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Contact us

Tel: +86-755-8981 8866 Fax: +86-755-8427 6832

Email & Skype: info@chipsmall.com Web: www.chipsmall.com

Address: A1208, Overseas Decoration Building, #122 Zhenhua RD., Futian, Shenzhen, China





Simplifying System Integration™

OMU1-S-RF Demo Unit User Manual

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UM_6612_016**

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Teridian Semiconductor Corp., 6440 Oak Canyon, Suite 100, Irvine, CA 92618
TEL (714) 508-8800, FAX (714) 508-8877, <http://www.teridian.com>

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1 Introduction

The Teridian Outlet Measurement Unit, Model OMU1-S-RF, is a low-cost power monitor utilizing the Teridian 78M6612 SOC. The Teridian 78M6612 monitors the AC line voltages and load current, and controls switching of an internal load relay. The embedded firmware calculates the RMS line voltage and RMS load current, watts, VA, VAR and power factor. The real time data is transmitted to a PC for display in a Windows® based Graphical User Interface (GUI). The 78M6612's UART interface is used as the communications link to a customer supplied RF module for the OMU1-S-RF.

The OMU1-S-RF evaluation kit is intended to be used for development and integration of a separate communications interface. Included with the OMU1-S-RF is a pair of isolated daughter boards and a Windows® based Graphical User Interface (GUI) for simplified access to the following measurement data and controls:

- Power, current, voltage and power factor indicator dials
- Adjustable display scales
- Minimum and peak parameter tracking
- Selectable strip chart display format
- Narrow-band versus Wide-band measurement
- Selectable sample size averaging
- Accumulated energy usage and expense tracking
- Line frequency
- Alarm indicators
- Programmable Alarm thresholds
- Internal load relay (16A) control
- Data log to file

Alternatively, the user can directly query the device with the command set using HyperTerminal and the provided *6612_OMU_S2_URT_V1_13 Firmware Description Document*.

1.1 Package Contents

The OMU1-S-RF Demo Kit includes:

- OMU1-S-RF module
- USB A/B cable
- USB-OPTO Daughter Board
- UART-ISO Daughter Board
- CD with Software and Documentation

1.2 System Requirements

The OMU1-S-RF GUI requires use of a PC with the following features:

- PC (1 GHz, 1 GB) with Microsoft® Windows XP or Win2000, equipped with USB port.
- Minimum 1024 x 768 video display resolution.

1.3 Safety and ESD Notes



EXERCISE CAUTION WHEN LIVE AC VOLTAGES ARE PRESENT!



Standard ESD precautions must be taken when handling electronic equipment. The OMU1-S-RF contains ESD protected interfaces.

Do not connect test equipment, ICE emulators or external development boards directly to the OMU-RF hardware. Damage to the OMU1-S-RF and external equipment will occur due to the 78M6612's "high side" reference topology. The 78M6612's V3P3 (i.e. "high side") is connected directly to Neutral (Earth Ground) creating a ground reference disparity with any properly grounded external equipment.

Always use the provided UART-ISO daughter board for connecting external development boards. Contact Teridian for instructions on connecting other types of test equipment.

1.4 Firmware Demo Code Introduction

The Firmware Demo Code provides the following features:

- Basic energy measurement data such as Watts, Volts, current, VAR, VA, phase angle, power factor, accumulated energy, frequency, date/time, and various alarm statuses.
- Control of alarm thresholds, calibration coefficients, temperature compensation, etc.

There are two means to facilitate performance evaluation between the user at the PC host and the firmware code in the OMU1-S-RF Demo Unit:

- The Graphical User Interface (GUI). This document describes the installation and use of the Windows based GUI.
- The Command Line Interface (CLI) via HyperTerminal or comparable terminal emulator on a different operating system. For information about the CLI, see the *6612_OMU_S2_URT_V1_13 Firmware Description Document*.

The OMU1-S-RF Demo Unit is shipped with Demo Code Revision 1.13 or later loaded in the 78M6612 chip and included on the CD. The code revision can be verified by entering the command `>i` via the command line interface. Firmware for the Demo Unit can be updated using either the Teridian TFP1 or an in-circuit emulator such as the Signum Systems™ ADM-51 (<http://www.signum.com/Signum.htm>).

The board components and firmware settings are designed to operate with the following nominal AC electrical ranges:

Voltage	Current	Line Frequency
110-240 VAC	10 mA – 20A	46-64 Hz

1.5 Testing the Demo Unit Prior to Shipping

Before every OMU1-S-RF Demo Unit is shipped, the following procedures have been performed at the factory:

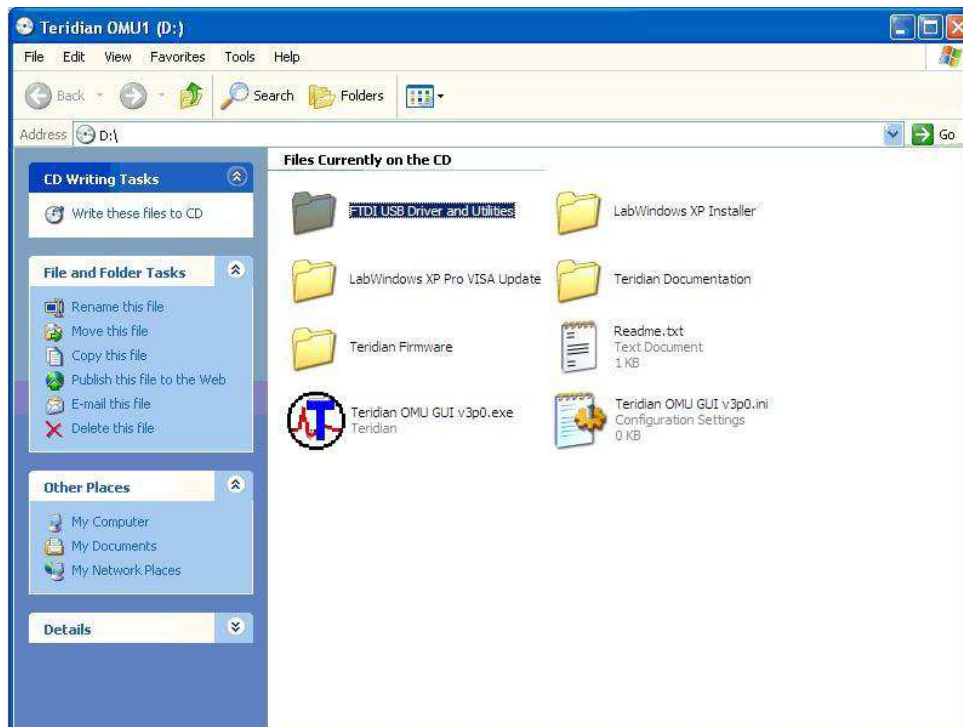
- Full Calibration – Precise energy source equipment is used to calibrate the current and voltage. The temperature is also calibrated at the same time.
- Accuracy Test – This "bench" level test ensures the energy measurement accuracy is within +/-0.5%.

