Mini-Circuits®

User Guide

USB Smart Power Sensors

PWR-8GHS-RC
1-8000 MHz
50 Ω

PWR-8FS
1-8000 MHz
50 Ω

PWR-8GHS
1-8000 MHz
50 Ω

PWR-6GHS
1-6000 MHz
50 Ω

PWR-4GHS
9 kHz-4000 MHz
50 Ω

PWR-4RMS
50-4000 MHz
50 Ω

PWR-2.5GHS-75
100 kHz-2500 MHz
75 Ω

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Chapter 1 – General Information

1.1 Scope of the User Guide

This User Guide provides general introduction, installation instructions and operating information for Mini-Circuits PWR series of USB and Ethernet smart power sensors. For detailed instructions on specific measurement applications using Mini-Circuits measurement applications software see the Application Measurement guide.

1.2 Warranty

See the Mini-Circuits website http://www.minicircuits.com/support/ordering.html for warranty information.

1.3 Definitions

Note: A note advises on important information you may need to ensure proper operation of the equipment. There is no risk to either the equipment or the user.

CAUTION	**A caution advises about a condition or procedure which can cause damage to the equipment (no danger to users).**

WARNING	**A warning alerts to a possible risk to the user and steps to avoid it. DO NOT proceed until you are sure you understand the warning.**

1.4 General Safety Precautions

Please observe the following safety precautions at all times when using Mini-Circuits smart power sensors.

CAUTION	1. **Note the maximum input power rating in the datasheet and the conditions specified for it. Exceeding these values may damage the power sensor.** 2. **Do not exceed the operational safe power levels for extended periods of time.**

1.5 Introduction

Traditionally, when you wanted to measure signal power from electronic components or circuit boards, you'd have to connect them to a bulky and expensive bench-top power meter. Not anymore. Mini-Circuits PWR power sensors offer a whole new approach, using a quick, simple, USB or Ethernet connection to turn your Windows® PC or laptop into an RF/Microwave power meter.

The PWR series offers a low-cost replacement solution for conventional RF/Microwave power meters, but goes even further by adding portability, easy data storage, advanced data-processing capabilities, and remote operation via Ethernet. Unlike most conventional bench-top instruments, they're self-calibrating and compensate automatically for temperature. They're quick and easy to use, whether you're in the field or helping someone complete a remote test installation over the phone.

1.6 *Service and Calibration*

The only user-performed service possible for the PWR models is external cleaning of the case and connectors as needed. Do not use any detergents or spray cleaning solutions to clean the PWR unit. To clean the connectors, use an alcohol solution, and to clean the PWR case, a soft, damp cloth. The recommended calibration cycle for Mini-Circuits PWR series smart power sensors is once a year. Calibration service is available from Mini-Circuits. For details; see Ordering, Pricing & Availability Information link from individual model pages on the website.

1.7 *Contact Information*

Mini-Circuits inc.
13 Neptune Ave
Brooklyn, NY 11235
Phone: 1-718-934-4500
General Fax: 1-718-332-4661
Sales / Customer Service Fax: 1-718-934-7092
sales@minicircuits.com
For regional offices and tech support see http://www.minicircuits.com/contact/offices.html

1.8 *Technical Description*

1.8.1 **Features of Mini-Circuits power sensors**

✓ Pocket-sized portability

✓ Automatic frequency calibration & temperature compensation

✓ Turns a laptop or PC into a low-cost replacement power meter

✓ Effective, easy-to-use software

- User-friendly GUI for any Windows® 32- or 64-bit computer (command-line support for Linux®)

- Multiple data display and output options, including Excel®

- Data averaging

- Relative measurements

- Scheduled data recording with user defined spec limits

- Multi-sensor support (up to 24), display options, and management tools

- Measurement Applications suite to simplify many common test scenarios

- Remote operation via TCP/IP networks

- DLL COM objects for both ActiveX, and .NET supporting LabVIEW®, Delphi®, C++, C#, Visual Basic®, and more (see programming handbook and application note AN-49-001 for details)

- Download and install in seconds from the included CD or online from minicircuits.com.

For specific model features, performance data and graphs, outline drawing, ordering information and environmental specifications, see our catalog at:
http://www.minicircuits.com/products/usb_power_sensor.shtml

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1.8.2 Intended Applications

Mini-Circuits PWR series smart power sensors are intended for indoor use in:
- Lab and test equipment setups for both manual and automated measurements
- Remote location monitoring
- Automatic, scheduled data collection
- Evaluation of high-power, multi-port devices with built-in virtual couplers/attenuators & other software tools

The models can be used by anyone familiar with the basics of electronics measurements.

1.8.3 Conformity

Mini-Circuits PWR series power sensors conform to all requirements for the following international standards:

RoHS – The models comply with EU directive for Restriction of Hazardous Substances for 6 substances.

USB 2.0 – The models meet the specifications of the Universal Serial Bus Ver. 2.0 communication standard as described by USB-IF.

USB HID – The models meet the requirements for Universal Serial Bus Human Interface Devices according to USB-IF's Device Class Definition for Human Interface Devices firmware rev. 1.11.

TCP/IP – The PWR-xxxx-RC series models' Ethernet communication complies with the specifications of the Transmission Control Protocol (TCP) and Internet Protocol (IP) as defined in RFC 791 and RFC 793.

HTTP – The PWR-xxxx-RC series models' support all requirements for communicating with the Hypertext Transfer Protocol (HTTP) as defined in RFC 1945.

Telnet – The PWR-xxxx-RC series models' support all requirements for communicating with the Telnet protocol, as defined in RFC 854.

1.8.4 Supported software environments

Mini-Circuits PWR series power sensors have been tested in the following operating systems:
32 bit systems: Windows 8, Windows 7, Windows Vista, Windows XP Windows 98
64 bit systems: Windows 8, Windows 7, Windows Vista, Linux
The power sensors will work with almost any software environment that supports ActiveX or .Net including: C++, C#, CVI®, Delphi®, LabVIEW® 8 or newer, MATLAB® 7 or newer, Python, Agilent VEE®, Visual Basic®, AutoIT, Visual Studio® 6 or newer, and more

Additionally the HTTP and Telnet protocols can operate from almost any computer with a network connection.
For more information see Mini-Circuits programming handbook Introduction and Chapter 4 on our website.

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1.8.5 Model Selection Guide

Model Parameter	8GHS-RC	8FS	8GHS	6GHS	4GHS	4RMS	2.5GHS-75
Frequency Range	1 MHz-8 GHz				1 MHz-6 GHz	9 kHz-4 GHz	50 MHz-4 GHz	100 kHz-2.5 GHz
Impedance and Signal type	50 Ω CW					50 Ω RMS	75 Ω CW
VSWR (typ)	1.1:1					1.05:1	
Max CW Power @ RF port	+20 dBm						
Max Current via USB	250 mA	70 mA				140 mA	70 mA
Dynamic Range	50 dB					55 dB	50 dB
Operating Temp.	0° C to 50° C						
Storage Temp.	-30° C to 70° C						
Hardware Requirements	Pentium II or later & USB port or Network port & power supply *	Pentium II or later, USB port					
32-bit Windows®	Win 98, XP, Vista, Win 7, Win 8						
64-bit Windows	Vista, Win 7, Win 8						
Linux®	Command-line support for 32- and 64-bit systems (no GUI support)						
Interface	USB HID, HTTP or Telnet	USB HID					
Measurement Speed (typ)	30 ms (high-speed) 100 ms (low-noise)	10 ms (fastest) 30 ms (high-speed) 100 ms (low noise)	30 ms (high-speed) 100 ms (low-noise)				

* Using a PoE splitter allows the model to be operated from LAN with PoE without additional power supply needed.

For additional details and ordering information, click on model P/N at the top of the column.

Chapter 2 – Installation and Setup

System requirements for the PWR models are a computer (Pentium II or better) with support for USB HID. To run the GUI program a Windows operating system for either 32 or 64 bits is also required.

The PWR-xxxx-RC models can also be operated remotely over a network with mains power (100-220V) supplied using the included power adaptor.

2.1 *Software Setup*

✓ **If you have had any problems installing the software, we're here to help.**
Try following these complete step-by-step instructions. If you still experience problems, give us a call at Mini-Circuits Worldwide Technical support. It's (718) 934-4500 or e-mail apps@minicircuits.com for North America, or go to minicircuits.com/contact/worldwide_tech_support.html for other regional numbers and addresses.

2.1.1 *First* save all work in progress and close any other programs that may be running.

2.1.2 *Next,* Insert the *Mini-Circuits* CD into the CD-ROM drive, or download the full CD software from minicircuits.com. If installing from files downloaded from the web - unzip the downloaded files to a temporary folder on your desktop or C: drive, then open the file folder you created and double-click the "Install" icon.

