Quick Start Guide PMA

# **Quick Start Guide for the**

# **POWER METER APPLICATION**

# MODEL LB478A/479A/480A/559A/579A/589A



Quick Start Guide PMA

## 1. Introduction

This document provides information to install and quickly start using your power sensor. You will need the sensor with USB cable; a compatible computer with available USB 2.0 port; and the software media. More detailed information is available in the product manual contained on the media supplied with your unit.

This document pertains to the LB478A/479A/480A and LB559A/579A/589A model USB power sensors when using the *Power Meter Application*. The LB4XXA series of sensors make CW and pulse measurements and the LB5XXA series of microwave sensors is limited to CW measurements only. (The LB480A sensor is also capable of making pulse profile measurements – refer to the LB480A Quick Start Guide and Product Manual for the *Pulse Profiling Application*).

Model Number and Description	SWR	Dynamic Range	CW & Pulse	Pulse Profiling
LB478A CW PowerSensor+ .01 – 8.0 GHz (functional to 10 GHz)	1.15:1	-35 to +20 dBm	Yes	No
LB479A CW Wide Dynamic Range PowerSensor+ .01 – 8.0 GHz (functional to 10 GHz)	1.09:1	-60 to +20 dBm	Yes	No
LB480A Pulse Profiling Wide Dynamic Range PowerSensor+ .01 – 8.0 GHz (functional to 10 GHz)	1.09:1	-60 to +20 dBm	Yes	Yes
LB559A Microwave PowerSensor+ .01 – 12.5 GHz	1.20:1	-55 to +20 dBm	CW	No
LB579A Microwave PowerSensor+ .01 – 18 GHz	1.20:1	-55 to +20 dBm	CW	No
LB589A Microwave PowerSensor+ .01 – 26.5 GHz	1.20:1	-55 to +20 dBm	CW	No

# 2. Installing the Software and the Sensor

#### **Operating System and Computer Requirements**

The PowerSensor+<sup>™</sup> line of products is compatible with Windows 2000 (SP2 or greater) and Windows XP operating systems. Support is available for various test development environments including MS Visual Basic 6.0; MS Visual Basic .NET; MS C# .NET; NI LabVIEW; NI LabWindows; and Agilent VEE.

Recommended PC configuration: Pentium D 1G RAM 1.0 GHz Processor CD Drive USB 2.0 Port\*

\* The USB port or hub *must* supply 500 mA @ 5 V for power sensor operation. *Refer to the USB Considerations* section of the product manual to determine if your computer has a USB 2.0 port(s).

Quick Start Guide PMA

#### Installation Procedure

#### Install the Software

Complete the following steps in sequence to install the software and to connect the sensor. Do not connect the sensor until instructed to do so.

- 1. Insert the Ladybug CD labeled *Power Meter Application Installation* into the computer drive. The installation should start automatically. (Alternately, the application may be supplied on a USB flash drive).
- 2. (Optional) If the installation does not start automatically, select Start > Run and type D:\setup.exe (where D:\ is the media drive) then press OK.
- 3. The installer below will open and guide you through the procedure. Select **Next** to continue.



Figure 1. Start of installation software - Welcome

Choose the license agreement option and select Next to continue. 4.



Figure 2. License agreement option

Quick Start Guide PMA

5. Select the installation folder location and user accessibility options. The default path is as shown below. Select *Next* to continue.

🛿 LadyBug Power Meter A	Application	
Select Installation Folder	r	
The installer will install LadyBug Power To install in this folder, click "Next". To Folder	r Meter Application to the following folds install to a different folder, enter it below	er. v or click "Browse".
Files\Ladybug Technologies LLC\	LadyBug Power Meter Application	B <u>r</u> owse Disk Cost
Install LadyBug Power Meter Applica	ation for yourself, or for anyone who use	es this computer:
	Cancel <back< td=""><td>Next &gt;</td></back<>	Next >

Figure 3. Select installation folder

6. The installer is ready to install the software on your computer. Select *Next* to continue.

⊌LadyBug Power Meter A	pplication		
Confirm Installation			
The installer is ready to install LadyBug	Power Meter Applica	ation on your computer	£
Click "Next" to start the installation.			
		11755	
	Cancel	< <u>B</u> ack	Next >
	.82		

Figure 4. Confirm installation

Quick Start Guide PMA

7. The software will install on your computer.

LadyBug Power Meter	Application		
Installing LadyBug Powe	∍r Meter Applica	ation	
LadyBug Power Meter Application is I	being installed.		
	<u>,</u>		
Please wait			
	Cancel	<u>K B</u> ack	Next >
ure 5. Installing the device			

8. The installation process will indicate completion. Select *Close* to exit.

d LadyBug Power Meter Application	
Installation Complete	
LadyBug Power Meter Application has been successfully installed. Click "Close" to exit. Please use Windows Update to check for any critical updates to the .NET Framewo	ork.
Cancel < Back	Close

Figure 6. Installation Complete

Quick Start Guide PMA

#### **Connect the Sensor**

9. Connect the supplied USB cable to the sensor and an available USB connector on the computer; or the USB hub connected to the computer. The USB port or hub must supply 500 mA @ 5 VDC for power sensor operation. Locate the sensor USB port shown below. Refer to the information regarding USB hubs contained in the product manual for more information. Note that some models may not have all the trigger connectors.