2 Installation

2.1 USB Driver Installation

This evaluation kit includes an optically isolated USB adaptor board for serial communications with a PC. The FTDI USB controller IC FT232RL performs the USB functions. The FTDI Windows driver presents a virtual COM port for enabling serial communications. Control of the OMU1-S-RF module can be managed using either a terminal emulation program or using the supplied Windows Dashboard GUI. The FTDI Windows driver is a certified driver for Windows 2000 and XP.

1. Upon attaching the OMU1-S-RF module to the PC, the Found New Hardware Wizard automatically launches and installs the appropriate driver files. If your PC does not find the FTDI driver files on its local hard disk drive, locate and reference the FTDI USB Driver and Utilities subdirectory on the CD. The FT232RL controller is powered from the USB cable and is active even when no AC power is applied to the OMU1-S-RF.



Notes: If an older FTDI driver has been previously installed, it is recommended to remove the older version before installing this newer FTDI driver. Execute the **ftdiClean.exe** utility from the FTDI USB Driver and Utilities subdirectory.

For FTDI driver support on other operating systems, please check FTDI's website at (<http://www.ftdichip.com/FTDrivers.htm>).

2.2 Basic Connection Setup

Figure 1 shows the basic connections of the OMU1-S-RF with the external equipment. The OMU1-S-RF is powered by an internal switch-mode power supply (SMPS) module and is not powered through the USB cable. The USB connection only provides the communications link between the host PC and the OMU1-S-RF.

The OMU1-S-RF has two NEMA connectors, one male and one female. The male connector is for inlet and the female connector is for outlet. The male connector is connected to a wall outlet or a power strip. The female connector connects to the load to be measured.

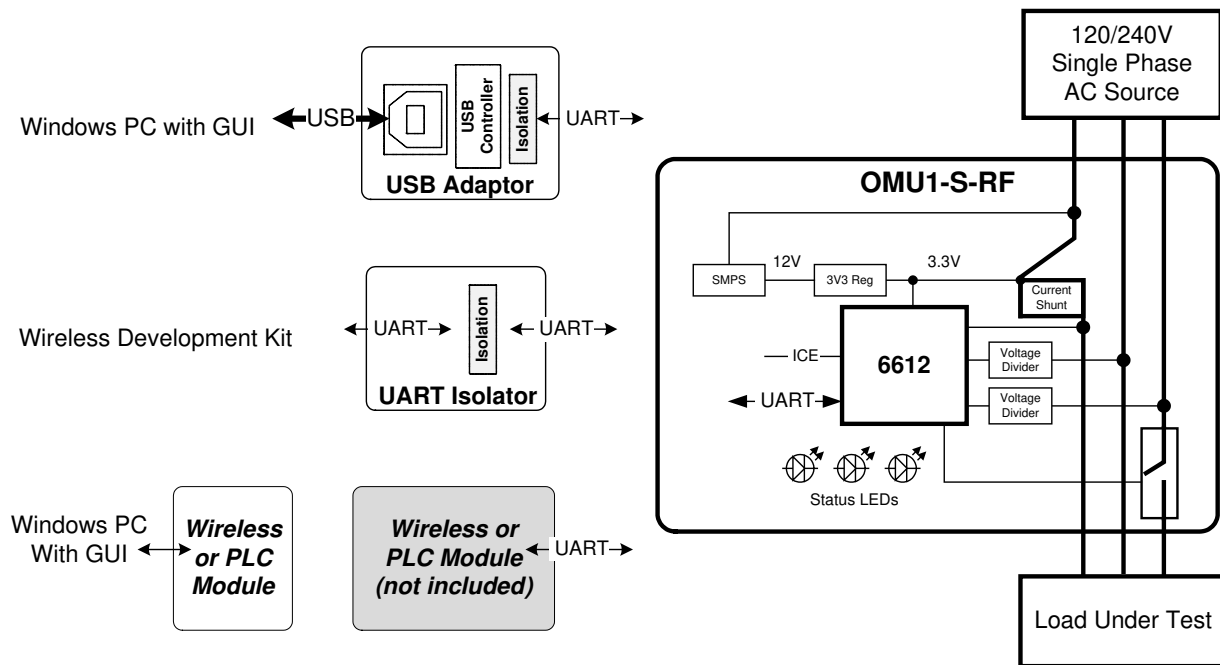
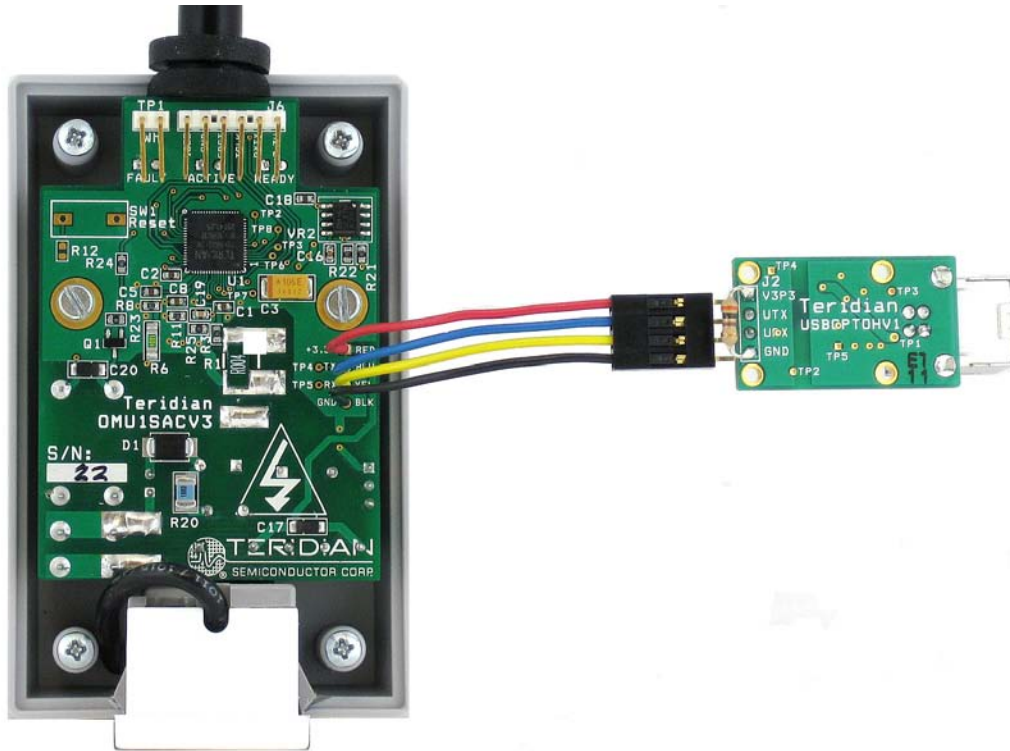