2.1.3 *If installation from the CD does not start automatically, run install.exe* from the <CD drive> root directory.
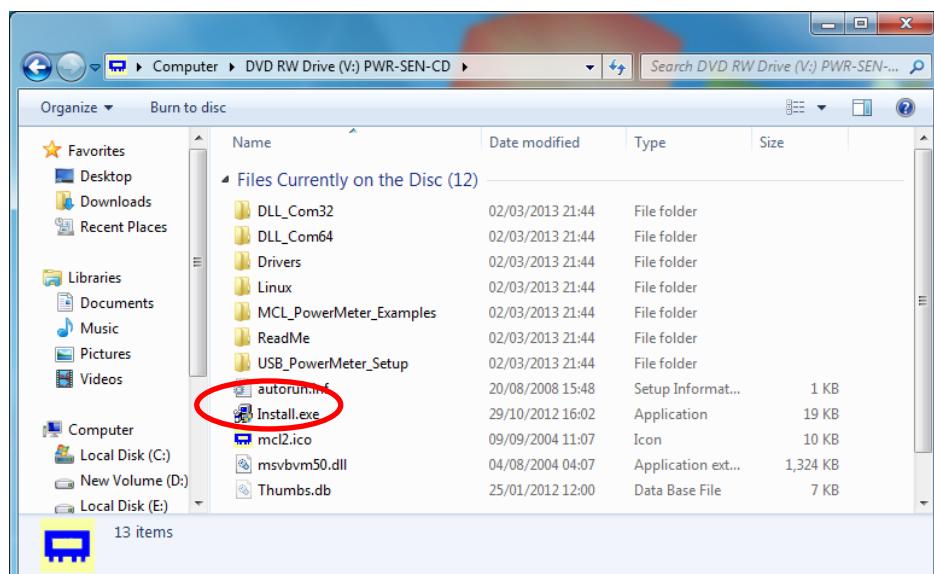
Figure 2.1.3 *CD file listing window*

2.2 Installation

2.2.1 ***The installer window*** should now appear. Click the "Install Now" button.

Figure 2.2.1 *Installation window*

2.2.2 ***The license agreement*** should now appear. To proceed, click "I Agree" and the "Continue" button.
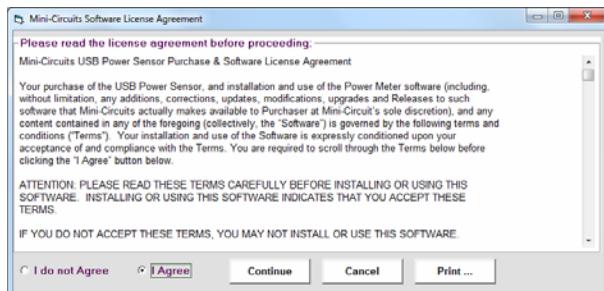

Figure 2.2.2 *License agreement*

2.2.3 ***The installation program will launch****.* Click the "OK" button to continue.
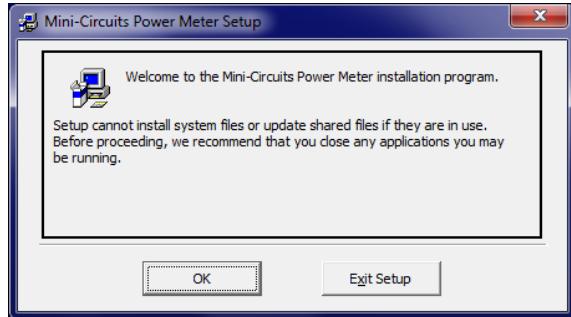
Figure 2.2.3 *Installation Program window*

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2.2.4 **The destination directory window** will appear. At this point it's a good idea to take a second and confirm the full destination address for the software. In most cases, the default will be your computer's hard drive (C:)\Program Files (x86)\Mini-Circuits Power Meter\. Or Change it then click the large button at the top to continue.
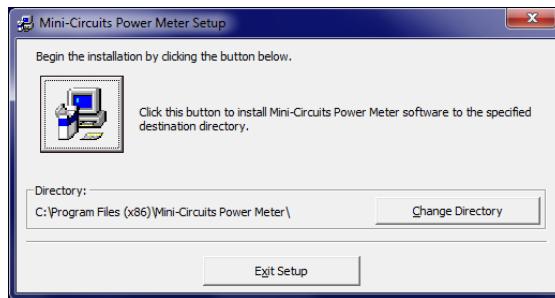
Figure 2.2.4: Destination Directory window

2.2.5 **The Program Group window** will appear. This window allows you to select the program group under which the link for the smart power meter program in the Start Menu will be created. If you change the Program Group for this software, be sure to record that information together with your destination address. Click on "Continue" to proceed.
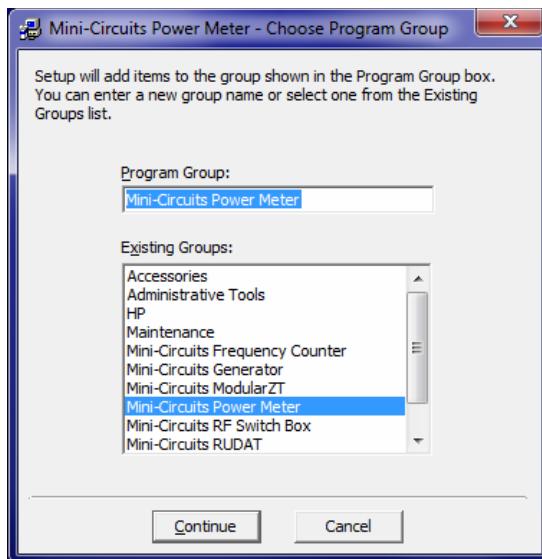
Figure 2.2.5: Program Group Window

2.2.6 **In a second or two, your installation will be complete.** Click "OK" to close the installer.
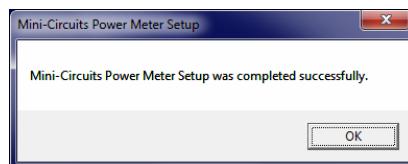
Figure 2.2.6: Installation complete

2.3 Power Sensor Physical Setup

2.3.1 **Align the red dot at** the Power Sensor USB connection with the one on the supplied cable and press in until you hear a 'click'.

Figure 2.3.1: *Plug cable into unit*

CAUTION	**1. Note the maximum rating power input in the datasheet and the conditions specified for it. Exceeding these values may damage the power sensor.** **2. Do not exceed the operational safe power levels for extended periods of time.**

2.3.2 **For USB control,** connect the USB type B plug of the supplied cable to the computer USB port and begin testing. For PWR-xxxx-RC models the RJ45 connector remains unconnected when in USB control.
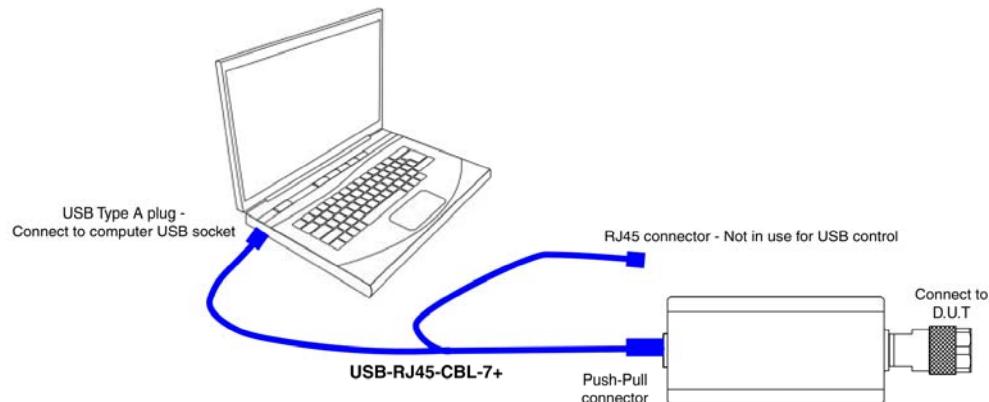
Figure 2.3.2a: *Connections for USB control of PWR-xxxx-RC model*

2.3.3 **For Ethernet control using AC/DC adaptor (PWR-xxxx-RC only)**
- Connect the USB type A plug of the 'Y' cable to the provided power adaptor and plug it in to a mains power socket, note the power sensor's power indicator lights up.
- Connect the Ethernet plug to a network port and note power sensor's Ethernet status indicators light up.
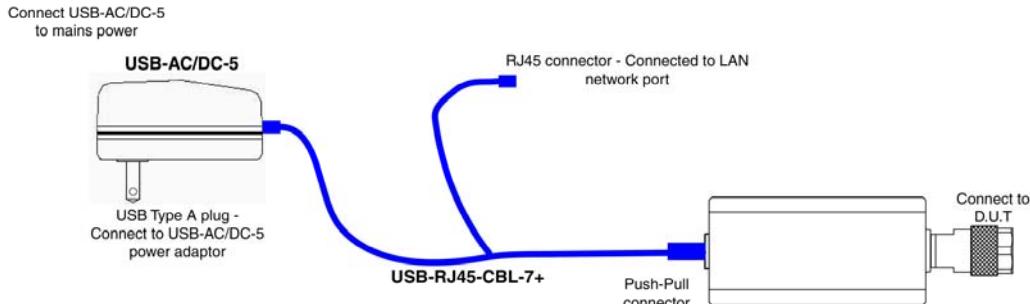
Figure 2.3.3: Connections for Ethernet control with power adaptor

