

**Software User Guide**

# **PSN50 CalXpert™**

The Anritsu logo is located in the bottom right corner of the page. It consists of the word "Anritsu" in a bold, sans-serif font. The letter "A" is stylized with a diagonal slash through it.

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	铅 (Pb)	汞 (Hg)	镉 (Cd)	六价铬 [Cr(VI)]	多溴联苯 (PBB)	多溴二苯醚 (PBDE)
印刷线路板 (PCA)	×	○	×	×	○	○
机壳、支架 (Chassis)	×	○	×	×	○	○
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# Chapter 1 — General Information

## 1-1 Scope of Manual

This manual provides general information, installation, and operating information for the Anritsu PSN50 CalXpert™ software application for the PSN50 USB Power Sensor and is intended for users who want to calibrate the PSN50 USB power sensor themselves or through a third-party calibration laboratory.

The procedures described in this manual are specific to the PSN50. Throughout this manual, the terms PSN50 and power sensor will be used interchangeably to refer to the device. Manual organization is shown in the table of contents.

This chapter contains a description of the PSN50 power sensor and a brief background on power sensor calibration.

## 1-2 Description

The PSN50 power sensor is a highly accurate, instrument that communicates with Anritsu Handheld (Portable) instruments. The power measurement capability of the PSN50 is intended to mimic that of a traditional thermal (thermo-electric) power sensor; therefore, it is ideal for measuring the average power of CW, modulated RF waveforms such as 3G, 4G, OFDM, and multi-tone signals. In other words, it measures true RMS power regardless of the type of input signal.

**Note** The power sensor has a USB 2.0 interface with a USB Type Mini-B port. The PSN50 can be remotely programmed over this USB interface. In addition to programming, the PSN50 is powered by the USB. The interface is USB 2.0 compatible, but with an interface speed of 12 Mbps.

The PSN50 sensor is a dual path diode sensor where each detection path is assigned to measure a specific range of input power levels. The high power path is assigned to measure power from +20 dBm to -7 dBm while the low power path is assigned to measure power from -7 dBm to -30 dBm. Within their assigned power levels, each of the detection diodes are operating in square-law and are inherently linear in power without requiring any sophisticated correction. An additional benefit of being inherently linear with the absence of complex corrections allows the PSN50 to be linear with virtually any signal type including CW and complex modulated signals such as WCDMA or WiMAX.

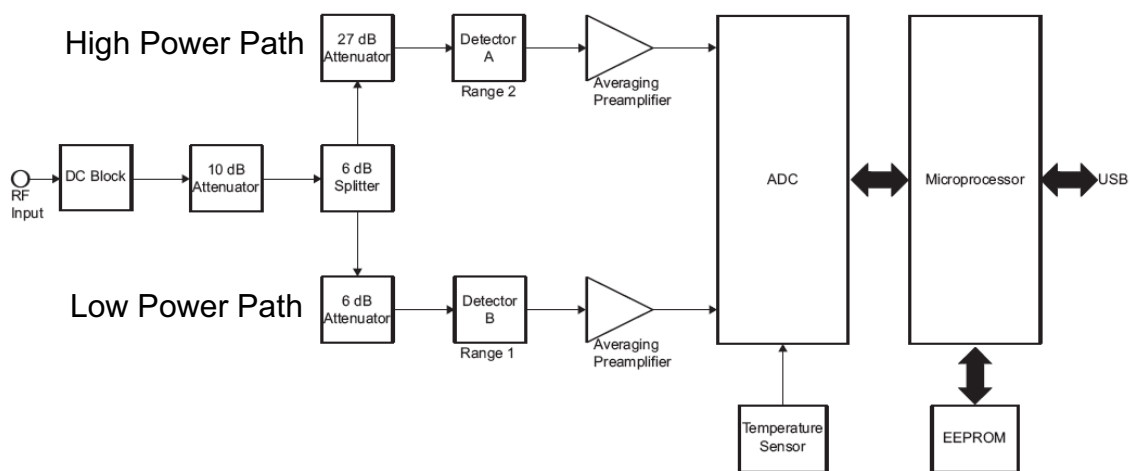


Figure 1-1. PSN50 Block Diagram

## 1-3 Power Sensor Calibration Background

In general, the following items are needed to calibrate any modern power sensor:

- Sensitivity calibration (50 MHz)
- Calibration factor (Calfactor) characterization
- Linearity characterization
- Temperature characterization
- Range “connection” characterization

Sensitivity calibration and Calfactor characterization are performed at a 0 dBm power level. They are strictly a calibration of the high power detection path.

**Note**

Calfactor tests are performed at countless calibration laboratories in the industry; and each laboratory has its own techniques, equipment, and measurement uncertainties. Choosing the calibration laboratory will depend on the application and uncertainty requirements. It is highly recommended that customer choose a high quality lab that has experience in performing power sensor calibrations. Anritsu will leave the user to decide which Calfactor calibration service to use. Otherwise, sensors can be sent to Anritsu for periodic calibrations.

Sensitivity calibrates the sensor’s response at 0 dBm and 50 MHz. Calfactor test calibrates the sensor’s frequency response with respect to 50 MHz and 1 mW.

The PSN50 EEPROM contains very precise linearity and temperature characterization data that are beyond the means of most third-party calibration labs. Linearity means the sensor’s response as it relates to input power. Each one of the detection diodes (high and low power paths) operates in square-law and is inherently linear in power; therefore, they do not require periodic linearity calibration.

The temperature characteristics of the detection elements do not change with normal aging and wear; therefore, temperature calibration is not needed for routine calibration. If a sensor is damaged due to excessive power or some other physical damages, then the power sensor needs to be returned to the factory for repair and calibration. Contact your local Anritsu Service Center and return the sensor with a detailed description of the observed problem(s).

The Range Connection characterization is performed at a transitional power (–7 dBm) between the high and low power detection paths. This test calibrates the low power detection path to the high power detection path so that the two elements combine for a wide dynamic power range (+20 dBm to –30 dBm) while maintaining a seamless linear response.



# Chapter 2 — Installation (PC Only)

## 2-1 Introduction

This chapter provides information on installing the PSN50 CalXpert™ application and power sensor drivers. It contains the following:

- [Hardware and Software Requirements](#)
- [Installing the PSN50 CalXpert Application](#)
- [Installing the PSN50 Power Sensor Drivers](#)

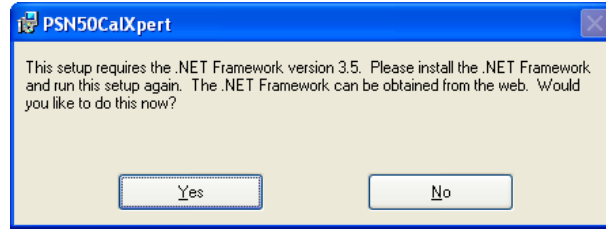
## 2-2 Hardware and Software Requirements

Please make sure that the following minimum requirements are met for installing and using the software:

- Intel® Pentium® III with 1 GB RAM or Intel® Pentium® IV with 512 MB RAM, or equivalent (Intel® Pentium® IV with 1 GB RAM recommended)
- Microsoft® Windows Vista® (32-bit only), Windows XP or Windows 2000
- Microsoft® .NET 3.5
- 100 MB hard-disk free space
- Display resolution 1024 × 768
- USB 2.0 full speed (compatible with USB 1.0 and 1.1) interface
- CD-ROM drive