Figure 1: OMU1-S-RF Application Diagram

2.2.1 Attaching the USB-OPTO Daughter Board to the OMU1-S-RF

Attach the USB-OPTO daughter board to the OMU1-S-RF for use with the supplied GUI. This hardware interface provides an easy way to explore the 78M6612 firmware features. The USB daughter board incorporates signal isolators to protect the connected PC.



Attach the USB-OPTO daughter board to the OMU1-S-RF's UART cable as shown. Take note of the cable's **Red** wire (+V) with regards to the daughter board's connector pin assignments.

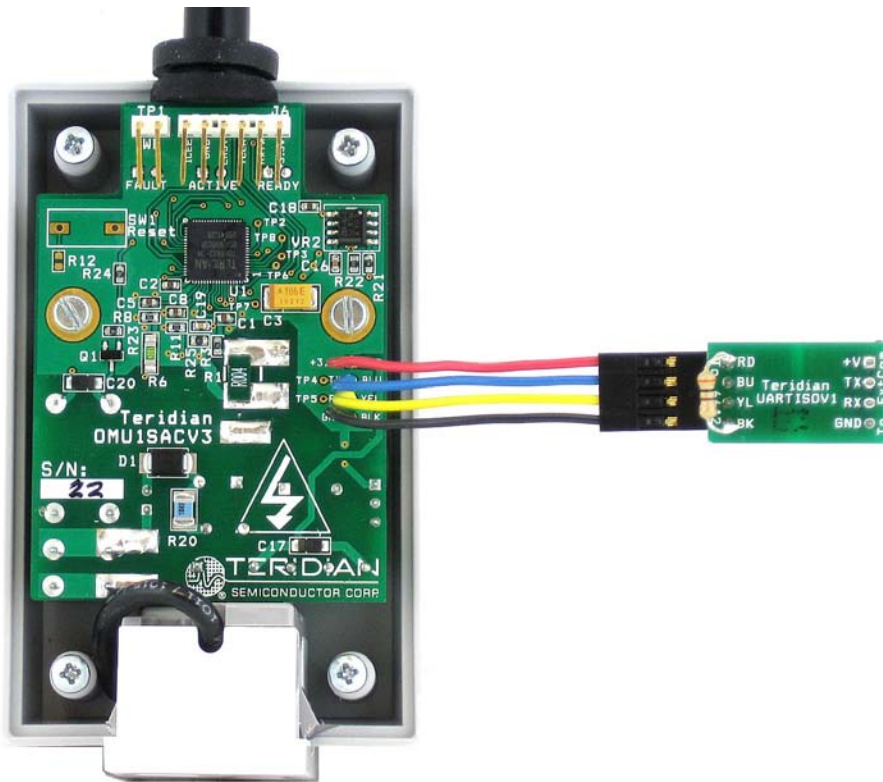


Do not attach external equipment to the OMU1-S-RF when using the USB-OPTO.

If it is necessary to attach test equipment, contact Teridian for instructions.

2.2.2 Attaching the UART-ISO Daughter Board to the OMU1-S-RF

Attach the UART-ISO daughter board to the OMU1-S-RF for use with **external development boards**. External development boards are customer-supplied hardware incorporating their communications module and debug interfaces. Their debug interfaces are typically RS-232 or USB cables with direct connections to a PC. The daughter board incorporates signal isolators to protect the external development board hardware and its attached PC.



Attach the UART-ISO daughter board to the OMU1-S-RF's UART cable as shown. Take note of the cable's **Red** wire (+V) with regards to the daughter board's connector pin assignments.

The UART-ISO daughter board does not supply power to the attached external development board. The female connector J2 is provided for attaching the external development board. The J2 pin assignments are as follows:

Pin 1	+3.3V or +5V (input, required to power signal isolator)
Pin 2	TX (78M6612 output, Vout dependent on voltage at pin 1)
Pin 3	RX (78M6612 input, Vin threshold dependent on voltage at pin 1)
Pin 4	GND

The UART-ISO daughter board does not support 1.8V signal levels.