2.3.4 *For Ethernet control using Power Over Ethernet (PWR-xxxx-RC only)*

- Connect your PoE splitter Data & Power socket to a network port providing DC power over Ethernet according to the instructions for the PoE splitter.
- Connect the USB plug of the 'Y' cable to the power connection of the PoE splitter (may require an adapter), note the power indicator lights up.
- Connect the RJ45 plug of the 'Y' cable to the PoE splitter's LAN socket and note the Ethernet status indicators light up.
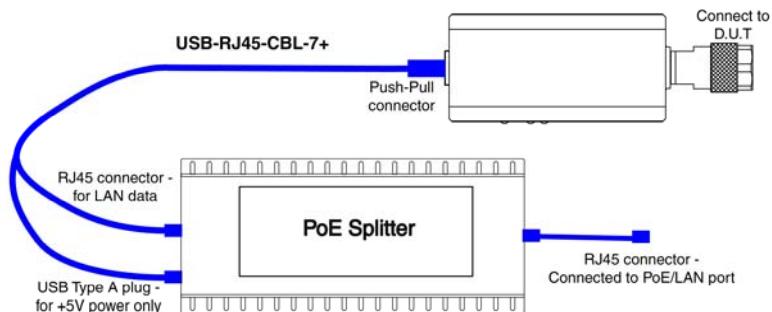
Figure 2.3.4: Connections for Ethernet control using Power Over Ethernet

Note: Using power over Ethernet requires the local network be set up to supply DC voltage in a range matching the DC input specifications of the PoE splitter used. The PWR-8GHS-RC cannot receive power via the Ethernet port and must use a POE splitter.

Chapter 3 – Using PWR Smart Power Sensors

3.1 *USB Interface*

3.1.1 **Go to the Start Menu** and select All Programs>Mini-Circuits USB Power Meter (default), or go to the other destination address you selected earlier. The "Mini-Circuits USB Power Meter" icon should be waiting there for you. Click on it and get started!
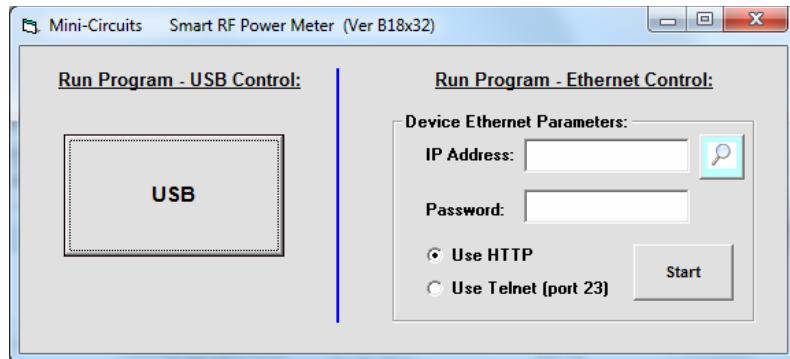
Figure 3.1.1: Power Sensor Startup screen

3.1.2 **The startup allows** you to select the control method you wish to use for the PWR units, USB or Ethernet control. All models support USB control, currently only PWR-8GHS-RC supports Ethernet control. For USB control click on the USB button, for Ethernet control see **section 3.2**

3.1.3 **If a single PWR power sensor is** connected to the computer via USB, the Smart RF Power meter screen will appear, already displaying your unit ready to start measurements**.**

Figure 3.1.3: Main screen

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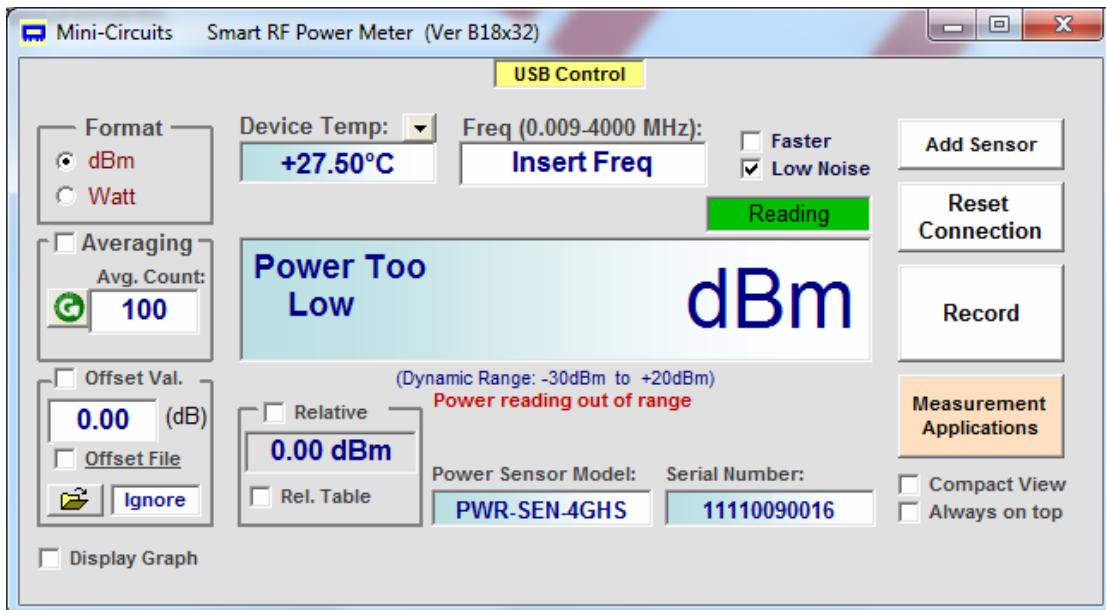
3.1.4 *If multiple PWR power sensors are* connected to the computer via USB, the initial screen will show a list of S/N for connected units. You can select a single unit, or multiple units you wish to start with – each opening in its own window. The program can handle up to 24 units connected *simultaneously*.

Figure 3.1.4: Unit selection screen
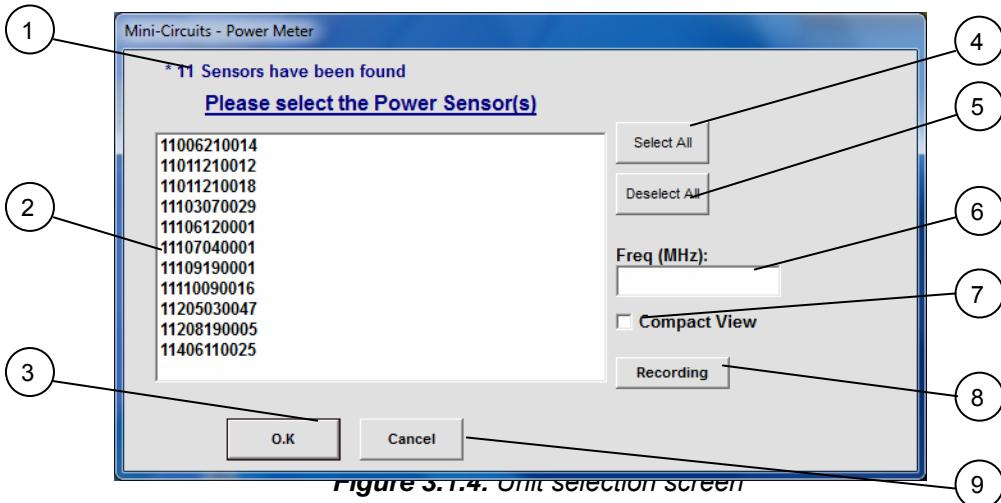
#	Name	Description
1	Number of sensors	Shows total number of power sensors detected
2	Sensor List	List, by serial number of all sensors detected
3	O.K	Proceed with the sensors selected
4	Select All	Marks all sensors listed
5	Deselect all	Cancels selection of all sensors listed
6	Freq	Enter the frequency to be tested for best results. If multiple units are selected all will use the compensation factor suitable for this frequency.
7	Compact View	Open selected power sensors in compact view
8	Recording	Open data recording window to set data recording for one or more of the sensors
9	Cancel	Exit the program

See **section 3.9** for detailed description of operating with multiple units.