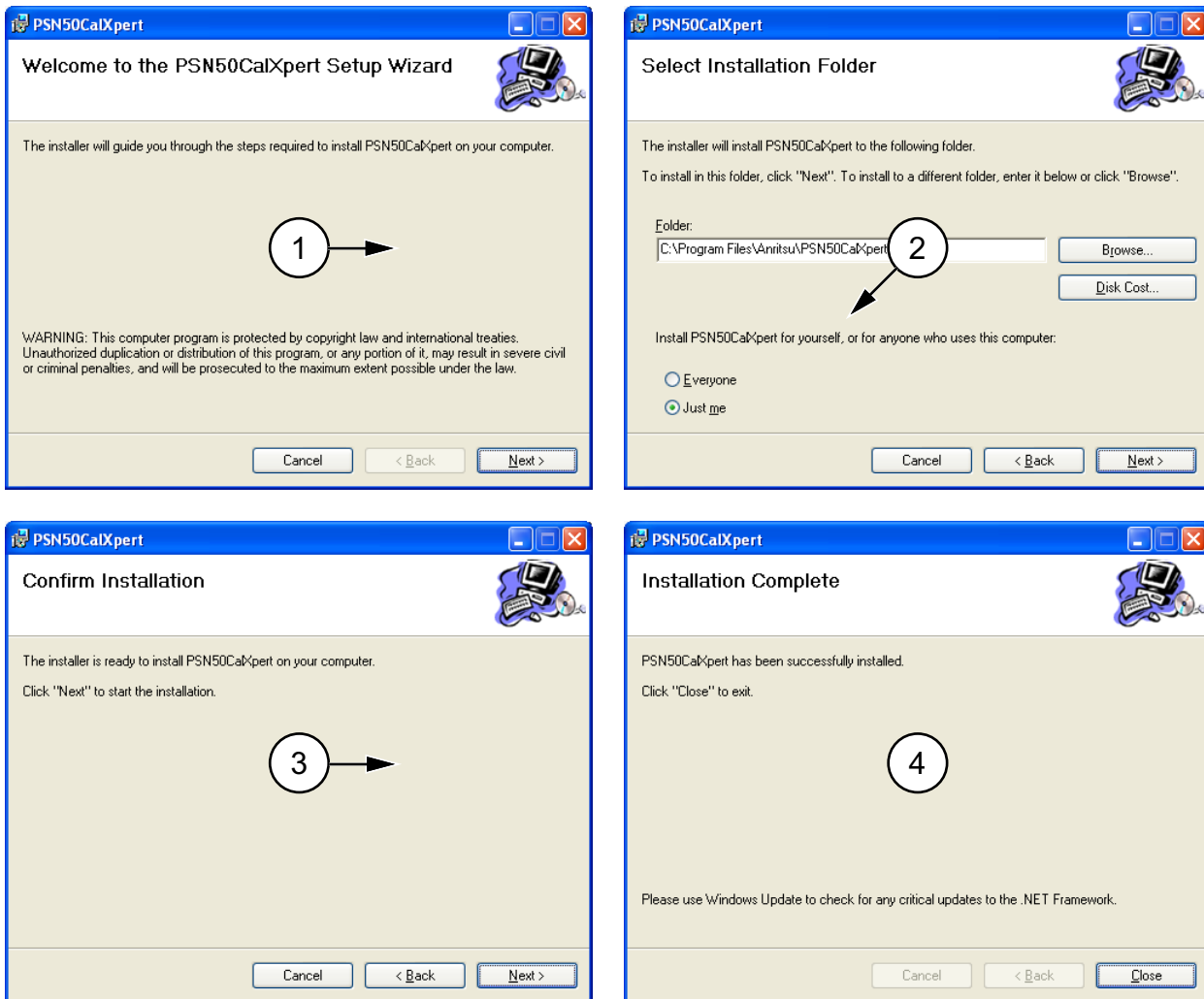
## 2-3 Installing the PSN50 CalXpert Application

If the Microsoft .NET Framework version 3.5 software is not installed, you will be prompted to download and install the .NET software. Select Yes or manually install the software from the Microsoft Web site.



**Figure 2-1.** PSN50 CalXpert Installation

Once this is complete, relaunch the installer and install the software as directed in the on-screen installation dialogs:



**Figure 2-2.** PSN50 CalXpert Installation

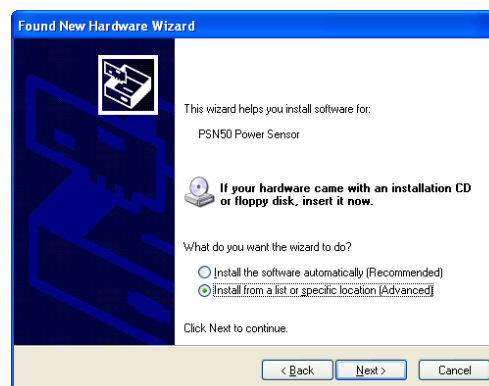
## 2-4 Installing the PSN50 Power Sensor Drivers

1. Connect the power sensor to the USB port of the PC with the supplied USB cable. The status LED lights green indicating that the sensor is turned ON.
2. When the Found New Hardware Wizard installation screen appears, select **No, not this time** to search for software, and then click **Next**.



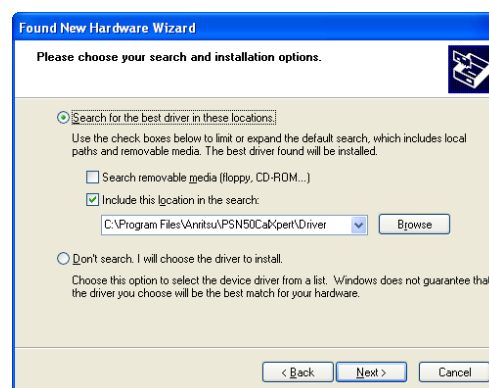
**Figure 2-3.** Found New Hardware Wizard

3. Select **Install from a list or specific location (Advanced)**, and then click **Next**.



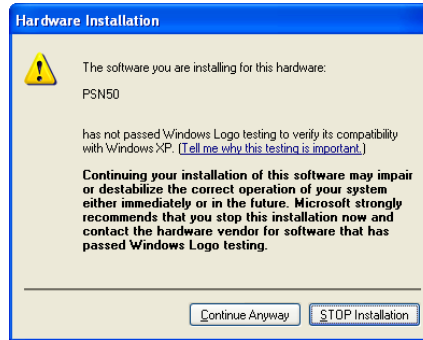
**Figure 2-4.** Found New Hardware Wizard

4. **Browse** to *C:\Program Files\Anritsu\PSN50CalXpert\Driver* and click **OK**, then click **Next** as shown below.



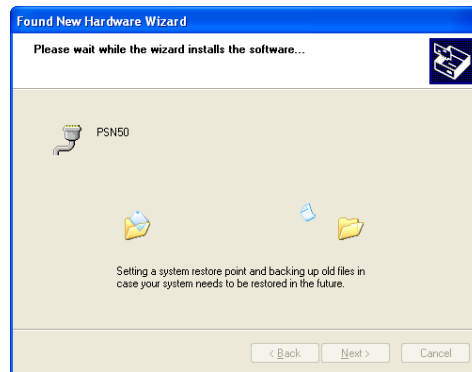
**Figure 2-5.** Found New Hardware Wizard

5. The Hardware Installation warning dialog appears as shown below. Click **Continue Anyway**.



**Figure 2-6.** Hardware Installation Warning

The hardware driver installs automatically.



**Figure 2-7.** Found New Hardware Wizard

6. When the installation is complete, click **Finish** to close the wizard.



**Figure 2-8.** Found New Hardware Wizard

7. The power sensor is now ready for use. Launch the PSN50 CalXpert application from the new desktop icon or from the **Start** | Programs | Anritsu menu. Refer to [Chapter 3, “Calibrating the Power Sensor”](#) for information about using the PSN50 CalXpert application.