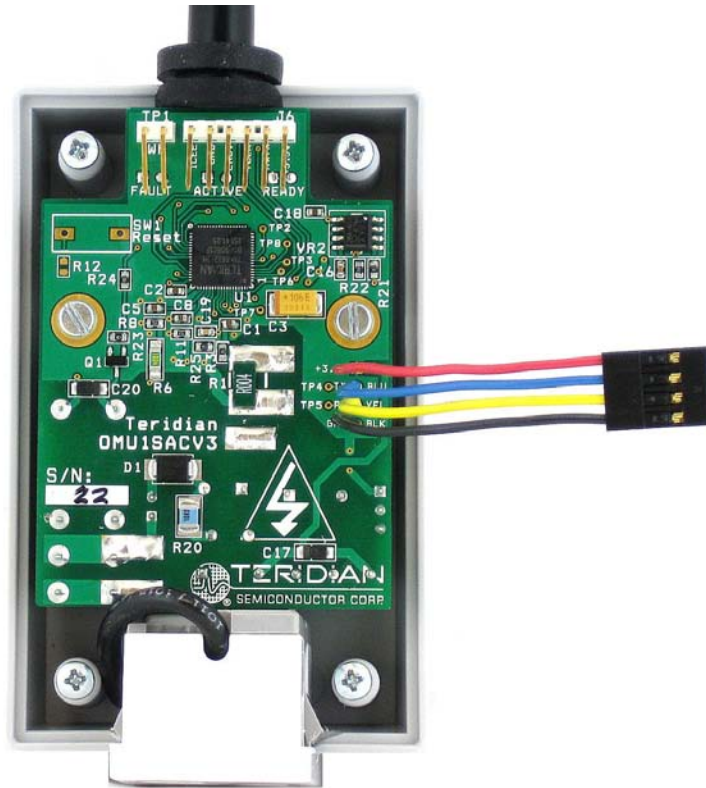


Do not attach external equipment to the OMU1-S-RF when using the UART-ISO.

If it is necessary to attach test equipment, contact Teridian for instructions.

2.2.3 Attaching a Customer-Supplied COM Module to the OMU1-S-RF

A fully isolated external communications board (i.e. Wireless or PLC module) may be attached to the OMU1-S-RF's UART cable without using the UART-ISO daughter board. The OMU1-S-RF UART cable supplies 100 ma max at +3.3 V.



The OMU1-S-RF UART cable pin assignments are as follows:

Pin 1	Red	+3.3V (output, 100ma max)
Pin 2	Blue	TX (78M6612 output, Vout: +3.3V/0V)
Pin 3	Yellow	RX (78M6612 input, Vin: +3.3V/0V)
Pin 4	Black	GND

The OMU1-S-RF UART cable does not support 1.8V signal levels.

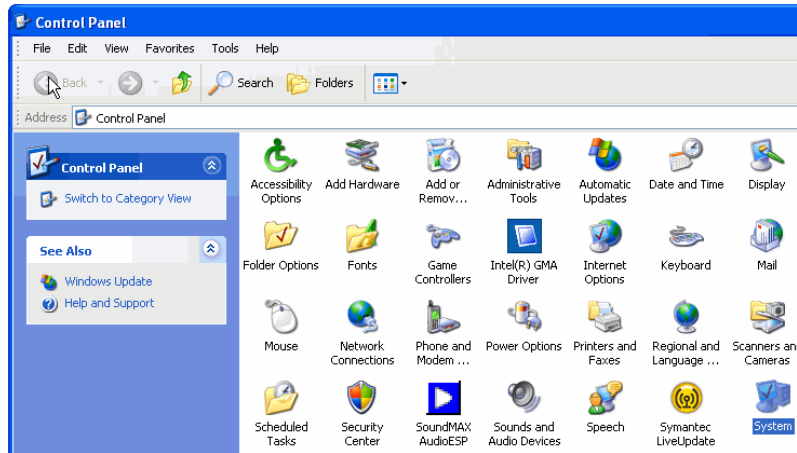


Do not attach external equipment to the OMU1-S-RF when using the UART cable.

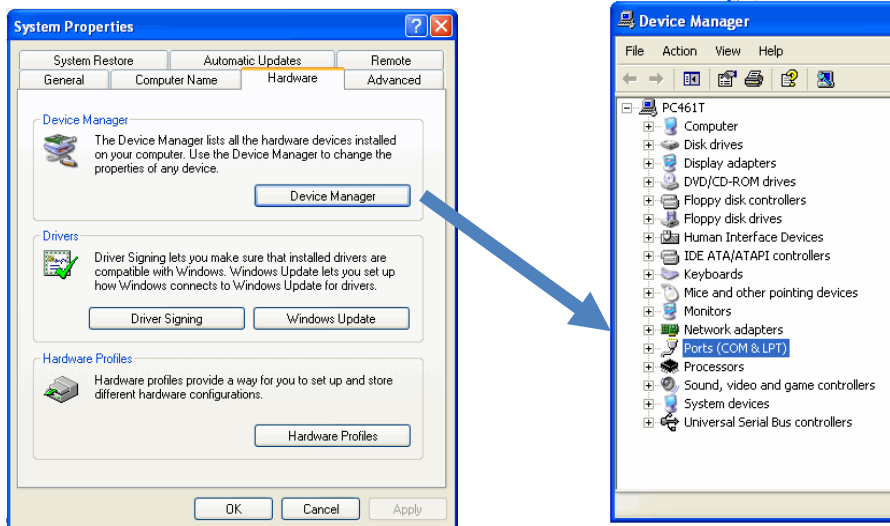
If it is necessary to attach test equipment, contact Teridian for instructions.

2.3 Confirm COM Port Mapping

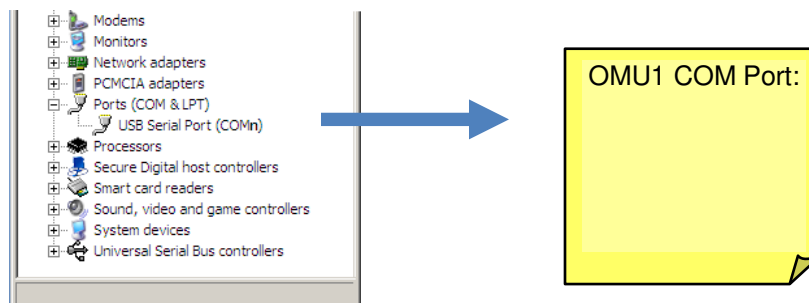
1. Launch the **Control Panel** and click on the **System** icon.



2. The **System Properties** screen appears. Click on the **Hardware** tab. Click on **Device Manager**. Under **Ports (COM & LPT)**, look for the **USB Serial Port** assignment.