3.1.5 *If no PWR power sensors are* connected to the computer via USB or there is a problem with the USB connection selecting USB will cause the following alert will pop-up. Click OK and check the USB connections before clicking the 'reset connection' button.
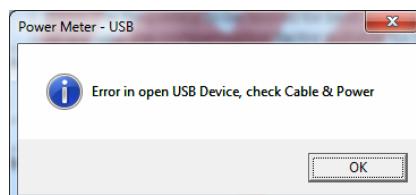
Figure 3.1.5: No USB unit found

3.1.6 ***After acknowledging the alert,*** the main measurement screen will appear with no unit selected and a 'Not Connected' notice. Click on 'reset connection' to try connecting again, or close the program.
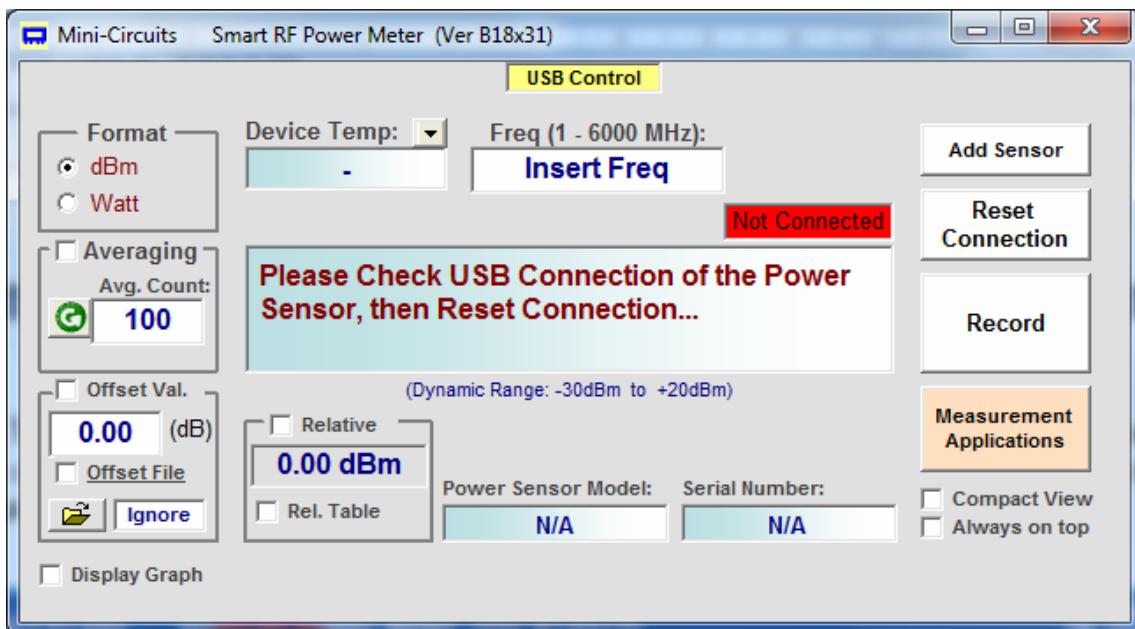

Figure 3.1.6: *No USB Unit found*

3.1.7 ***If there's a faulty D.U.T connection,*** no RF power or the power is below the sensors dynamic range a 'Power Too Low' notice will appear.
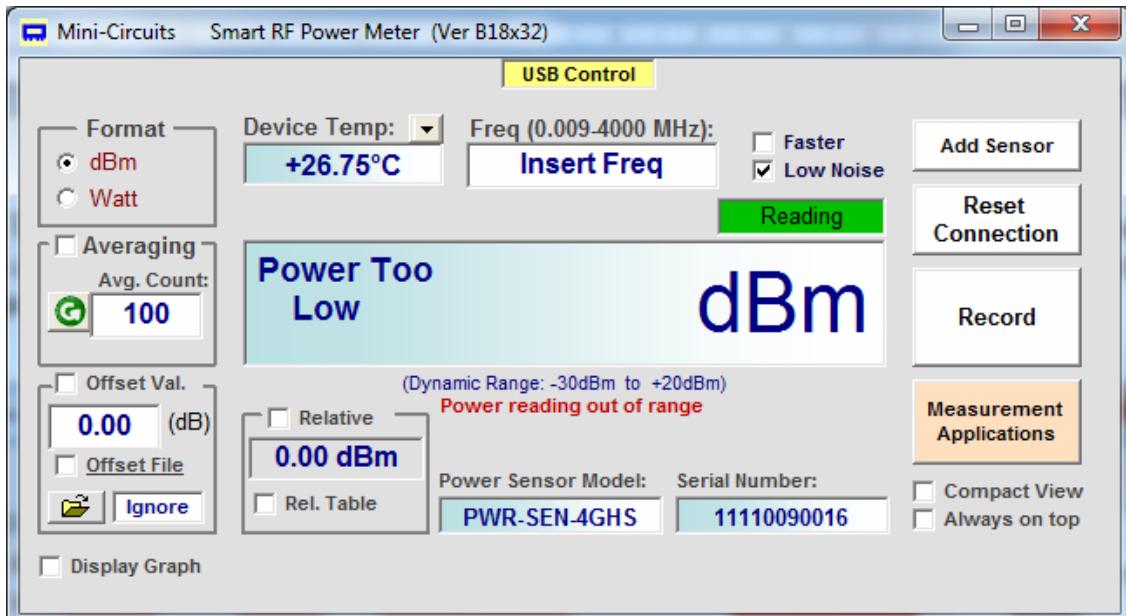

Figure 3.1.7: *Power Too Low*

3.1.8 _The Ethernet Configuration (PWR-xxxx-RC only) screen can_ only be accessed from the USB control main screen. Click on the Ethernet-Config button in the bottom right corner of the screen, and the Ethernet configuration screen will appear.
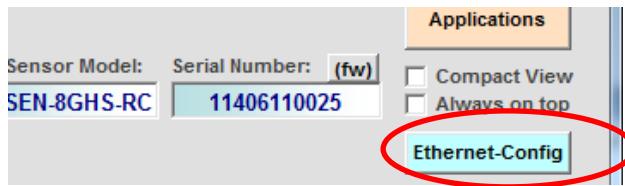
Figure 3.1.8 Ethernet-Config button on USB main screen

3.1.9 _The Ethernet Configuration screen will_ open showing the current configuration. **Figure 3.1.9** shows the factory default of the power sensor. If these settings fit your local network, you do not need to access the setup before connecting the power sensor to the network.
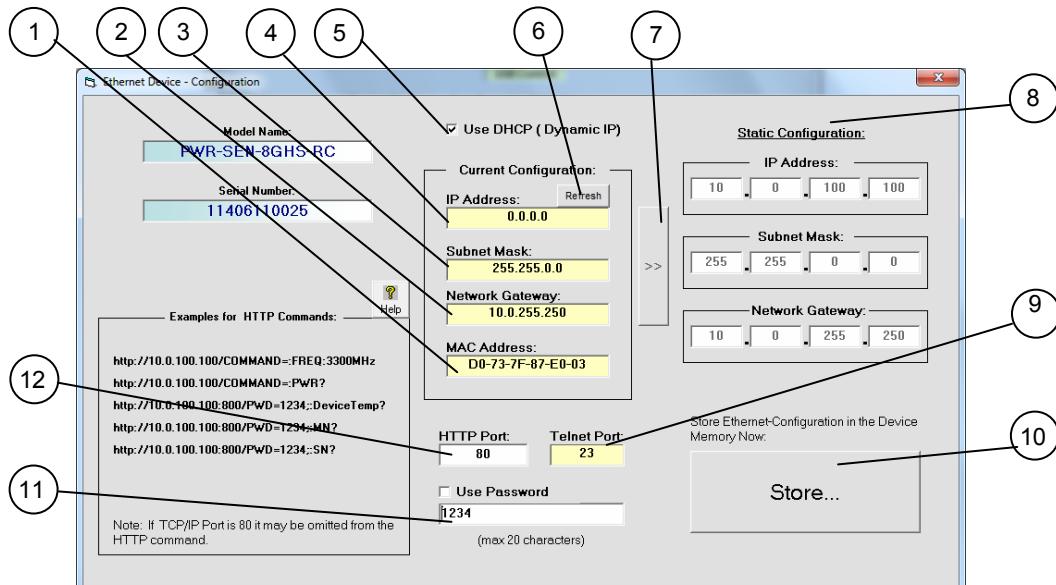
Figure 3.1.9: Ethernet Config. screen (showing factory default state)

Note: If you are using a proxy server for your LAN connections you may need to define a name for the power sensor IP address, or disable the proxy server to connect to the power sensor via Ethernet.

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3.1.10 *The Ethernet Configuration settings are:*

#	Name	Description
1	MAC Address	Media Access Control Address – a unique, unchanging identifier for the smart power meter unit.
2	Network Gateway	IP address of the network gateway. When DHCP is selected this is assigned by the server.
3	Subnet Mask	The Network's Subnet Mask. When DHCP is selected this is assigned by the server.
4	IP Address	The IP address of the unit in your Network. When DHCP is selected this is assigned by the server.
5	Use DHCP	When selected the smart power meter will query the server for appropriate parameters with no input from the user and will disregard manually entered IP address, subnet mask and network gateway settings.
6	Refresh	Request IP address, gateway and subnet mask from the server.
7	Copy State	Copies current state of dynamic IP to static IP, not available when DHCP is selected.
8	Static Configuration	When DHCP is not selected the user must specify the values below and will not be changed by the server.
9	Telnet Port	Port to be used for Telnet communication. Cannot be changed by user
10	Store	After you've made all changes you want to click on this button to save the settings.
11	Password	If you want to limit the users able to access the power sensor select "Use Password" and enter the desired password (up to 20 characters).
12	HTTP Port	Specify the port to use for HTTP communication with the network (default 80). Note port address does not get assigned by the server when DHCP is selected. Port 23 is reserved for Telnet communication and cannot be used.