# Chapter 3 — Calibrating the Power Sensor

## 3-1 Calibrating with PSN50 CalXpert

PSN50 CalXpert is a calibration wizard that guides you through the Range connection test and performs necessary operations to complete the calibration of the power sensor. Calibrating the PSN50 via the PSN50 CalXpert wizard is just a two step process:

1. Install PSN50 CalXpert application and PSN50 power sensor drivers as instructed in [Chapter 2](#).
2. Run PSN50 CalXpert as directed in this chapter.

<b>Note</b>	All of the calibration steps, Calfactor, sensitivity, and range connection should be performed in succession at room temperature ( $\pm 1$ °C).
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### Required Equipment

Equipment meeting the following specifications is required for sensor calibration:

- Synthesizer: 50 MHz to 6 GHz, +15 dBm minimum (Anritsu MG3690 Series)
- Reference Power Meter and Sensor: Absolute power accuracy better than 0.5 dB (Anritsu PSN50 or ML2437A, with MA2442D)
- 10 dB Fixed Attenuator: 1.25 SWR from 50 MHz to 6 GHz (Anritsu 41KA-10)
- K to N Adapter (Anritsu 34NFK50)

### Calfactor and Sensitivity

PSN50 CalXpert provides a user interface to send commands to the sensor from the PC. Calibration and sensitivity measurements can be made from within PSN50 CalXpert. The user can zero the sensor, set the frequency, and read out the power.

<b>Note</b>	The frequency setting command is not to be used for calibration because the Calfactor and Sensitivity should always be determined at the default 50 MHz frequency throughout the calibration process.
-------------	---

Calfactor and sensitivity are defined below:

$$\text{Calfactor (freq)} = [\text{PowerRead (freq)} / \text{PowerRead (50 MHz)}] \times 100\%$$

$$\text{Sensitivity} = \text{PowerRead (50 MHz)} / 1 \text{ mW}$$

where

freq is the frequency of the DUT's input power.

PowerRead (50 MHz) is the DUT power reading at 50 MHz when input power is 1 mW (0 dBm).

PowerRead(freq) is the DUT power reading when input power is 1 mW (0 dBm) at a given frequency (freq).

### Temperature Consideration

Temperature of the sensor is another important factor needed for Calfactor characterization. The sensor temperature (not the ambient) can be found by using the PSN50 CalXpert program.

## Saving Calfactor and 50 MHz Sensitivity

The Calfactor and 50 MHz Sensitivity measurements are made from within the PSN50 CalXpert application and they must be saved to a text file (\*.txt). This text file is required by PSN50 CalXpert to continue with the calibration. The file format is given below:

**Note**

The frequency MUST be set to 50 MHz because all of the Calfactor and Sensitivity measurements are to be made at the default frequency of 50 MHz.

For the text file, a single <TAB> spacing is between frequencies and percentages. A sample file is provided in the Program Files folder where PSN50 CalXpert was installed (Sample\_Cal\_factor.txt).

```

Model Number
PSN50
Serial Number
XXXXXX
Date:
MM/DD/YYYY
Temperature:
XX.XX
Sensitivity
X.XXX

Freq      Calfactor (%)
0.05     XX.X
0.10     XX.X
0.30     XX.X
0.50     XX.X
1.00     XX.X
1.50     XX.X
2.00     XX.X
2.50     XX.X
3.00     XX.X
3.50     XX.X
4.00     XX.X
4.50     XX.X
5.00     XX.X
5.50     XX.X
6.00     XX.X

```

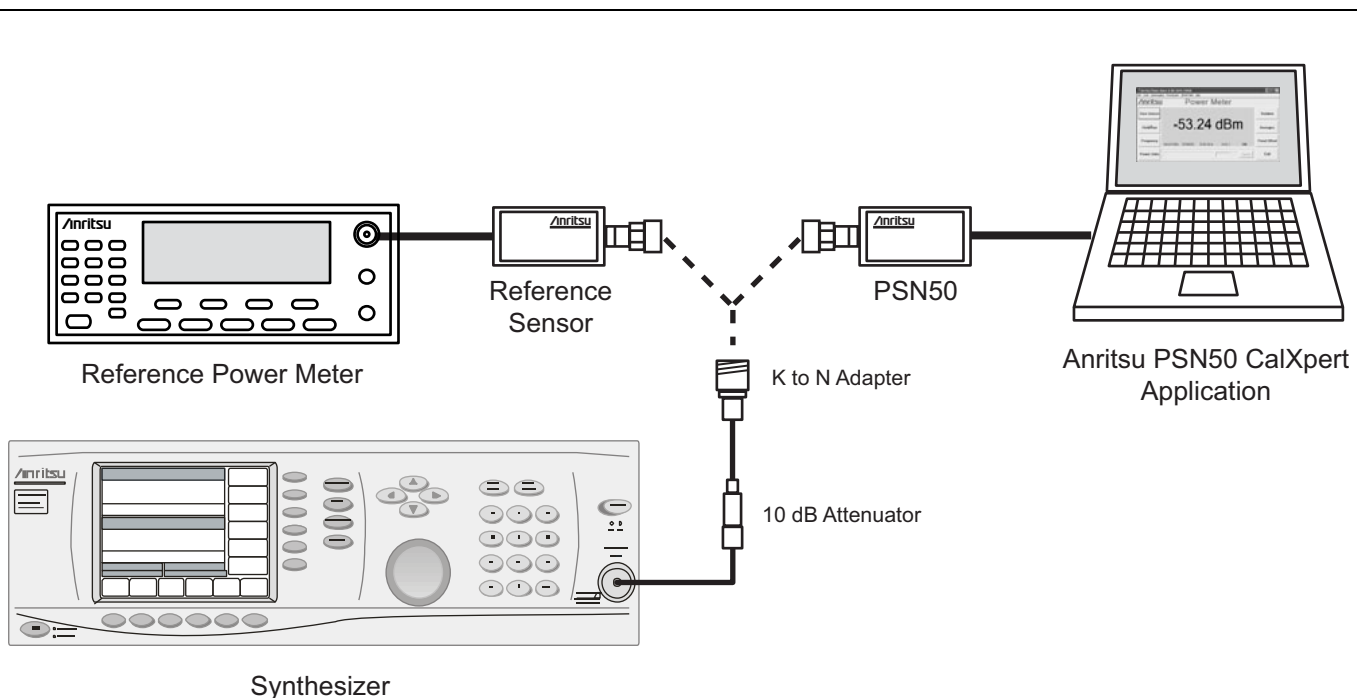
## Uploading the Calfactor, Range Connection Characterization, and Final Calibration

The PSN50 CalXpert program generates three files that are stored in the program files directory. The default location is: C:\Program Files\Anritsu\PSN50CalXpert. These files are:

- **PSN50\_<serial number>.hex**  
This file is generated before user commences the calibration of the sensor and contains old calibration data. This file is generated in cases where users need to revert to original calibration data.
- **NEW\_PSN50\_<serial number>.hex**  
This file is generated after the user completes the calibration of the sensor and contains new calibration data.
- **CalibrationReport.xls**  
This file is generated after the user completes the calibration of the sensor. It contains old and new Calfactor and corresponding differences.

The range connection characterization requires a  $-7$  dBm ( $\pm 0.5$  dBm) signal applied to the input of the sensor. A 10 dB fixed attenuator can be connected in-line to improve the source match.

