LB5900 Series Power Sensor
Analog Recorder Output Operation Guide

The Recorder Output function (Option 001) is a 0 to 1 VDC calibrated, scalable output that is proportional to the measured RF input power. Note that on LB5900 series Analog Recorder Out and Trigger Out share the same connector. Only one can be used at any one time. PMA-12 sets the output to Recorder Out automatically when *Recorder Out* is selected using the Mode dropdown menu. Once this is done, the Start RO button can be used to enable and disable Recorder Out. The recorder output signal passes through a 40 Hz hardware filter and the output is updated 1,000 times per second.

An important unique feature of LadyBug's Recorder Output Option is that it is capable of running when no computer is connected. For example, after the options are set up, and Recorder Out is active, the sensor can be powered through the USB cable or through the SPI cable if Option SPI has been purchased; and recorder output will deliver a calibrated analog output if set accordingly.
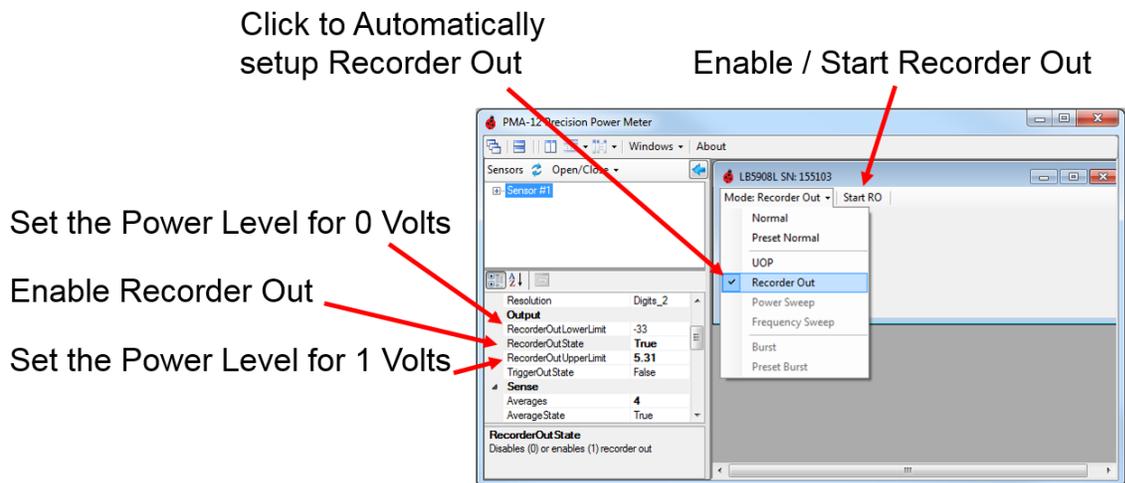

Figure 1 - Recorder Out Setup

The level setup for the **Recorder Out** is located in the Sensor's Detail Tab. Setup is accomplished by establishing a desired power level for 0-Volts (lower power level) on the Recorder Output and a power level that is to result in a 1-Volt Output (the higher power level). Power applied below the lower level will result in a 0-Volt output; and power over the higher power will result in a 1-Volt output. It is important to note that the sensor's output MUST be driven
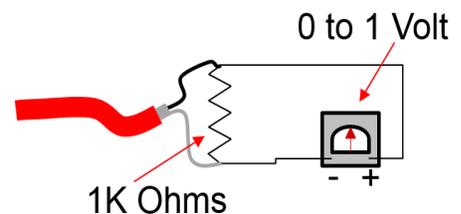
into a 1,000 ohm load (see image at right) for the output scaling to be accurate. The output voltage will not be correct without the load. Once the settings are established, the output will be a linear representation of the power between the two levels, the levels are set with dBm values. The output voltage within these ranges is a calibrated DC measurement value.

To set up Recorder Out, identify the minimum and maximum power levels (in dBm) that you require. Place these values in the *RecorderOutLowerLimit* and *RecorderOutUpperLimit* in the left hand pane as shown in Figure 1. Once the values are established, the formula below can be used to determine the output voltage (Vout) for any given dBm power level.

$$V_{out} = (10^{(PMEAS/10)} - 10^{(ZeroVoltSet/10)}) / (10^{(OneVoltSet/10)} - 10^{(ZeroVoltSet/10)})$$

The same formula (shown below) can be copied and pasted into excel at cell B4. When pasted into cell B4, the cells listed below will establish the inputs values. All power units are in dBm. Out of range data is not accounted for.
B1 is the dBm power setting to deliver for 1 Volt
B2 is the dBm power setting to deliver 0 Volts
B3 is the actual input power.

$$=(10^{(B3/10)} - 10^{(B2/10)}) / (10^{(B1/10)} - 10^{(B2/10)})$$

Grounding Note
LB5900 Sensors have solid grounding between the USB shield, USB Common and SMB (Recorder Out) Common connections. It is important to take ground current into consideration between all connected equipment. LadyBug Recorder Out resolution specifications are generally (see specification sheet for exact specification and sensor accuracy data) in the range of 25 micro volts. Small ground currents caused by power across cables can affect the measured output voltage if care is not utilized.