3.1.11 *After making the changes you want, click on "Store"* and the
changes will be saved to the smart power meter's memory. See **section 3.2** for working with Ethernet control**.**

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3.2 *Ethernet Interface (PWR-xxxx-RC only)*

3.2.1 ***After starting the GUI (section 3.1) you*** can select the control method you wish to use for the PWR, either USB or Ethernet control. All models support USB control, only models with the RC suffix (such as PWR-8GHS-RC) support Ethernet control. To start operation with USB see **section 3.1**. For Ethernet control either type the IP address and port of the power sensor, or click on the search icon.
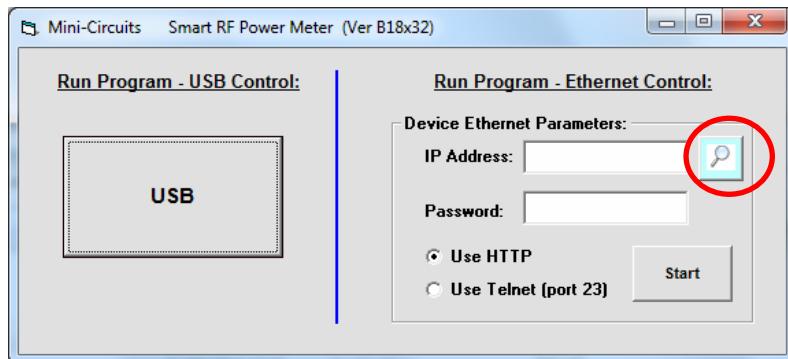

Figure 3.2.1: Power Sensor Startup screen

3.2.2 ***After clicking on the search icon*** The IP search will pop up with a list of smart power meter IP addresses found and their HTTP ports on the left side of the screen, and full details of each unit on the right. Mark the IP address you wish to use and click select. The search window will close and the IP address will be entered in the IP address field of the initial screen automatically.
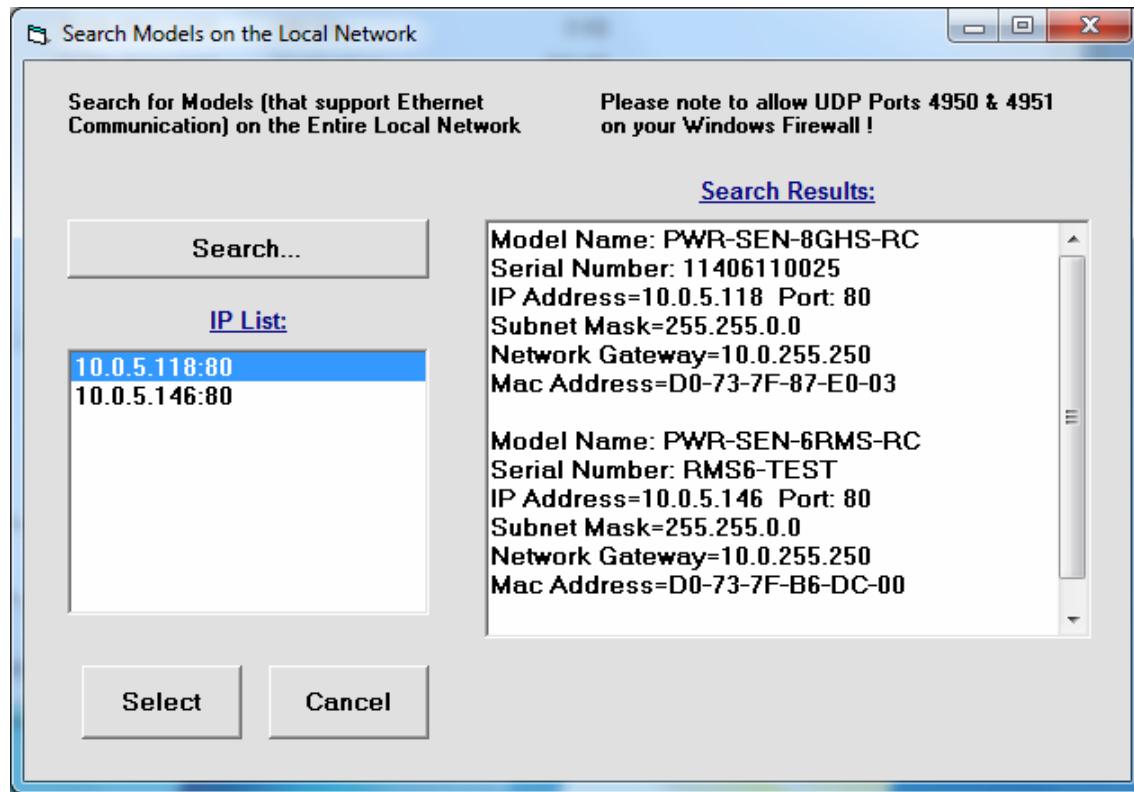
Figure 3.2.2: Ethernet IP search window

Notes:

1) To refresh the list of units found click on the Search button.
2) The search function uses ports UDP 4950 and UDP 4951 for communication, ensure your firewall allows access to these ports.

3.2.3 ***After entering the IP address,*** enter your password if you set one (see **section 3.1.10**), select the communication protocol you wish to use (HTTP or Telnet) and click start, the unit's main screen will open.

Note: changing Ethernet settings is only possible via USB control, see **section 3.1.8** for details.

3.2.4 ***Telnet or HTTP commands can*** also be used to control the power sensor without using the GUI. Just type in the command in the address field of your Internet browser or implement a Get/Post HTTP function in your selected application (for HTTP) or establish a Telnet connection (for Telnet). A full list of the commands available and their syntax is available in Mini-Circuits programming handbook chapter 2, and in a text file on the CD provided with the power sensor, in the Ethernet directory.

Note: Depending on the browser used and your network configuration you may need to disable the proxy server for your computer, or add the smart power meter's IP address to the list of addresses in the proxy server.

3.3 *Main Screen*

The main screen provides a simple and easy-to-use interface for measuring RF power with the PWR power sensor (See **Fig 3.3**).
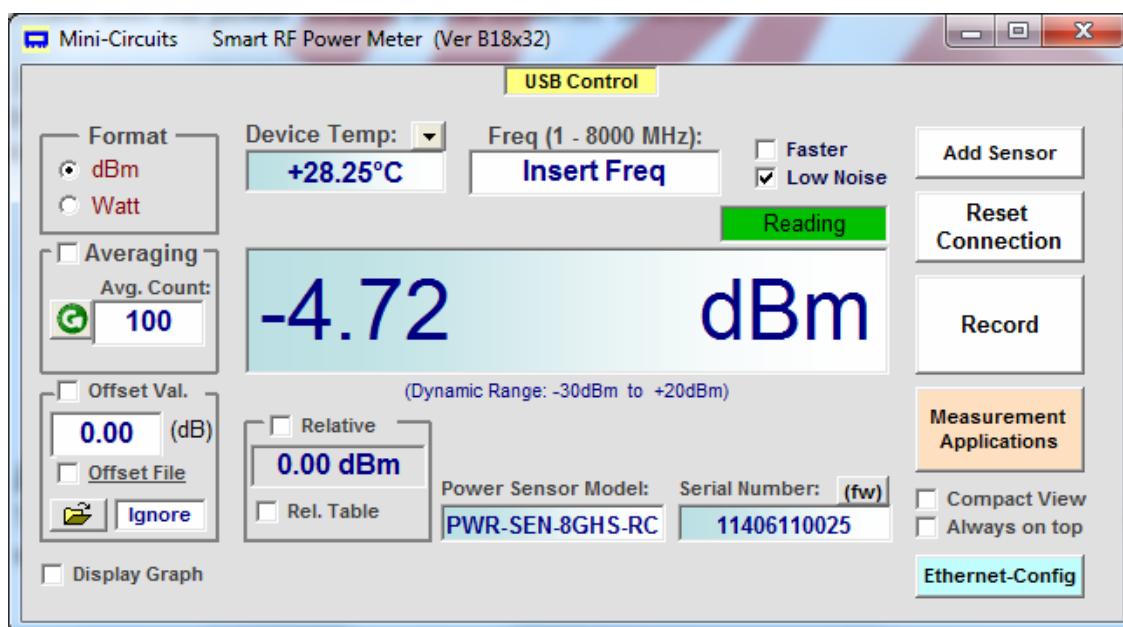
Figure 3.3: PWR Main Screen

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3.3.1 *Left Side of Screen (Fig. 3.3)*

Format Select dBm or Watts format to display the data in.