1. Connect a reference sensor to the synthesizer as shown in [Figure 3-1](#) below:



**Figure 3-1.** Range Connection Characterization Setup (typical)

- Record the synthesizer power settings that result in a measured power of  $-7$  dBm for each of the following frequencies:

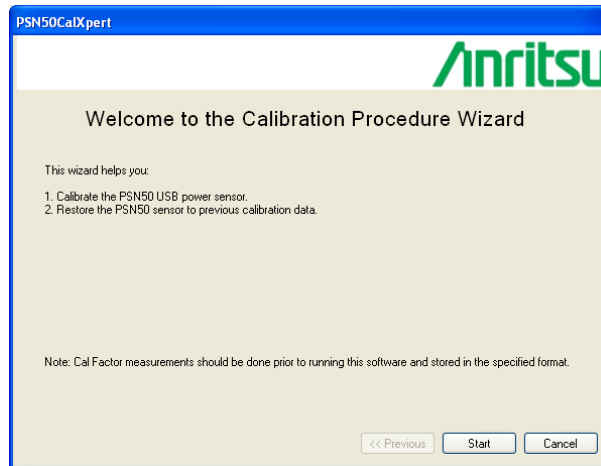
**Table 3-1.** Synthesizer Frequency and Power Settings

Frequency (GHz)	Synthesizer Power Setting (for $-7$ dBm)
0.050	
0.100	
0.300	
0.500	
1.000	
1.500	
2.000	
2.500	
3.000	
3.500	
4.000	
4.500	
5.000	
5.500	
6.000	

These recorded settings are used later to properly set the synthesizer when the PSN50 CalXpert wizard prompts for a  $-7$  dBm input.



3. Connect the power sensor to the PC (Figure 3-1) and launch the PSN50 CalXpert wizard:  
**Start** | Programs | Anritsu | PSN50CalXpert
4. Click Start in the Welcome screen as shown below:



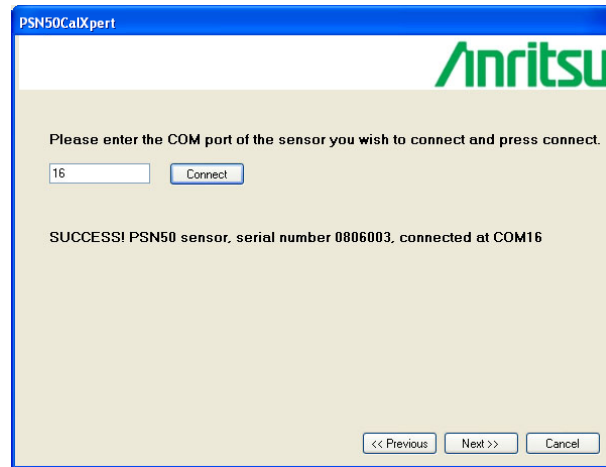
**Figure 3-2.** PSN50 CalXpert Welcome

5. Enter the COM port to which the sensor is connected.

<b>Note</b>	COM ports can be checked in Windows in the Control Panel via: <b>System</b>   Hardware   Device Manager   Ports (COM & LPT)
-------------	--

6. Press **Connect**. You should see the following message  
SUCCESS! PSN50 sensor, serial number <serial number>, connected at COM <X>
7. If you do not see the SUCCESS message or if you cannot connect to the sensor, check the following:
  - a. Check if you can see the sensor in the device manager under Ports. If you cannot see your PSN50 sensor in the device manager, make sure you have installed the driver.
  - b. The application may not work if the sensor is connected to the host PC through a hub. Connect the sensor directly to the computer.
  - c. The application may not connect to the sensor if the COM port number is greater than 16. Remap the COM port to a number less than 17. Refer to the “Serial port compatibility” section.

8. After connecting to the sensor, press **Next**.



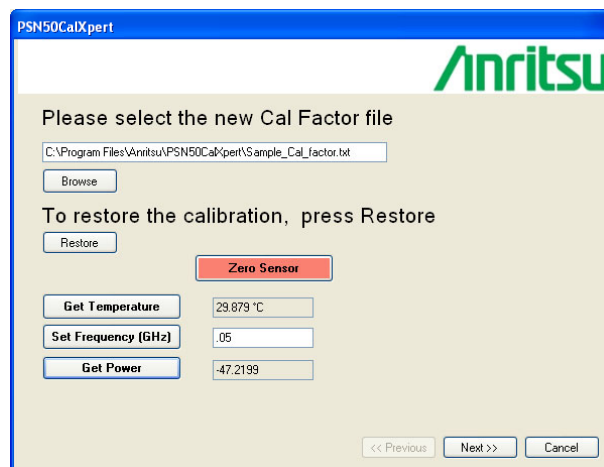
**Figure 3-3.** Detected Sensor List

9. The following dialog provides for creating the Calfactor and 50 MHz sensitivity file required to proceed. Use the command interfaces provided to read the power and temperature from the sensor. Record the values to be used when creating a Calfactor and sensitivity file.

**Note** The frequency MUST be set to 50 MHz for the Calfactor and Sensitivity measurements.

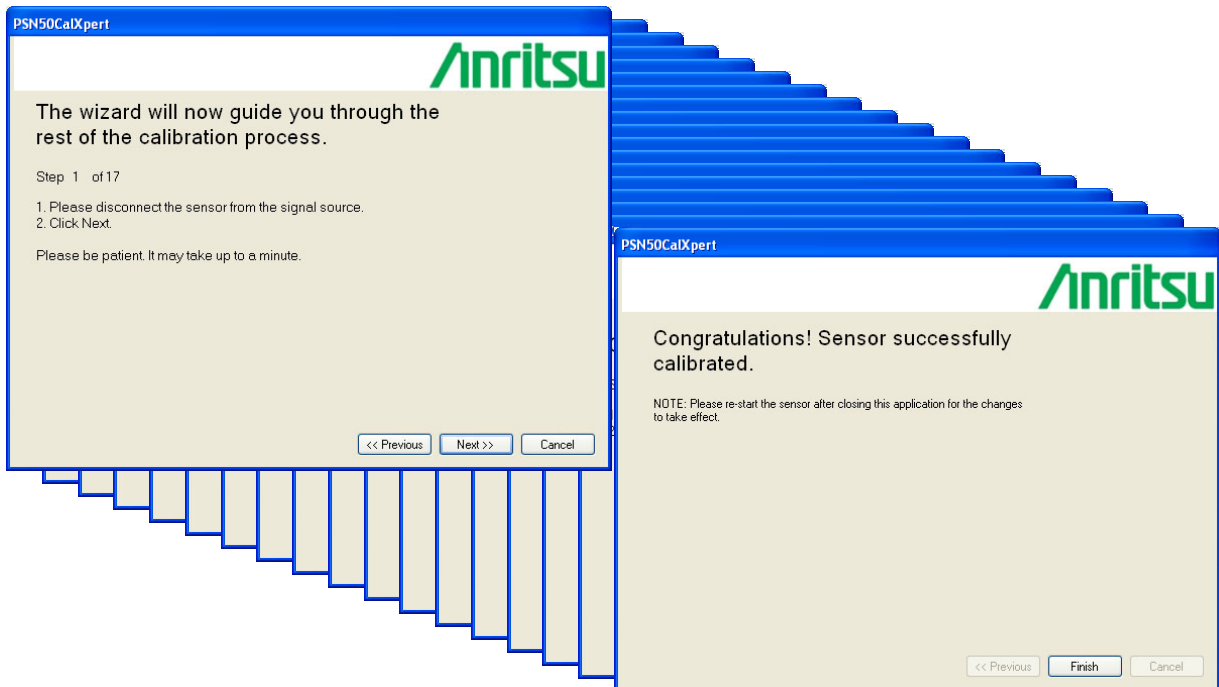
10. Start the final calibration steps after the calfactor file has been created by clicking Browse to select the new Calfactor file, then click Next >>.

Additional options for restoring a previous calibration (refer to [Step 13](#)) or for instantly detecting the temperature of the power sensor are also available.