3. Take note of the COM port assignment for the USB Serial Port.



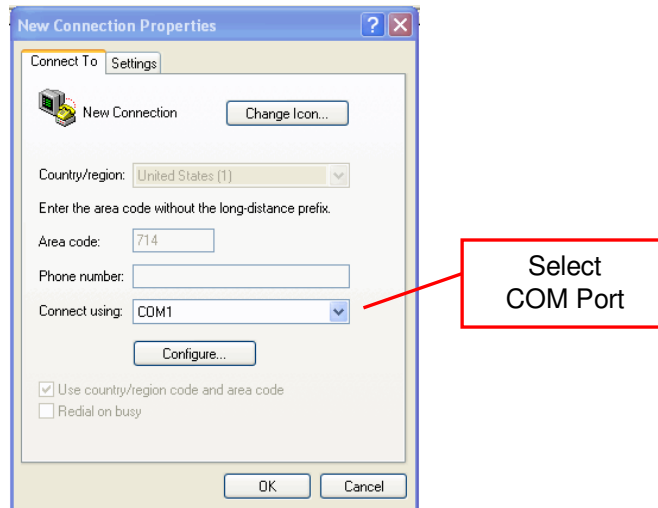
2.4 Verify Serial Connection to the PC

After connecting the USB cable from the OMU1-S-RF to the host PC, start the HyperTerminal application (or another suitable communication program) and create a session using the communication parameters show in Table 1.

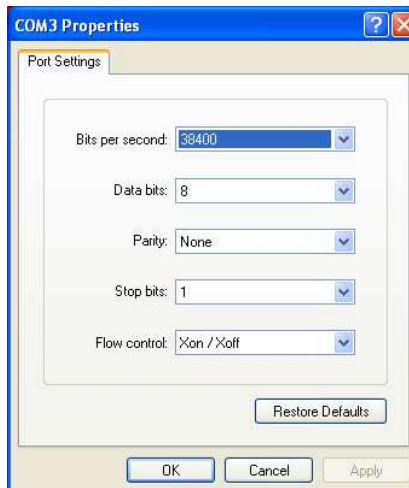
Table 1: COM Port Setup Parameters

Setup Parameter	78M6612
Port speed (baud)	38400
Data bits	8
Parity	None
Stop bits	1
Flow control	Xon/Xoff

HyperTerminal can be found in Windows by selecting **Start → All Programs → Accessories → Communications → HyperTerminal**. The connection parameters are configured by selecting **File → Properties**. The **New Connection Properties** menu appears.



Select the appropriate COM port and click **Configure**. The **COMn Properties** menu appears.



Note that port parameters can only be adjusted when the connection is not active. It may be necessary to click the Disconnect Button (shown in Figure 2) to disconnect the port.

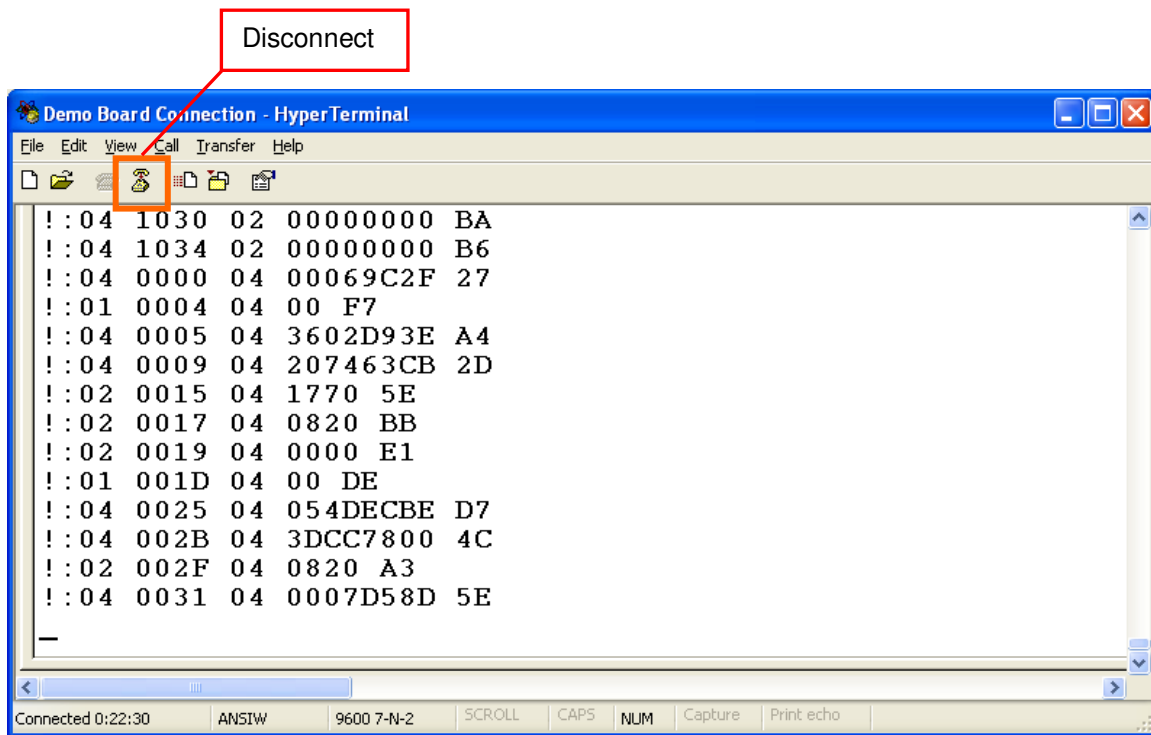
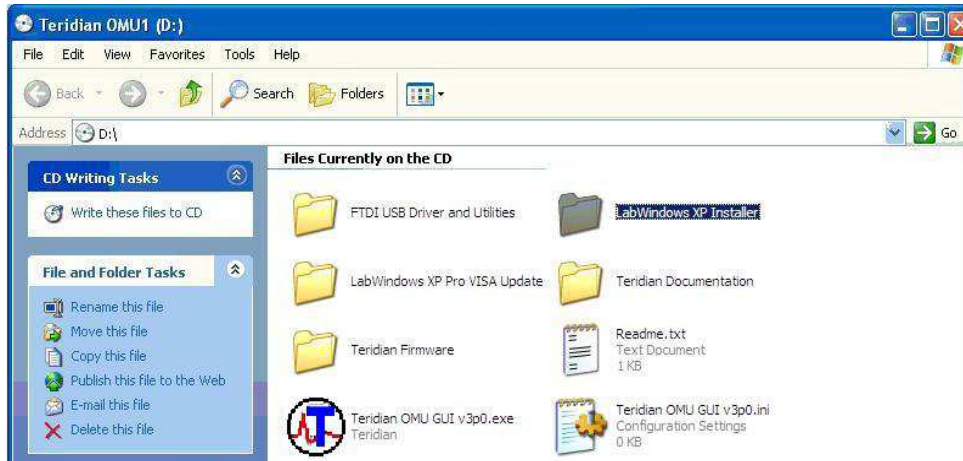