Averaging Check the averaging box and enter the number of measurements you wish to average. Individual measurements will be taken at the specified measurement speed (see section 3.3.2). When selected the power sensor will average the power reading over the number of measurements specified in Avg. Count and display the number of measurements averaged. Clicking on the button to the left of the average count window will clear the averaged values and reset the count.

Offset Val. This feature allows the user to compensate for Loss or Gain in their DUT setup. A positive value compensates for a Loss, and a negative value for a Gain. Click on the check box, and enter the appropriate value (in dB) in the window below.

Offset File Check to get offset values from a saved file. Primarily used for advanced Measurement Applications, described below.

Display Graph Check to activate real-time graph, see **section 3.4** for details.

3.3.2 *Top Center of Screen (Fig. 3.3)*

Device Temp. Displays the power sensor's internal temperature. Click on the drop box to select Celsius or Fahrenheit display format. The PWR smart power sensors compensate automatically for any temperature variation in the 0-50°C (32-122°F) range.

Freq Displays the power sensor's specified frequency range and allows the user to enter the expected input frequency. For best performance, enter the approximate signal frequency you wish to test.

Meas. Speed Check the mode in which you wish to operate. "Low Noise" – 100ms typ, "Faster" – 30 ms typ, or (for PWR-8FS only) "Fastest" – 10ms typ.

Connection status Displays the status of connection to the power sensor: "Reading" – good connection, "Searching" - attempting to reestablish connection, "Not connected" – Power sensor not found.

3.3.3 *Bottom Center of Screen (Fig. 3.3)*

Relative Check to save your current reading as a baseline value. From then until unchecked, measurements will show how DUT power varies from that baseline. In dBm format, relative results are given in dBc and in Watt format in %.

Rel. Table Opens Relative Frequency points Table. When table is filled entries in the table will supersede current reading for relative measurements. See **section 3.5** for details.

Model Displays model name of power sensor currently connected.

Serial Number Displays serial number of power sensor currently connected.

(fw) **(For PWR-8GHS-RC model only)** opens the Firmware info window to allow upgrading the firmware of the connected sensor. See **section 3.7** for details

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3.3.4 *Right Side of Screen (Fig. 3.3)*

Add Sensor Click to work with more than one sensor from the same computer. For more details, see **section 3.9**, "Multi-Sensor Setups".

Reset Connection Click to reconnect a power sensor to your computer after it was disconnected, or when replacing one sensor with another.

Record Opens the data record window, for more details see **section 3.6**.

Measurement Applications Open advanced measurement applications window. See Measurement Applications Guide for details.

Compact View Reduce size of window. This option is usually employed for multi-sensor setups. See **section 3.8** for details.

Always on Top Click to keep your power sensor screens on top of other applications.

Ethernet-Config **(For PWR-8GHS-RC only)** when in USB control opens the Ethernet configuration window to change the current configuration. See **section 3.1.8** for details.

3.4 *Real-Time Graph*

Checking the 'Display Graph' box in the lower left corner of the main screen will cause a graph window (**Fig. 3.4**) to appear below the main screen.
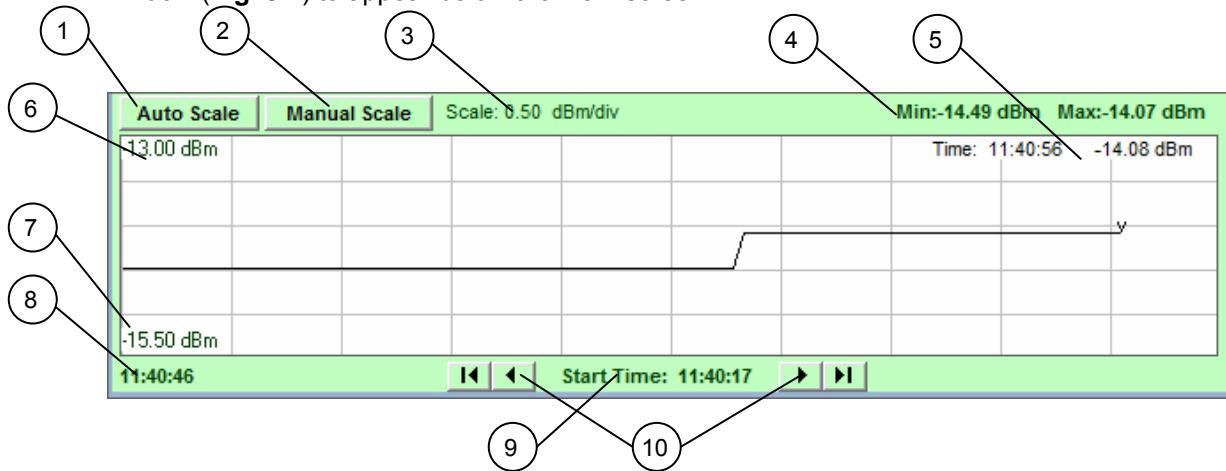
Figure 3.4: Real-Time graph

3.4.1 *Real-Time graph indicators and functions (Fig. 3.4)*

#	Name	Description
1	Auto Scale	Set Y scale automatically to best display current data.
2	Manual Scale	Opens a small window to allow setting the Max value and value per div. of the Y axis. The values shown will be in the same units as those specified in the Main screen format field. Clicking on the button a second time will close the Manual Scale window.
3	Scale	Current value per division of Y axis
4	Min/Max values	Minimum and Maximum values currently displayed in graph
5	Current reading	Current time and power reading
6	Max scale	Max value of Y scale
7	Min scale	Min value of Y scale
8	Time	Start time of currently displayed graph
9	Start Time	Time at which real-time graph was started
10	Arrows	Use arrows to scroll back and forth in graph.

3.5 *Relative Frequency Points Table*

3.5.1 ***Checking the 'Rel. Table' check box*** will open the relative frequency points table shown in Fig 3.5. This table allows specifying multiple points for relative measurements. To add a point to the table enter the relevant frequency and click on 'Add Relative Point' – the current power reading will be added to the table.
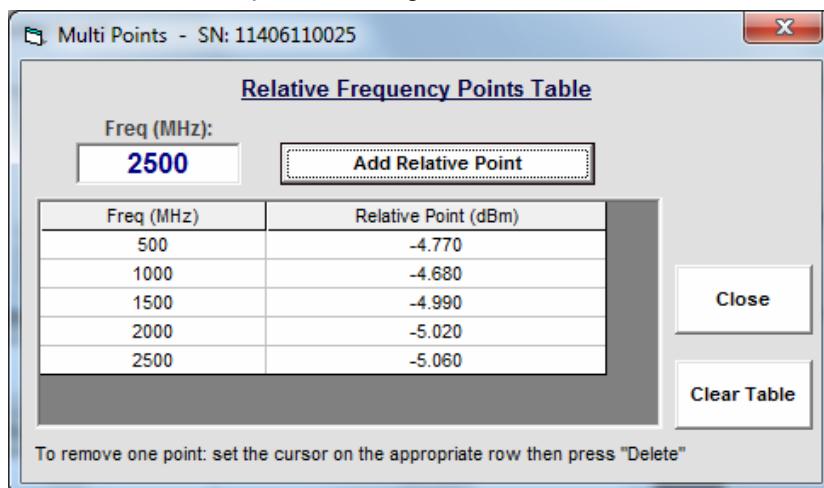
Figure 3.5.1: *Relative Frequency Points Table*

3.5.2 ***To delete a*** point click on the row you wish to delete then press the 'Delete' key. To delete all values from the table click on the 'Clear Table' button.

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3.5.3 **Once you're satisfied** with the entries close the table, the main screen will now show 'TABLE' in relative measurement field. Checking the 'Relative' checkbox will change all measurements into relative measurements referenced to the values in the table. If a frequency not listed in the table is specified for measurement the smart power meter program will calculate the correct reference value based on interpolation of existing data points.
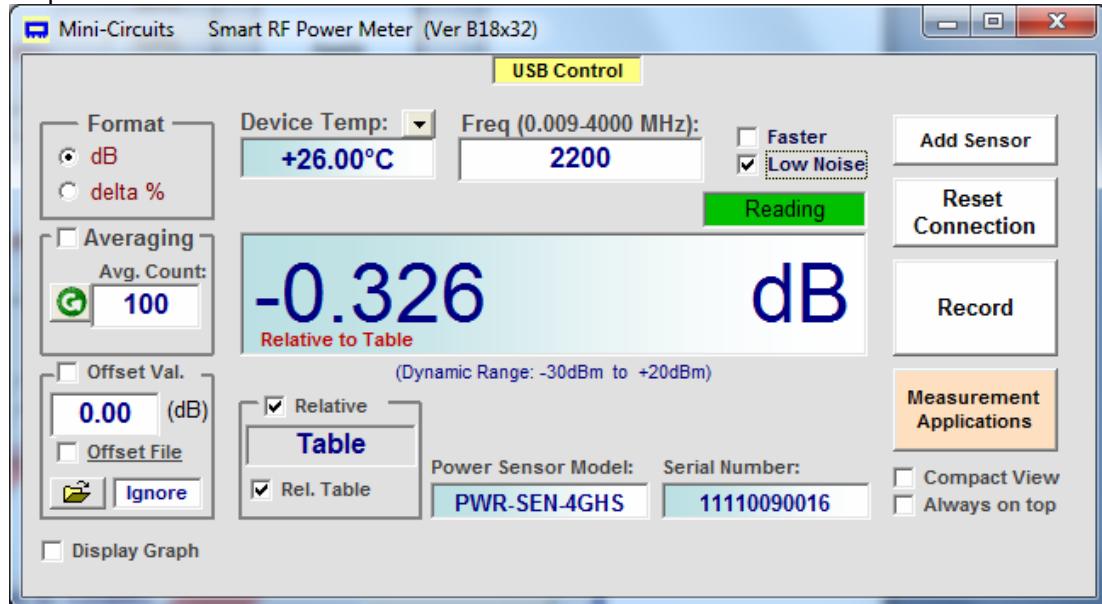
Figure 3.5.3: Measurements relative to table