Using Recorder Out in Unattended Mode

Analog Recorder Out can be used with no computer attached. The sensor can be set to retain the Analog Recorder Out settings and start with the output activated by activating the Unattended Mode (UOP) and Analog Recorder Output.

Note: The analog out features of Unattended Operation (Option UOP) are included with the purchase of the Analog Recorder Out (Option 001), however the unattended internal digital measurement storage is not implemented.

During the power up cycle when UOP is active, Analog Recorder Output will exhibit voltage transitions from 0 volts to 5 volts until the sensor's processor is running. After stability; and prior to measurement, the output will be at 1 volt (into its specified 1000 ohm load); after the sensor begins normal operation, the output will be stable and is updated 1000 times per second. Depending on the sensor model, firmware version and the number stored measurements, time to stability can be up to 20 seconds.
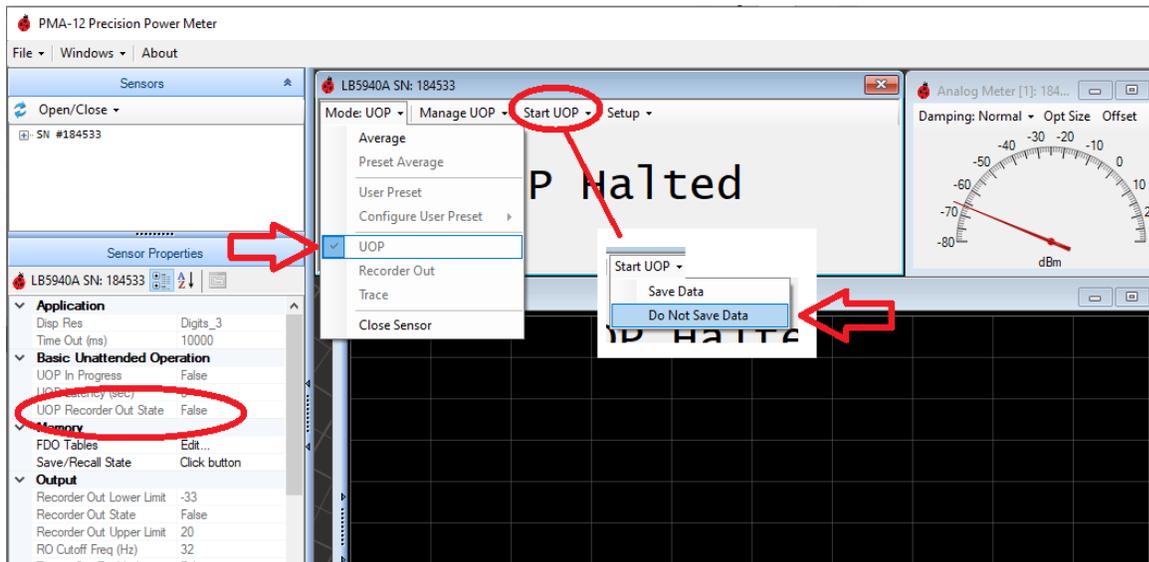
Figure 2 - Recorder Out in Unattended Operation

To protect equipment that may be controlled by Recorder Out, the default condition for Recorder Out when returning from power up is always OFF unless specifically set otherwise, this includes power up in Unattended Operation. To enable Recorder Out for use while the sensor is operating in Unattended Operation mode, a special function must be set. This parameter, *UOP Recorder Out State*, is circled at left in Figure 3. When set to True, Recorder Out will function while the sensor is running in Unattended Mode. The parameter can only be changed when the sensor is operating in Average mode (Figure 3 middle, Mode). While the sensor is in UOP Active mode (In progress) the function will remain set and the sensor can be repeatedly power cycled without losing the Recorder Out settings or UOP state. If the sensor is powered up while UOP is not active, *UOP Recorder Out State* will be cleared to FALSE and Recorder Out will not operate in Unattended Operation unless the parameter is set again.

Unattended Recorder Out Example

To enable Recorder Out while in Unattended Operation, perform the following.

1. Set the sensor to Preset Average and set your Frequency
2. Set Recorder Out Upper and Lower Limits (See Recorder Out section for info)
3. In the Sensor Window, Under the Mode Dropdown, Set the mode to *Recorder Out* (Figure 3 middle)
4. Verify Recorder Out functionality
5. Under the Mode Dropdown, Set the mode back to *Average* (Figure 3 middle)
6. Under *Basic Unattended Operation*, set *UOP Recorder Out State* to True (Figure 3 left)
7. In the Sensor Window, Under the Mode Dropdown, Set the mode to *UOP* (Figure 3 middle)
8. In the Sensor Window, Click Start UOP
9. In the Sensor Window select *Do Not Save Data* or if Option UOP is installed, data can be stored.
10. Remove and Reconnect power and test to verify
11. To return the sensor to normal operation, connect to the computer, select *Halt UOP*, (which appeared in the menu when UOP was started); then set Mode to *Normal* set *UOP Recorder Out State* to *False.*