Quick Start Guide PMA

10. The computer will indicate *Found New Hardware* and the hardware wizard should open automatically to establish the USB configuration for the sensor(s). Select *No, not this time* to connect to Windows Update as shown below, then click *Next* to continue.



11. Select Install from a specific location (Advanced) as shown below then click Next to continue.

Found New Hardware Wiz	ard
	This wizard helps you install software for: Ladybug LB4XX Device If your hardware came with an installation CD or floppy disk, insert it now.
	What do you want the wizard to do? <ul> <li>Install the software automatically (Recommended)</li> <li>Install from a list or specific location (Advanced)</li> </ul> Click Next to continue.
	K Back Next > Cancel

Quick Start Guide PMA

12. Select Don't search, I will choose the driver to install as shown below then click Next to continue.



**NOTE:** The following steps assume this to be an initial installation of a PowerSensor+ $\mathbb{M}$ . You can jump to step 21 if you are installing more sensors or you have previously completed an installation on the computer.

13. Click *Have Disk* as shown below. Do not choose *Next* or *Cancel* as you will return to this screen after loading the driver software from its specified location.

Found New Hardware Wizard
Select the device driver you want to install for this hardware.
Select the manufacturer and model of your hardware device and then click Next. If you have a disk that contains the driver you want to install, click Have Disk.
Manufacturer (Standard CD-RDM drives) (Standard IDE ATA/ATAPI cor (Standard keyboards) (Standard system devices) CD-ROM Drive (force CDDA accurate) CD-ROM Drive (force CDDA inaccurate) CD-ROM Drive (force IMAPI disable) CD-ROM Drive (force IMAPI disable) CD-ROM Drive (MAPI settings 0.1)
This driver is digitally signed.     Have Disk       Tell me why driver signing is important.     Have Disk
< <u>B</u> ack <u>N</u> ext > Cancel

Quick Start Guide PMA

14. Click Browse without entering a path as shown below. The default path is C:\Program Files\Ladybug Technologies LLC\LadyBug Power Meter Application\LB4XX\_2K.inf. Be sure to browse to this location and *do not* cut and paste the path name here.

H	Insert the manufacturer's installation disk, and then make sure that the correct drive is selected below.	ОК
		Cancel
	_	

15. Select Local Disk (C:) (or the drive on which the application was installed) then click Open.



16. Select the *Program Files* folder as shown below then click *Open*.



Quick Start Guide PMA

17. Select the *Ladybug Technologies LLC* folder as shown below then click *Open*.



18. Select the LadyBug Power Meter Application folder as shown below then click Open.

Locate File			? 🛛
Look in: 🚞	Ladybug Technologies LLC	💌 Q 🌶	📂 🛄 •
LadyBug F	Power Meter Application		
the second se			
File name:		~	Open
Files of tupe:	Satur Information (* mf)		Cancel
r nes or gype.	Locolo mionialon ( .mi)		Canoor

Quick Start Guide PMA

19. Select the LB4XX\_2K.inf file as shown below then click Open.

Locate File						[	? 🗙
Look in:	LadyBug Power Meter Application	~	0	1	Þ		-
LD4XX_2K							
File <u>n</u> ame:	IB45X 2K inf			~	٢	Oper	
Files of <u>type</u> :	Setup Information (*.inf)			~		Canc	

20. The driver path will be listed as shown below. The default path is C:\Program Files\Ladybug Technologies LLC\LadyBug Power Meter Application\LB4XX\_2K.inf. Click **OK** to continue.



21. Click *Next* to continue the process as shown below.



Quick Start Guide PMA

22. The window below will appear briefly as the software is installed.

Found New Hardware Wizard	
Please wait while the wizard installs the software	
Ladybug LB4XX Device	
Setting a system restore point and backing up old files in case your system needs to be restored in the future.	
< <u>B</u> ack <u>N</u> ext > Ca	ncel

23. Click *Finish* as shown below to complete the hardware installation then proceed to the following steps to launch the application software.