3.6 Data Record Window

Get started by clicking the Record button on the right side of the Main Screen. The Power Meter Recording Screen will open, with the serial number of the sensor being recorded at the top:

Figure 3.6: Data Record Window

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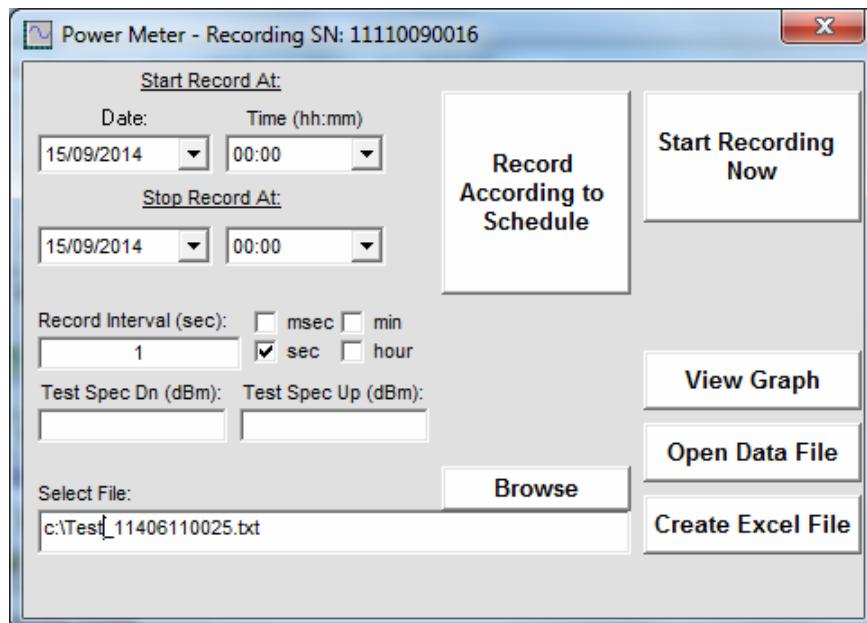
3.6.1 *Left side of Screen (Fig. 3.6)*

Start Record at: Specify date and time at which to start recording, for scheduled tests.

Stop Record at: Specify date and time at which to stop recording, for scheduled tests.

Record Interval Specify the interval at which data points will be recorded, from every 10ms, to 9999 hours. Make sure the measurement speed is less than the record interval.

Test Spec If you enter specification limits in these fields data points which exceed these limits (either above or below) will be marked in the data by an asterisk (*).

Select File Enter the path and file name where you wish to record data, there is no required file name. See **section 3.6.4** for data format.

3.6.2 *Right side of Screen (Fig. 3.6)*

Record According to Schedule Close record window, saving current settings and schedule. Data recording will start according to the schedule specified.

Start Recording Now Close record window, saving current settings. Data recording will start immediately

Browse Open a browse window to select an existing file, or navigate to the desired path.

View Graph Open a graphical presentation of the data stored in the selected file.

Open Data File Open the data file selected (read only presentation).

Create Excel File Export data in selected file to Excel file and open the new Excel file (requires Microsoft Excel to be installed on the local PC)

3.6.3 *View Graph*

Clicking on the 'View Graph' button in the data record window (**Fig 3.6**) will open a graphical presentation of the recorded data(**Fig 3.6.3**). Default presentation is of power only, using the same units as the data was recorded in, but user can select to present both power and temperature by checking 'Show temperature graph' or change the power units by clicking on the arrow next to the graph title.

Figure 3.6.3: *View Graph Window*

3.6.4 *Open Data File*

Data recorded is saved to a text file in the format shown in **Fig. 3.6.4**

Figure 3.6.4: *Data File Window*

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3.6.5 *Create Excel File*

When exporting data to an excel file Data will initially be in format shown in Fig 3.6.5

Figure 3.6.5: *Excel data Window*

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3.7 Firmware Update (PWR-xxxx-RC only)

The firmware upgrade process requires a computer running a Windows operating system and with the latest Mini-Circuits GUI (Graphical User Interface) program installed for the PTE model to be upgraded.

3.7.1 *In line with our Quality Policy and our efforts toward* continuous improvement, Mini-Circuits frequently adds new features to improve our existing software. To get the latest firmware, go to:
http://www.minicircuits.com/support/software_download.html scroll to the power sensor section and click on the Firmware Download link at the bottom right corner of the section (**Fig 3.7.1**), this will take you to the firmware download page.

Figure 3.7.1: Software Download page, PWR section

3.7.2 **Check the revision listed** for PWR-8GHS-RC, if it is newer than the revision you have installed - click on the download link for PWR-8GHS-RC. Save the zip archive to your computer and extract the .Hex file it contains without changing the filename.

Note: If the file name of the .Hex file is changed it will not be recognized as a valid firmware file.

3.7.3 *The smart RF Power Meter GUI* must be started in USB control (See section 1) to allow Firmware upgrade. When in USB control, you will note an **(fw)** indicator over the serial number field in the PWR-8GHS-RC main screen (other models do not support firmware upgrade at this time).
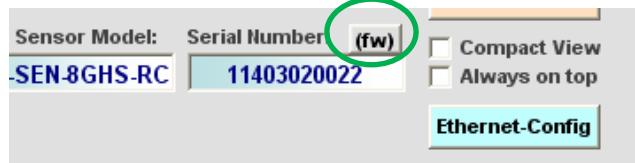
Figure 3.7.3: Firmware indicator on main screen

CAUTION	A power interruption, to either the computer or the power sensor while the firmware is being updated may cause the firmware to be corrupted. It is therefore recommended to only update the firmware while the computer is connected to an Uninterruptible Power Supply (UPS).

3.7.4 ***Click on the '(fw)' indicator,*** this will cause the firmware - info window to open (See **Fig. 3.7.4**). The 'Firmware' listed is the version of the firmware installed in your smart power meter. Click on "Update Firmware" to select a new firmware version to install or click 'Exit' to close the firmware – info window.
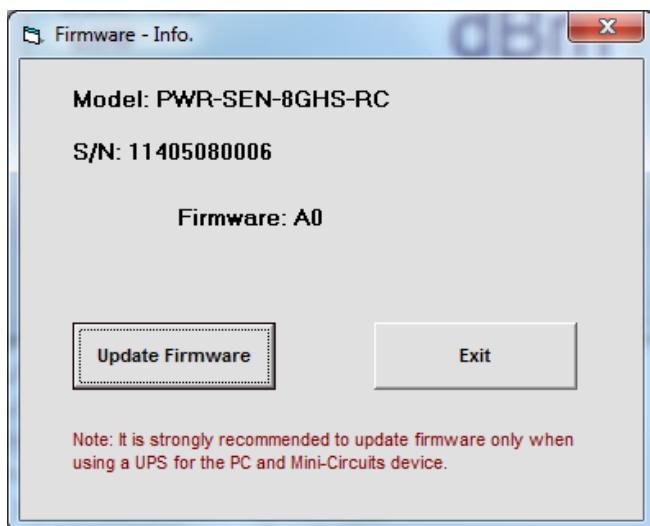
Figure 3.7.4: Firmware
Information Window