Figure 2: HyperTerminal Window with the Disconnect Button

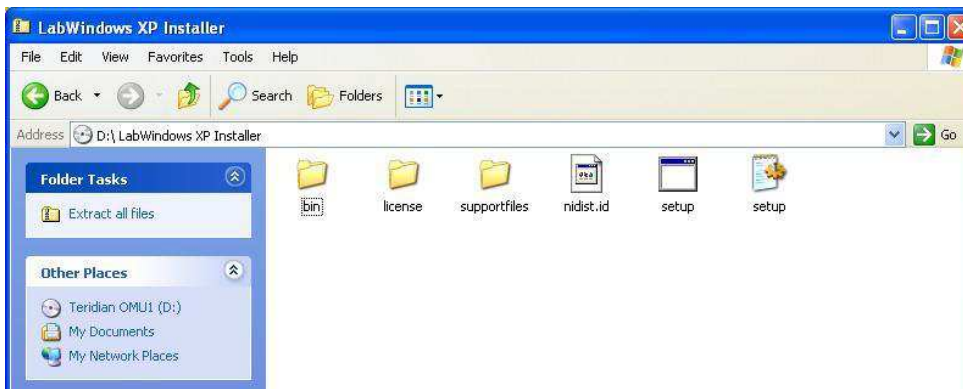
2.5 NI™ RunTime Installation

The GUI Dashboard program is created using National Instruments LabVIEW™. The NI RunTime Engine must be installed first before launching the Dashboard GUI.

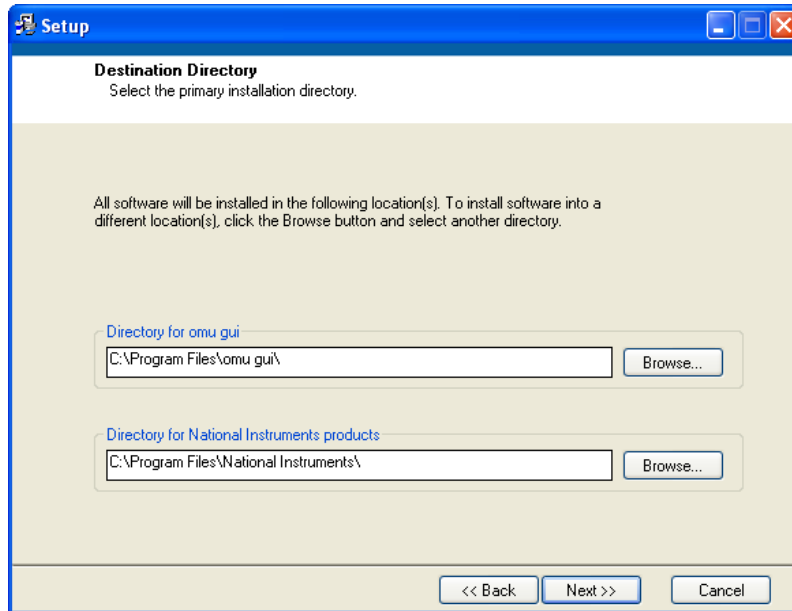
1. Open the **LabWindows XP Installer** directory on the CD.



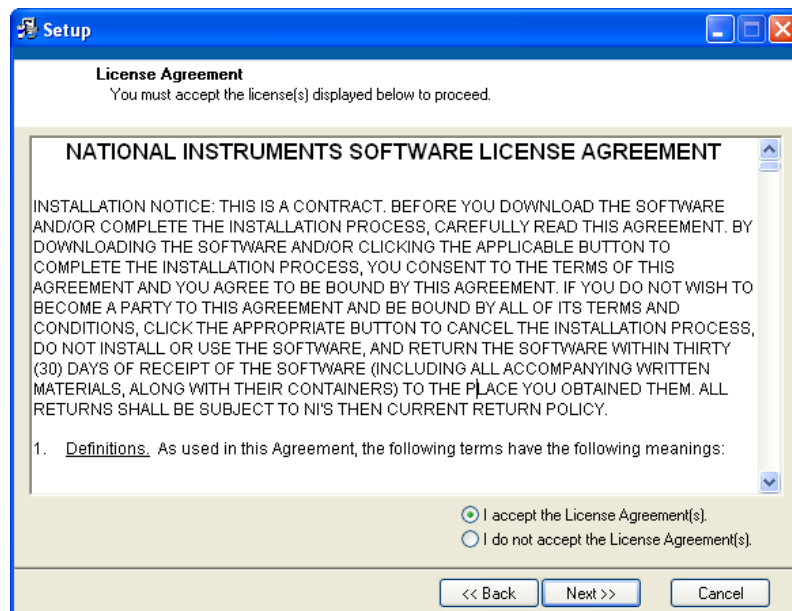
2. Execute the **setup.exe** file.



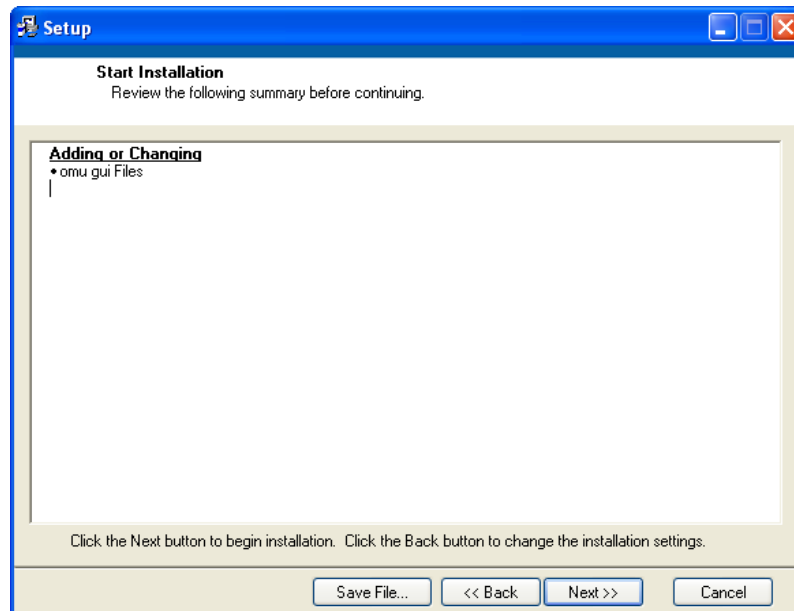
3. Select the destination directory.



