The SmartSensor Interface Module can be operated with the external power supply and simultaneously recharge the batteries.

Appendix D: Troubleshooting Tips

PROBLEM	PROBABLE CAUSE	SOLUTION
LaserPAD Software does not detect SmartSensor Interface Module	Dead Battery in SmartSensor Interface Module	Connect 5V wall plug to the SmartSensor Interface Module for a 14 hour complete charging cycle
	Serial Cable is not properly connected to SmartSensor Interface Module	Verify proper serial cable connection at the Pocket PC and the SmartSensor Interface Module.
LaserPAD Software does not detect the SmartSensor.	SmartSensor is not connected properly to the SmartSensor Interface Module	Secure the DB 25 head connector at the SmartSensor Interface Module
	SmartSensor EEPROM is faulty	Contact Coherent for Service
	SmartSensor Interface Module is faulty	Contact Coherent for Service
The host PC does not sync with the Pocket PC	The LaserPAD software is conflicting with the Active Sync Software	Verify that the LaserPAD software is not running and exit the LaserPAD software if necessary
The update rate of the LaserPAD software appears to be slow.	Other Pocket PC programs are utilizing system resources.	Verify that no other Pocket PC programs are currently running.
	The Pocket PC memory is not available through normal use.	Press the mechanical reset button on Pocket PC to clear the memory
Over Temp message appears	The maximum operating temperature for the Thermal SmartSensor has been exceeded.	Reduce the Laser input power or attenuate the laser output beam. When the SmartSensor is within the normal temperature range, the message will automatically clear.
Batteries do not hold a charge	Rechargeable battery pack is faulty	Contact Coherent for Replacement Battery Pack.
Missing Data on LaserPAD Screens	Data and Background colors are matched	Tap the default color button on the LaserPAD Software Settings Screen.
Semiconductor Sensor Power Readings are not correct.	The LaserPAD software wavelength settings do not match the laser source.	Verify the Wavelength value displayed in the LaserPAD software matches the Laser Source
LaserPAD Power Readings do not appear to be correct.	The LaserPAD software attenuation value does not match the laser input.	If the beam is measured directly, verify that the attenuation value is set to 1.0. If the beam is not measured directly, verify that the LaserPAD attenuation value matches the current optical attenuation.
Semiconductor Sensor Power Readings do not increase as the laser power increases.	The Semiconductor Sensor is saturated.	Verify that the laser input is within the proper range specified in Appendix B of this manual.

Warranty

The seller warrants to the original Buyer each item manufactured by it to be free from defects in material and workmanship for a period of time and under such conditions as specified in the Seller's warranty for the individual product, or for twelve (12) months from delivery if a warranty for the individual product is not specified. Major sub-systems manufactured by other firms but integrated into the Seller's systems are covered by the original Manufacturer's warranty. The Seller's liability under valid warranty claims is limited to repair or replacement at the Seller's plant or the Buyer's location, all at the option of the Seller.

THE FOREGOING WARRANTY IS EXCLUSIVE AND IN LIEU OF ALL OTHER WARRANTIES, WHETHER WRITTEN, ORAL OR IMPLIED AND SHALL BE THE BUYER'S SOLE REMEDY AND THE SELLER'S SOLE LIABILITY ON CONTRACT OR WARRANTY OR OTHERWISE FOR THE PRODUCT. THE SELLER DISCLAIMS ANY IMPLIED WARRANTY OR MERCHANTABILITY OR FITNESS FOR PURPOSE.

All claims under warranty must be made promptly after occurrence of circumstances giving rise thereto, must be received within the applicable warranty period by the Seller, and shall be subject to the terms and conditions stated herein. Such claims should include the product serial number, the date of shipment, and a full description of the circumstances giving rise to the claim. Before any products are returned for repair and/or adjustment, authorization for the return and instructions as to how and where these Products should be shipped must be obtained from the Seller. Any product returned to the Seller for examination and/or warranty repair shall be sent prepaid via the means of transportation indicated as acceptable by the Seller. The Seller reserves the right to reject any warranty claim on any item that has been shipped by non-acceptable means of transportation. When any product is returned for examination and inspection, or for any other reason, the Buyer and its shipping agency shall be responsible for all damage resulting from improper packing or handling, and for loss in transit, notwithstanding any defect of non-conformity in the Product. In all cases, the Seller has sole responsibility for determining the cause and nature of failure, and the Seller's determination with regard thereto shall be final.

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Sales and Service Information

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