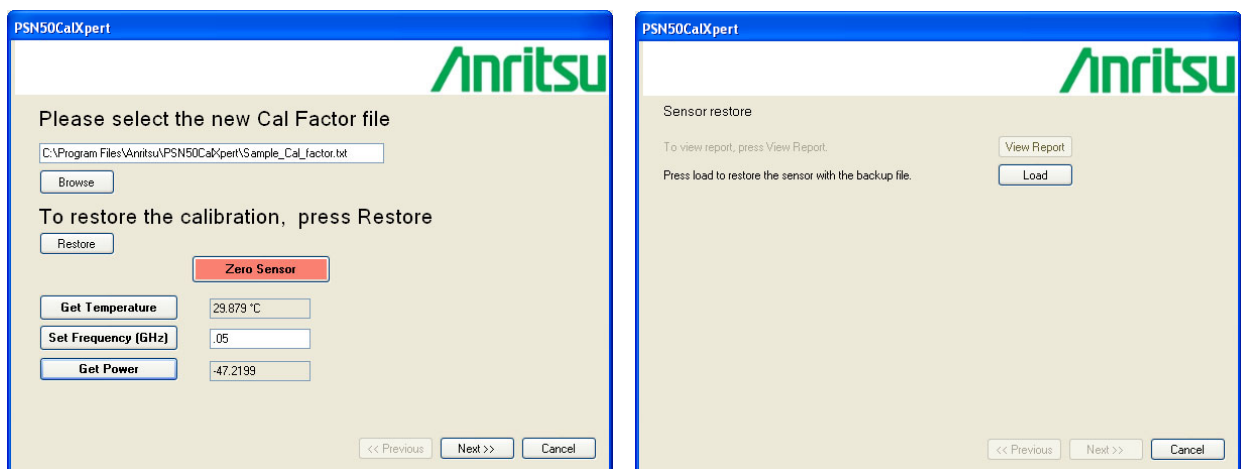
**Figure 3-4.** PSN50 CalXpert File Selection, Restore Calibration, and Temperature Check

11. The PSN50 CalXpert wizard now guides you through a series of 17 steps to complete the calibration. Follow the on-screen instructions as shown below. Use [Table 3-1](#) to set the synthesizer to the range connection power of  $-7$  dBm during the final calibration.



**Figure 3-5.** PSN50 CalXpert Wizard Steps (1 to 17)

12. When the calibration is complete, the following message is displayed “Congratulations! Sensor successfully calibrated.” Click Finish to close PSN50 CalXpert.
13. To restore a previous calibration, click Restore and select the appropriate HEX file, then click the Load button as shown below.



**Figure 3-6.** Loading (Restoring) a Previous Calibration

14. When the calibration has been successfully restored, the following screen is displayed. Click Finish to close PSN50 CalXpert.

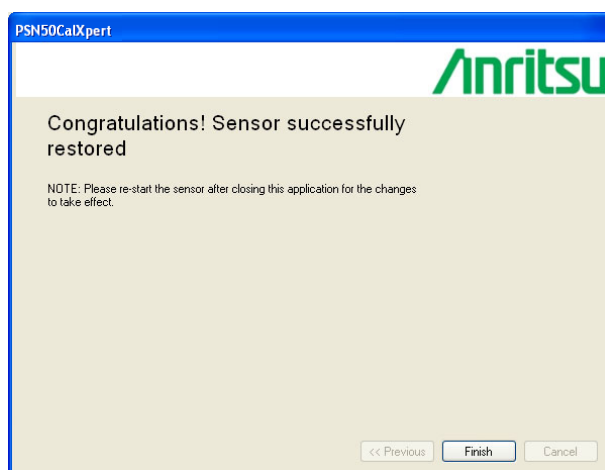


Figure 3-7. Restored Calibration Complete

## 3-2 Verifying Calibration

The calibration can be verified by running a fresh PSN50 CalXpert session, reconnecting a calibrated PSN50 sensor, and then using the command interface provided to zero the sensor and set the frequency to synthesizer frequency and reading out the power. The validation can be done at multiple cal frequencies and power levels.

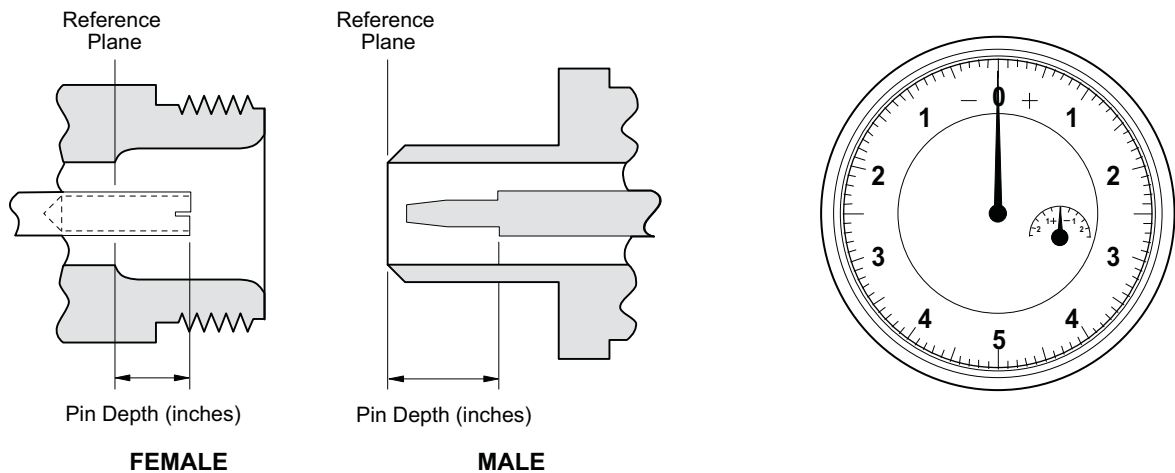
# Appendix A — Connector Care and Handling

Anritsu MA241x8A Power Sensors are high-quality precision laboratory instruments and should receive the same care and respect afforded to such instruments. Follow the precautions listed below when handling or connecting these devices. Complying with these precautions will guarantee longer component life and less equipment down time due to connector or device failure. Also, such compliance will ensure that Power Sensor failures are not due to misuse or abuse – two failure modes not covered under the Anritsu warranty.

## Beware of destructive pin depth mating connectors

Destructive pin depth of mating connectors is the major cause of failure in the field. When an RF component is mated with a connector having a destructive pin depth, damage will usually occur to the RF component connector. A destructive pin depth is one that is too long with respect to the reference plane of the connector (Figure A-1, left).

The pin depth of DUT connectors should be measured to assure compatibility before attempting to mate them with Power Sensor connectors. An Anritsu Pin Depth Gauge or equivalent can be used for this purpose (Figure A-1, right)



**Figure A-1.** Pin Depth

If the measured connector is out of tolerance in the “+” region, the center pin is too long (see Table A-1, below). Mating under this condition will likely damage the precision RF component connector. If the test device connector measures out of tolerance in the “-” region, the center pin is too short. This should not cause damage, but it could result in a poor connection and a consequent degradation in performance.

**Table A-1.** Allowable DUT Connector Pin Depth

Connector Type	Pin Depth Gage Model #	Pin Depth (inches)	Pin Depth Gage Readout
N-Male	SC3825	0.207 +0.030 -0.000	0.207 +0.000 -0.030
N-Female	SC3825	0.207 +0.000 -0.030	0.207 +0.000 -0.030

## Avoid over torquing connectors

Over torquing connectors is destructive; it may damage the connector center pin. Always use a connector torque wrench when tightening connectors. Never use pliers to tighten connectors.

## Avoid mechanical shock

Connectors are designed to withstand years of normal bench handling. However, do not drop or otherwise treat them roughly. Mechanical shock will significantly reduce their service life.