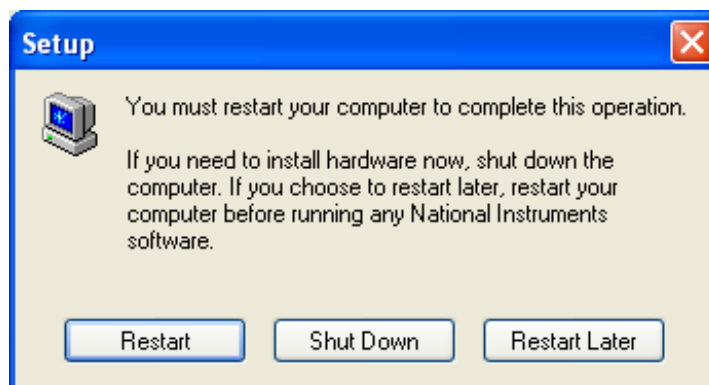
4. Accept the License Agreement.



5. Start the installation.



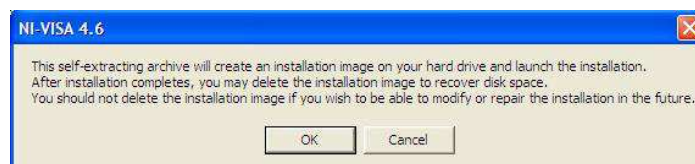
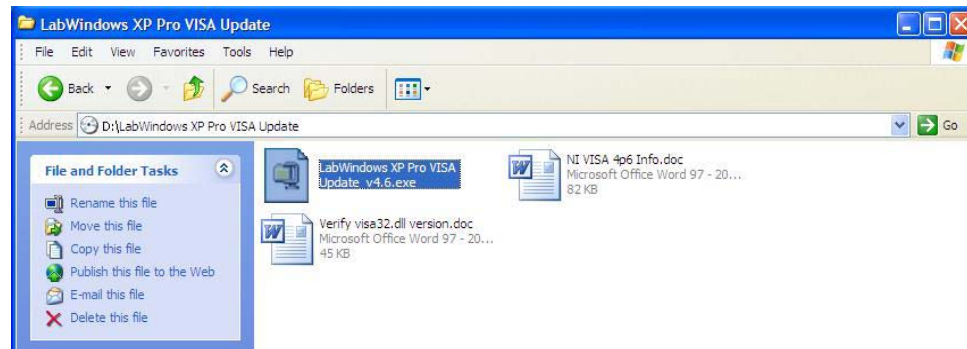
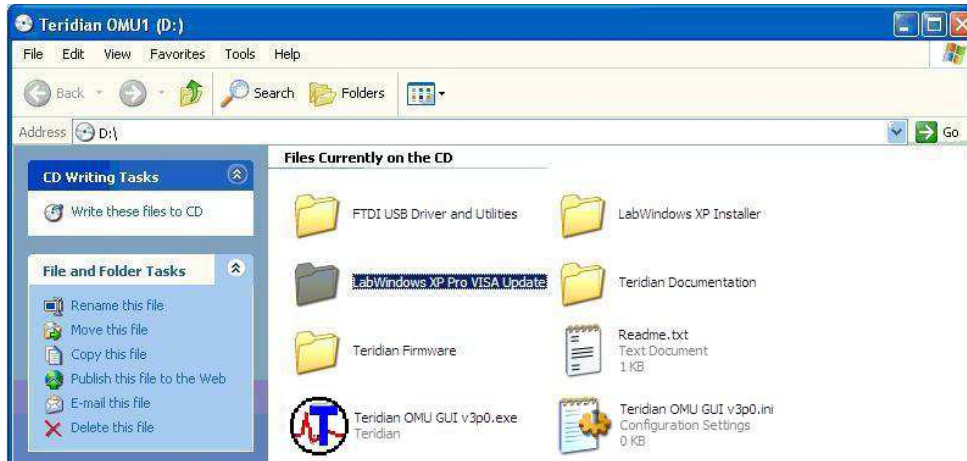
6. When the installation is complete, restart your computer.



2.6 Install LabWindows™ XP Pro Update

Do not install LabWindows XP Pro Update on Win2k.

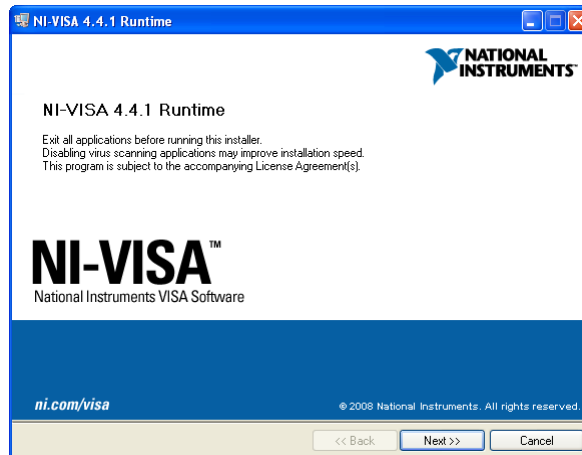
1. Launch the **LabWindows XP Pro VISA Update.exe** installation file on the CD.