Found New Hardware Wiz	ard
	Completing the Found New Hardware Wizard The wizard has finished installing the software for: Ladybug LB4XX Device
	Click Finish to close the wizard.
	K Back Finish Cancel

Quick Start Guide PMA

- 24. The above procedure can be repeated for multiple sensors. Repeat from step 9 if more sensors need to be configured or continue to the next step.
- 25. Click the LadyBug shortcut icon on the computer desktop to start the application software.



26. If you have one sensor connected proceed to the next step. If you have multiple sensors connected continue with this step. The Select Device window will appear initially as shown below to indicate the sensor(s) connected by serial number. Select the unit serial number from the pull down and click *OK* to continue. The six-digit serial number is located under the USB port connector on the sensor body.

Select Device	×
Current Devices & Addresses	
Address: 80 SN: 08B280	
	cel
	-

27. The initialization window will appear briefly and create the calibration tables as shown below.



Quick Start Guide PMA

28. The default measurement interface will open as shown below (the LB480A in this instance) and is representative of all models using the *Power Meter Application*. The actual number you see in the display will vary somewhat from sensor to sensor. For example: The LB478A dynamic range is limited to -35dBm, so the number you see in the display will be about -35dBm with the LB478A connected.



29. The software and hardware installation process is now complete. Continue to the next section entitled "Getting Started" to quickly start making measurements.

Quick Start Guide PMA

# 3. Basic Operating Instructions – Getting Started

#### **Operating Precautions**

Observe the warnings about maximum input power. Insure that the RF input connector on the sensor is clean and undamaged as well as the mating connector. The following procedures assume the software and hardware have been installed according to the installation process outlined in the preceding section of this document.

## **Program Start Up**

Start the software if it is not currently running by clicking on the desktop icon labeled "Power Meter Application" or launch it from its program location (select *Start > All Programs > LB Technologies LLC > LB Power Meter Application*). Select the sensor(s) by serial number if more than one sensor is connected to the computer. The serial number is stamped below the USB port on the sensor body. We will be using the LB480A user interface for demonstration purposes throughout this document. You may not have the LB480A sensor but the interface is common to all models in the power meter configuration.

The GUI comes up by default in the average power or CW mode of operation for all models; frequency is set to 1 GHz; averaging is set to 75 measurements; measurement update rate is medium; offsets and frequency response are disabled. These parameters are accessible from the Measurement menu. The **Preset** button will return the interface to the default state. (*There will be no Pulse Power mode of operation for the LB5XXA CW power sensor*).



A separate GUI with unit model, serial number and address will appear for each active device when you open a new instance of the *Power Meter Application*. The GUI allows identification of the individual sensor(s) by blinking the LED on the sensor body. Clicking the ID button shown above will cause the LED on the sensor to blink four times in quick succession. The ID and Preset functions are duplicated on the Measurement menu.

Quick Start Guide PMA

#### **Making Basic Measurements**

This guide applies to models LB478A, LB479A and LB480A as well as models LB559A, LB579A and LB589A. All sensors function identically for CW measurements. The significant difference between these sensors is the ability to make pulse measurements.

The sections of this guide that focus on pulse measurements apply only to models LB478A, LB479A and LB480A. These sensors will be collectively referred to as LB4XXA sensors throughout the remainder of this document. The LB4XXA sensors can make both CW and pulse (modulation) measurements. The LB559A, LB579A and LB589A will be collectively referred to as LB5XXA sensors. The LB5XXA sensors can make broadband CW measurements only. These CW measurements are thermally compensated, true RMS measurements.

#### Zeroing and Reference Power Calibration

The design of the PowerSensor+<sup>™</sup> does not require zeroing or power calibration and there is no provision for zeroing or calibration. However, for the purpose of software compatibility, the programmatic interface has "null" function calls for zeroing and calibration. See the Programming Guide for details.

#### Setting the Units of Measurement and Center Frequency

Select the display preferences and select the measurement units (power and frequency) from the Display menu as shown below. There are selections for digital or analog presentations of frequency and power; an analog frequency scale; and an analog power scale. You can also switch between displays and size the display from compact to very compact. Refer to the GUI functions section of the product manual for more information about menu items and toolbar functions.



Quick Start Guide PMA

The power and frequency units are also selectable from the toolbar as shown below. Or you can change the power units by clicking on the units label to the right of the power reading itself. You can change the center frequency by clicking anywhere on the frequency reading in the active display.



You can also set the frequency (GHz) from the Measurement menu as shown below. The center frequency *must* be updated when the incoming signal frequency changes as this frequency setting is used to correct for amplitude flatness and temperature variation. Measurement accuracy requires the frequency to be set and not doing so can be a significant source of error.



**NOTE:** The frequency can also be changed by sliding the analog frequency scale pointer just below the active display – see arrow above. The pointer will change color from blue to red when the center frequency is beyond the measurement range of the sensor. The pointer is less accurate but more convenient than entering a frequency value.