## Avoid applying excessive power

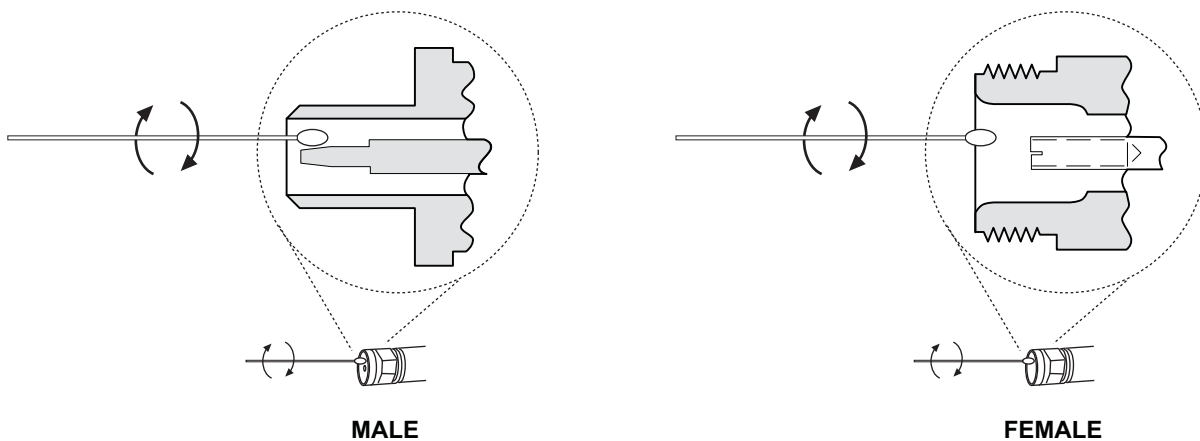
The PSN50 sensor is rated at 150 W maximum continuous input power given a load VSWR of 3:1 or less. Exceeding the maximum input power level may permanently damage the internal components, rendering the power sensor useless.

## Cleaning connectors

The precise geometry that makes the RF component's high performance possible can easily be disturbed by dirt and other contamination adhering to the connector interfaces. When not in use, keep the connectors covered. To clean the connector interfaces, use a clean cotton swab that has been dampened with denatured alcohol.

The following are some important tips on connector care:

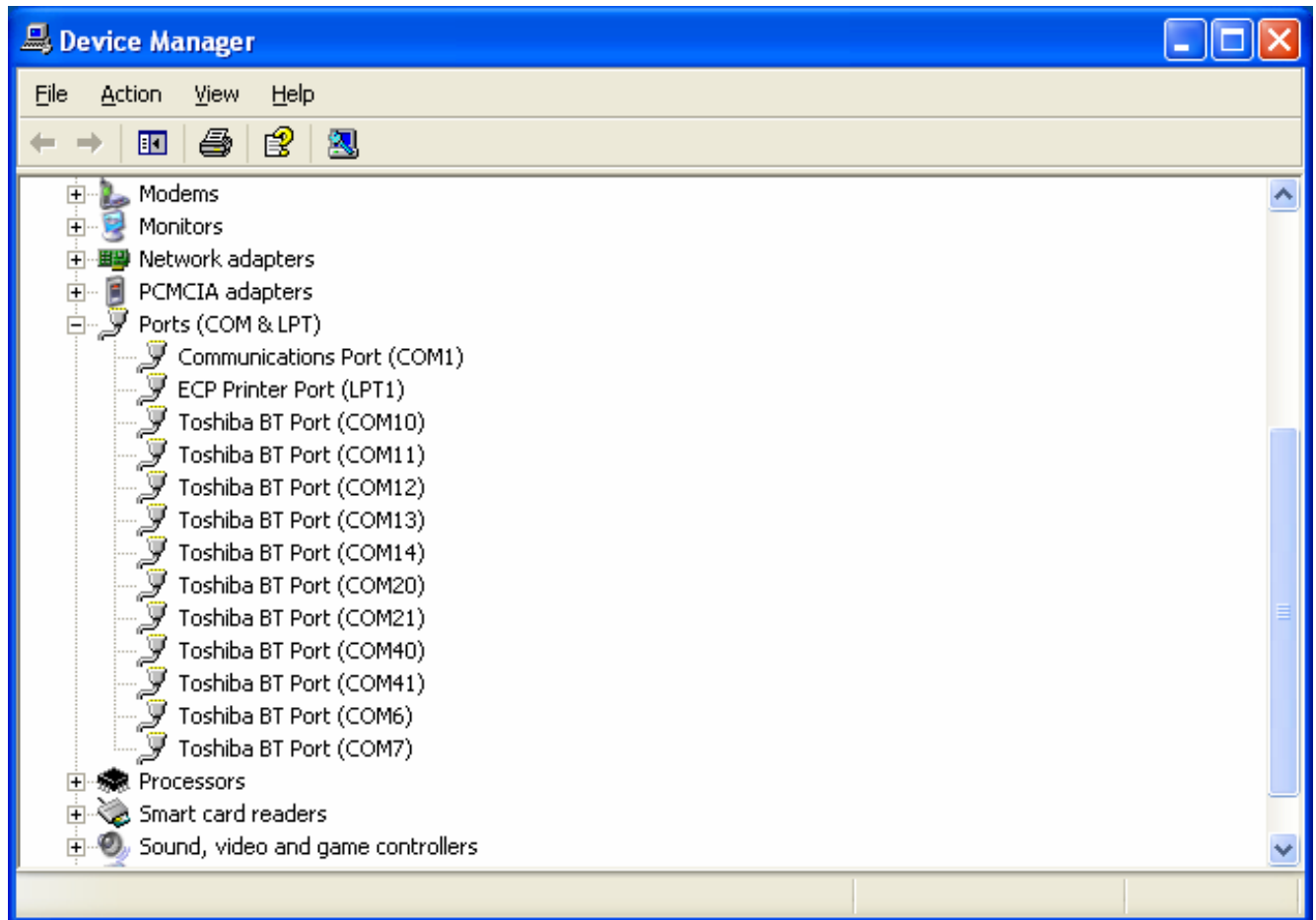
- Use only isopropyl alcohol as a cleaning solvent. Do not use excessive amounts of alcohol as prolonged drying of the connector may be required.
- Never put lateral pressure on the center pin of the connector.
- Verify that no cotton or other foreign material remains in the connector after cleaning.
- If available, use compressed air to remove foreign particles and to dry the connector.
- After cleaning, verify that the center pin has not been bent or damaged.
- Avoid touching connector mating planes with bare hands. Natural skin oils and microscopic dirt particles are very hard to remove.
- Always check the pin depth of DUT connectors before use to determine if they are out of spec. One bad connector can damage many.
- Always use an appropriate torque wrench.
- Put dust caps on the connector after use.



**Figure A-2.** Cleaning Connectors

# Appendix B — Serial Port Compatibility

The PSN50 CalXpert application requires that the serial ports from COM1 to COM16 be used. You can find out the COM port number by going to **Start | Settings | Control Panel | System | Hardware | Device Manager | Ports (COM & LPT)**. Disconnect and reconnect the power sensor's USB cable from the computer and notice the new COM port number that appears in the Ports list.



**Figure B-1.** Device Manager

If the COM port number is less than 16, then the PC application is able to communicate with the sensor. However, in some cases when the power sensor is connected, Windows may map the serial port to a port number greater than 16, such as COM17 or COM29 depending on which USB port that is being used. If the power sensor is connected and the PSN50 CalXpert application does not connect to the sensor, a port number above COM16 may be assigned to the sensor. To correct this problem, follow one of the methods outlined in the following sections.