3.7.5 ***A browse window will open to the firmware directory*** under the path you selected when installing the GUI program (See **Fig. 3.7.5**). Navigate to where you saved your firmware file in **section 3.7.1**, Select the firmware version you wish to install and click 'O.K'.
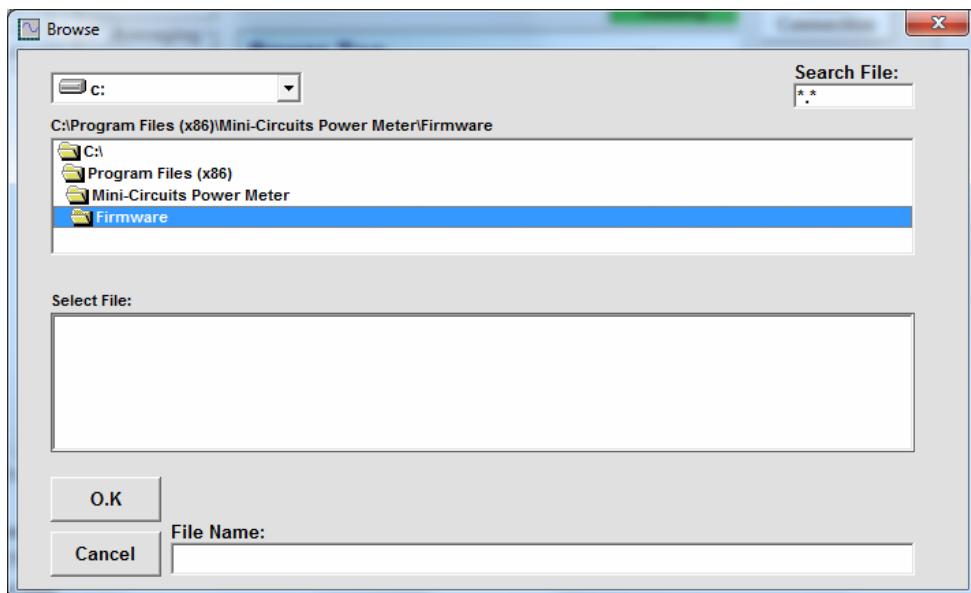
Figure 3.7.5: Firmware - Browse Window

3.7.6 ***The selected file will be installed in the power sensor.*** The process will take up to a minute***.***
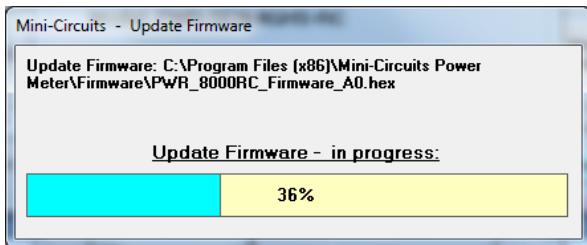
Figure 3.7.6: *Firmware - Progress Bar Window*

3.7.7 ***After the firmware has updated*** an alert will appear. Click 'OK' to shut down the smart power meter program and then restart it normally.
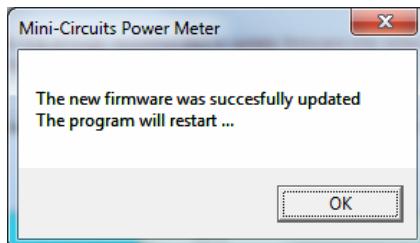
Figure 3.7.7: *Firmware - Successful Update*

3.8 *Compact View*

3.8.1 ***Checking 'Compact View'*** in the bottom right corner of the main screen will cause the screen to shrink to the compact view display.
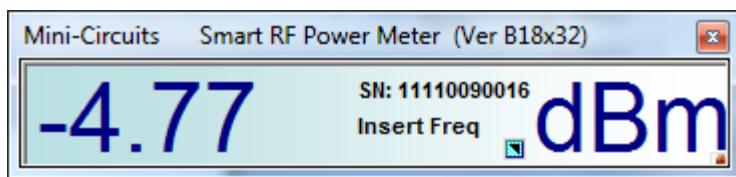
Figure 3.8.1: *Compact view window*

3.8.2 ***Clicking on any spot in the 'Compact View'*** screen will cause the program to return to the main screen. In compact view the program displays power measurement, measurement units, Power sensor S/N, and the frequency entered but you must return to main screen to change any parameters.

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3.9 *Working with multiple sensors*

3.9.1 *Starting with multiple power sensors*
When the smart power meter detects multiple power sensors on startup, the power sensor selection window will appear. Select the sensors you wish to work with, or click 'Select all' for all sensors.
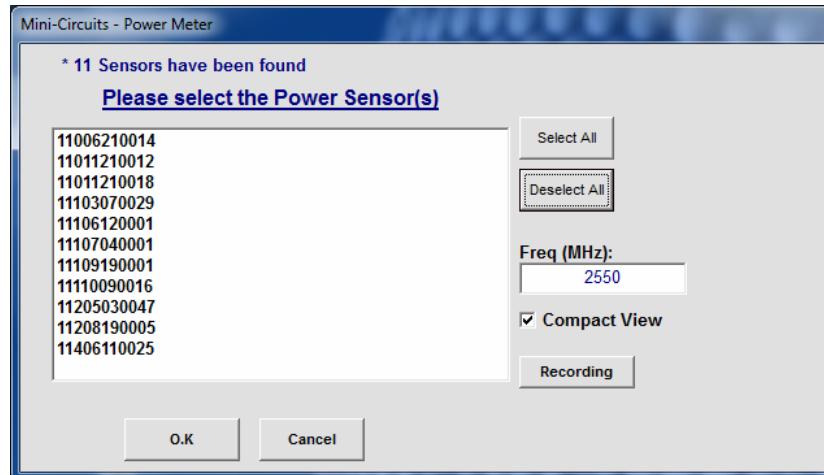
Figure 3.9.1: Power Sensor selection window

3.9.2 *Specifying frequency and Compact view*
If all the sensors you are working with are testing the same frequency you may enter the frequency in frequency field of the power sensor selection screen, instead of individually for each sensor. When working with many power sensors simultaneously, it is recommended to check the compact view box before starting them so as to have all sensors open initially in compact view and only expand them when you need to modify the settings (See **Fig** *3.9.2)* .

Figure 3.9.2: Multiple power sensor windows

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3.9.3 *Data recording*

Clicking on the 'Recording' button in the bottom right corner of the screen will cause the data recording section of the window to expand below the initial power section selection window (See **Fig 3.9.3**). Recording data settings in this window will apply to all power sensors selected. For description of data recording settings see **section 3.6.**
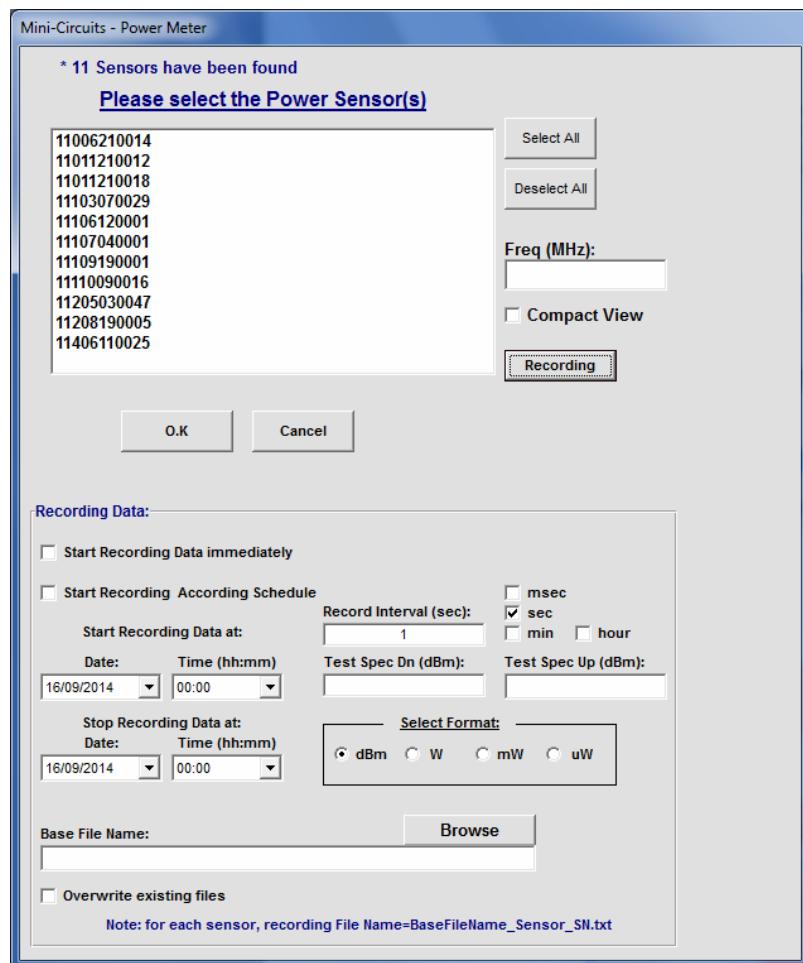
Figure 3.9.3: *Recording Multiple power sensors*

Note: File names for multiple power sensor data recording are always in the format of [path]_[model S/N].txt. Thus if the path entered is c:\test the data for power sensor serial number 11405080006 will be saved to file c:\test_11405080006.txt

3.9.4 *Add sensor*

If you have already started working with a PWR power sensor and wish to start a second sensor you can click on the 'Add sensor' button in the main screen. This will open a second startup screen, as shown in **section 3.1.2**, showing the additional sensors available. If only two sensors are connected via USB when clicking on USB it will automatically open the second sensor, without displaying the power sensor selection screen.

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