Quick Start Guide PMA

#### **Measurement Resolution**

The amplitude resolution is fixed to a thousandth of a measurement unit. Frequency is selectable in MHz or GHz ranges.

#### Making an Average Power (CW) Measurement

Complete the following steps to make a typical CW measurement (all models):

1. Using a signal generator or other appropriate source, provide a signal source with the following parameters:

CW Frequency:	1 GHz
Power Level:	0 dBm (1 mW)
Modulation:	OFF
RF Power:	OFF

*WARNING:* DO NOT EXCEED +23dBm, 200mW, or 3.15VRMS. Refer to the specifications in the product data sheet for maximum allowable limits by model number.

Setup the GUI to receive the RF source input as shown below including the power and frequency units. All
parameters shown can be disabled for this example except for Triggering (option 003), which can be set to
continuous and internal mode:

Select: Measurement > CW Power (or activate the CW button on the toolbar for LB4XXA models only) Select: Measurement > Set Frequency Enter: 1 GHz Select: (Optional) Triggering > Continuous > Internal



- 3. Connect the sensor to the RF source and turn the RF power on.
- 4. The GUI display should now indicate approximately  $\sim 0$  dBm at 1 GHz.
- 5. Vary the source power to see if the GUI display tracks the source power.

Quick Start Guide PMA

#### Making a Pulse Power Measurement

Complete the following steps to make a typical pulse power measurement (LB4XXA models only):

1. Using a signal generator or other appropriate source, set the RF source for a pulse modulated output as indicated below:

Power Level:0 dBm (1 mW)CW Frequency:1 GHzPRF10 kHz (or a PRI of 0.1 msec)Pulse Modulation:50% Duty Cycle (or a pulse width of 50 usec)RF Power:OFF

*WARNING:* DO NOT EXCEED +23dBm, 200mW, or 3.15VRMS. Refer to the specifications in the product data sheet for maximum allowable limits by model number.

Setup the GUI to receive the RF source input as shown below including the power and frequency units. All
parameters shown can be disabled for this example except for Triggering (option 003), which should be set to
continuous and internal mode.

Select: Measurement > Pulse Power (or click the Pulse button on the toolbar for LB4XXA models only) Select: Measurement > Set Frequency Enter: 1 GHz

Select: (Optional) Triggering > Internal > Continuous



- 3. Notice that the active display above indicates input Duty Cycle (DC); Peak power (Pk); Average power (Avg); and Crest Factor (CrF) when in the Pulse Power mode. The larger reading indicates the pulse power.
- 4. Connect the sensor to the RF source and turn the RF power on.
- 5. The GUI display should now indicate the source power at 1 GHz: ~0 dBm pulse power; ~50% DC; ~0 dBm peak; ~-3 dBm average; and ~3 dB CrF (Crest Factor is the ratio between peak and average power or PAR).
- 6. Vary the source power and duty cycle to see if the GUI display tracks the source.

Quick Start Guide PMA

**NOTE:** The default pulse measurement setup is the automatic or 3 db points below peak power. This "dB below peak" value can be changed by de-selecting automatic and entering a different value if the specific pulse characteristics are known. *Refer to the "Pulse Measurement Criteria" and "Pulse Peak Criteria" sections of the product manual under Detailed Operating Instructions for further information.* 

# 4. Related Information

PowerSensor+™ measurements are real time presentations of power. They are not a type of calculated measurement made by most CW sensors. You will notice a corresponding change in the duty cycle reported in the GUI if you change the duty cycle of your source. You will notice a change in the pulse power (the large display), peak power, and average power if you change the power level but the duty cycle will remain unchanged.

The LB479A and LB480A can measure 350 nsec pulses at -55 dBm (and lower) with a PRF of 1 kHz (or lower). Such measurements may require averaging to be set between 5000 and 10000.

All sensor models can also make the more traditional pulse measurement using a simple duty cycle adjustment. This type of measurement is supported, however, it is generally less sensitive and more prone to error because of the pulse shape factor. *An example of this more traditional method is explained in the product manual under section 3. Basic Operating Instructions - Making Basic Measurements - Alternate Pulse Measurement.* This method can be used to measure pulse power with the LB5XXA series of microwave CW sensors.

This document was intended to touch on the basics of instrument operation. Refer to the documents below for more detailed information about the user interface:

- o LBXXXA Product Manual for the Power Meter Application
- o LBXXXA Programming Guide
- Data Sheet by model number (LBXXXA)

Available on-line at <u>www.Ladybug-tech.com</u>

LadyBug Technologies LLC 3345 Industrial Drive, Suite 10 Santa Rosa, CA 95403 Phone 707.546.1050 Fax 707.237.6724