## B-1 Method 1–Download Updated Software

The preferred method for resolving serial port compatibility issues is to download software updates for your product from [www.us.anritsu.com](http://www.us.anritsu.com).

## B-2 Method 2–Trying a Different USB Port

1. Disconnect the USB end of your power sensor from your computer.
2. Connect the USB power sensor to a different USB port on your computer. Connecting to a USB hub tends to increase the port numbers, so connecting directly to the computer's USB port usually provides the best result.
3. Open the Device manager to see if the new port assignment is from COM1 to COM16. If it is NOT, return to step 1 and connect to a different USB port. If the port assignment is from COM1 to COM16, the problem has been resolved and no further action is required.

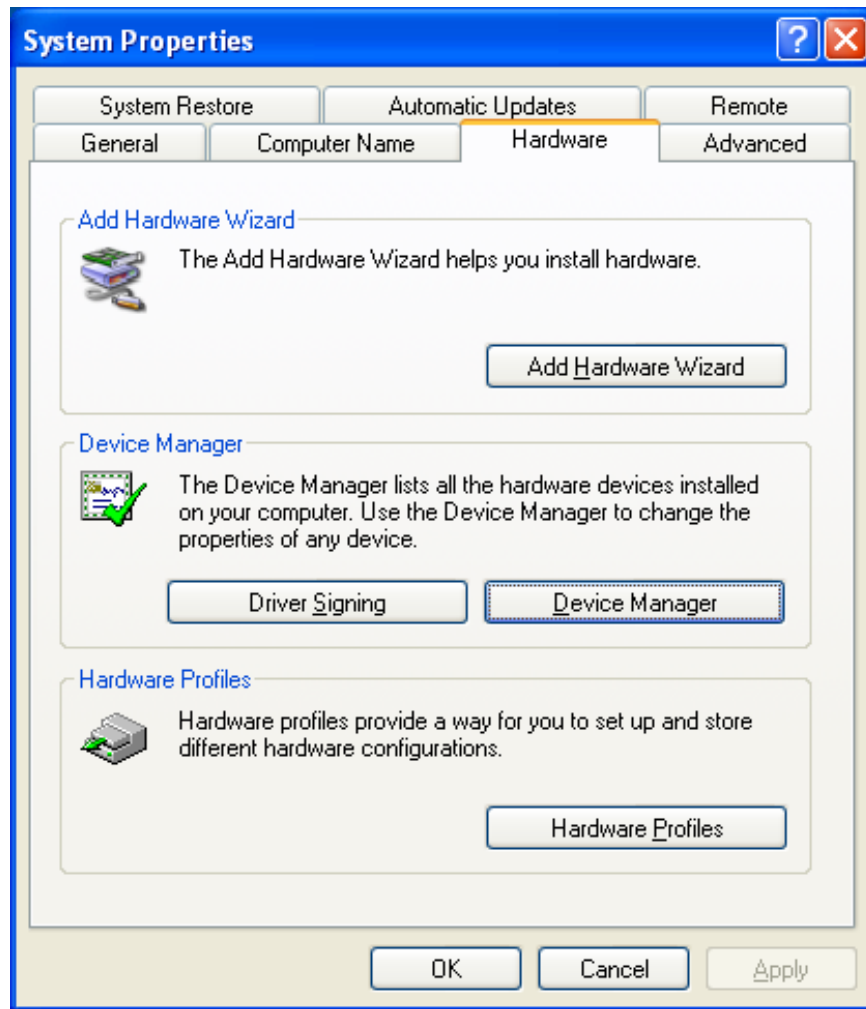
## B-3 Method 3–Remapping a Serial Port

A serial port may be remapped to a different number, such as changing a serial port from COM19 to COM5. This may be needed if method 1 above does not result in a serial port assignment from COM1 to COM16 or if you prefer to use a USB hub or a specific USB port on your computer.

1. Open the System Properties by going to **Start | Settings | Control Panel | System**, or simultaneously pressing the **Windows** and **Pause** keys.



2. Select the **Hardware** tab and click the **Device Manager** button to open the Device Manager.



**Figure B-2.** System Properties

3. Click the + box next to Ports (COM & LPT) to expand the installed ports list.

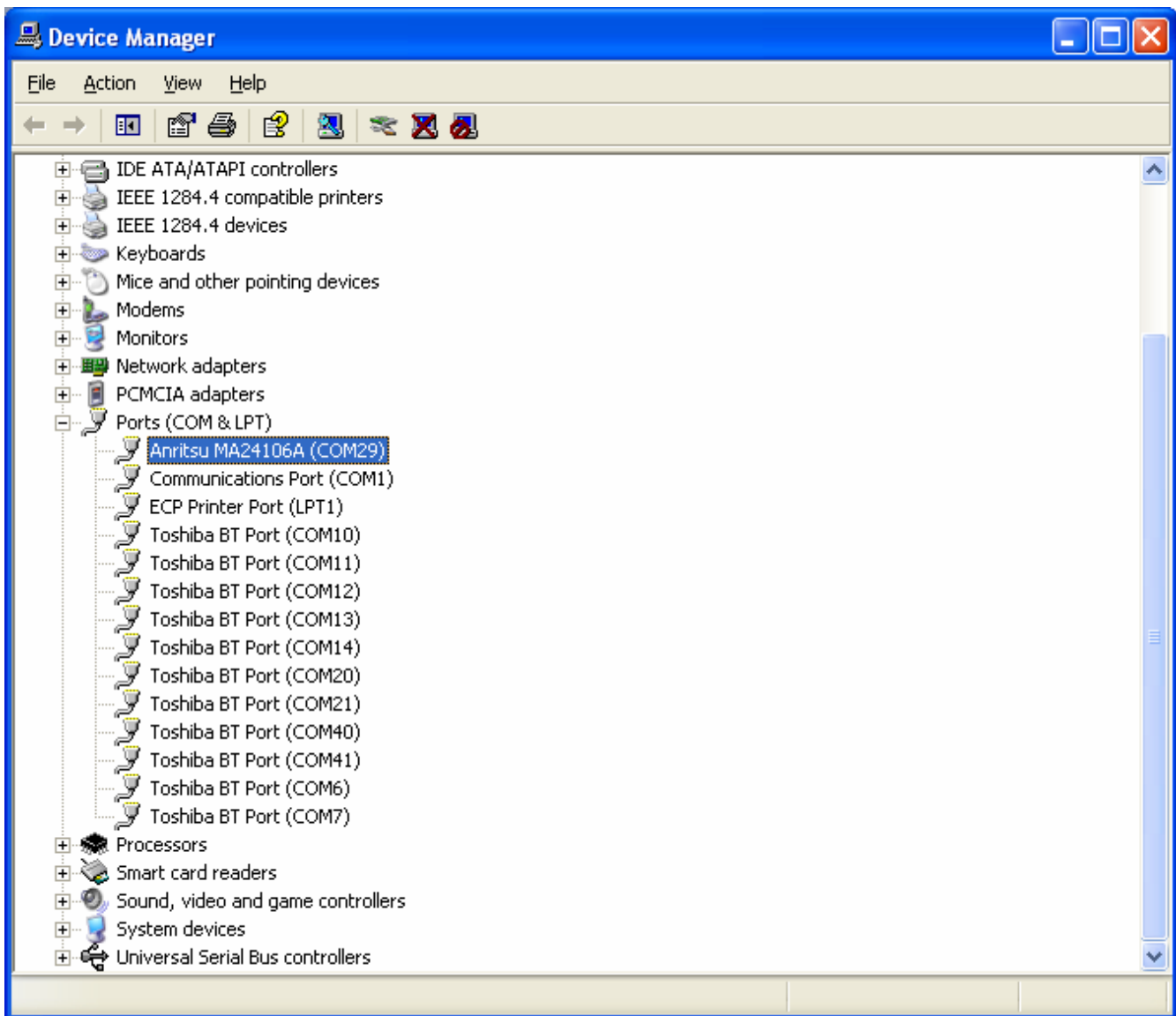
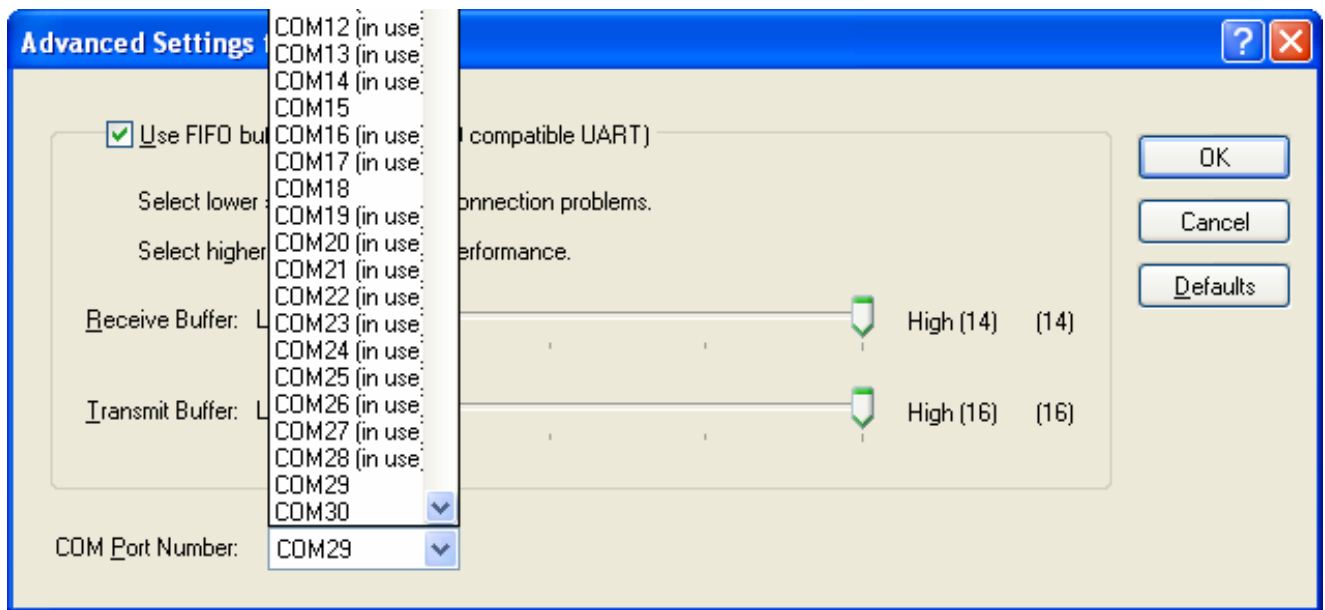


Figure B-3. Device Manager

4. Select the port that is assigned to the power sensor. Disconnect and reconnect the sensor and notice the new COM port number that appears. The new port is the current port assignment for the power sensor.
5. Right-click on the new port assigned in step 4 above and select **Properties** from the pop-up menu to display the properties for that port.
6. Click the **Port Settings** tab of the properties window.

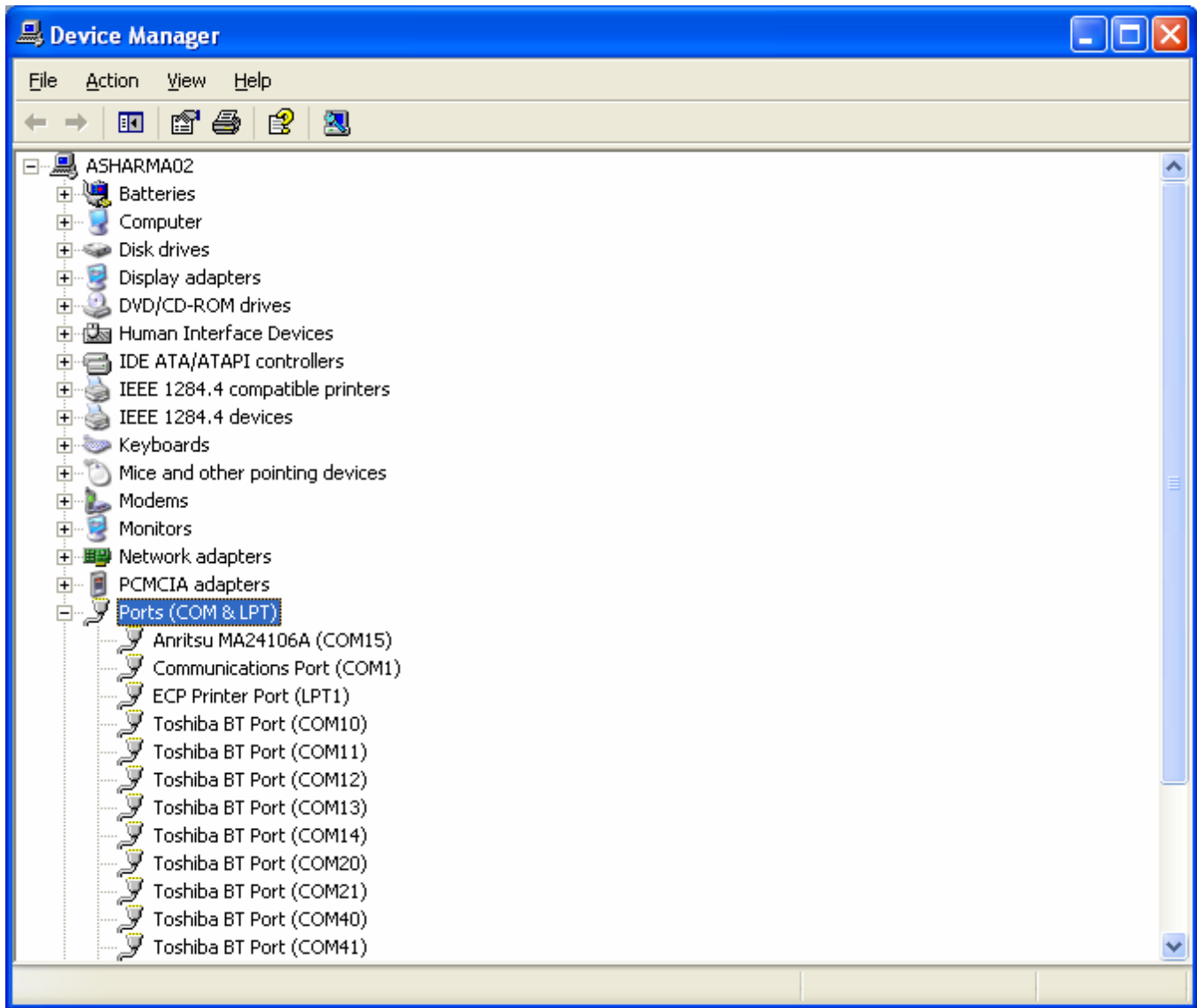
7. Click the **Advanced** button to show the advanced property settings for the port.



**Figure B-4.** Advanced Settings for COM Port

8. Select a COM Port Number in the range of 1 through 16. If possible, select a port that is NOT marked as “in use” in the COM Port Number list. If all of the ports are marked as being in use, select port number 16 unless you know for sure that something is actually using COM16.

9. You will get an alert when you close the window telling you that the COM port number may be in use by another device and asking if you want to continue. Click **Yes** to continue.



**Figure B-5.** Device Manager

10. Close all windows that you have opened up to this point.

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