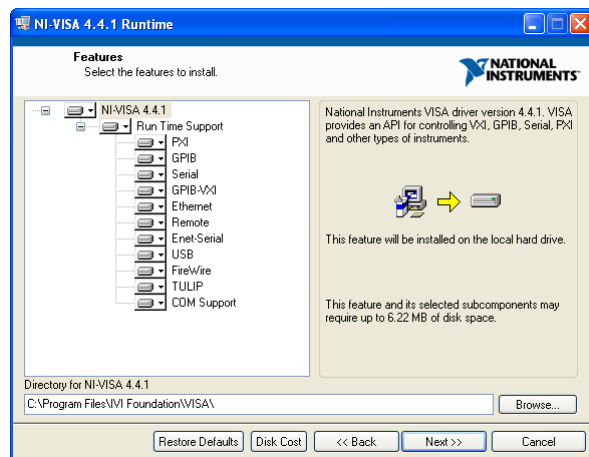
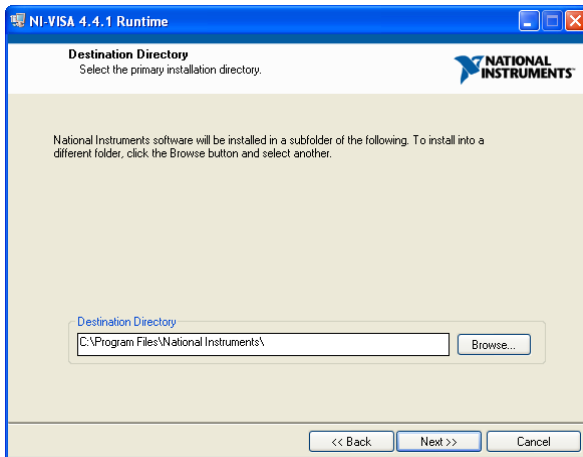
2. Un-zip the file to the proper folder.



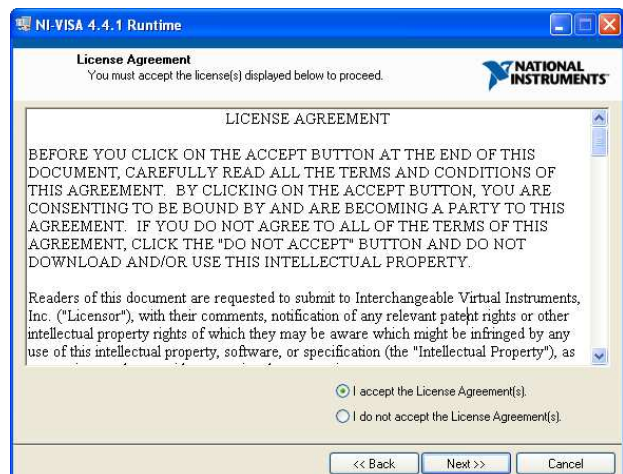
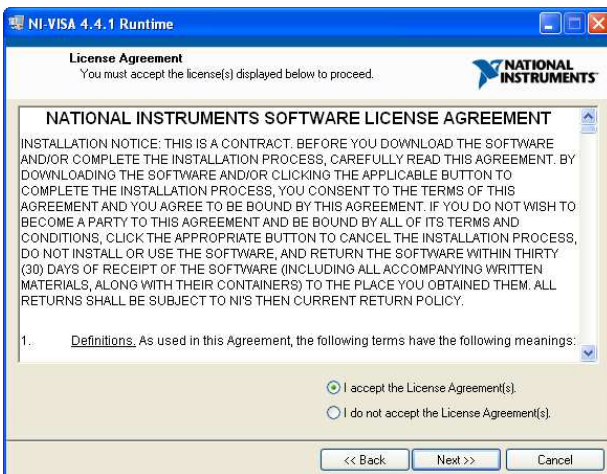
3. Start the installation.



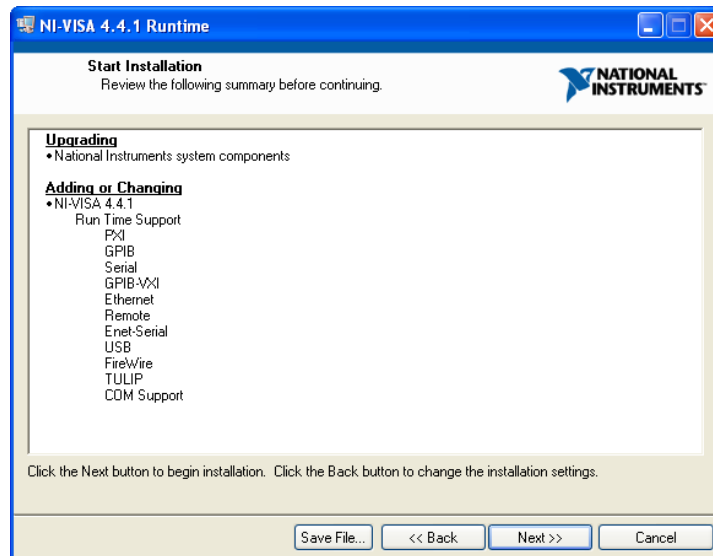
4. Select the proper destination directories.



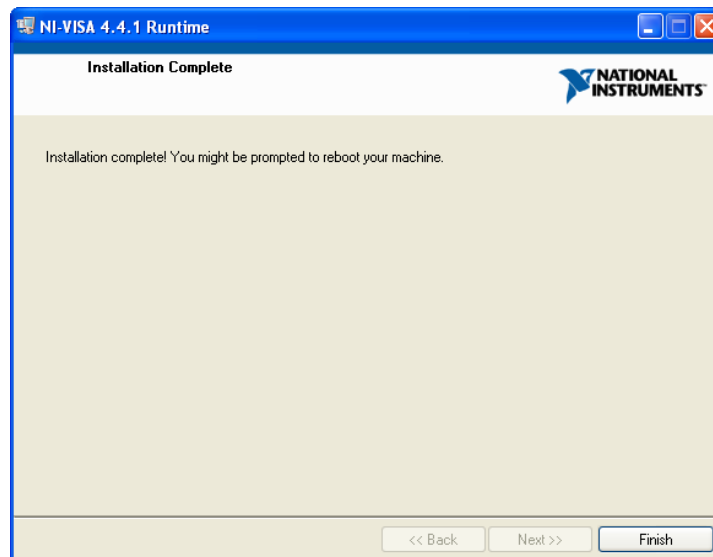
5. Accept the License Agreements.



6. The following screen appears. Click **Next**.



7. Click **Finish**.



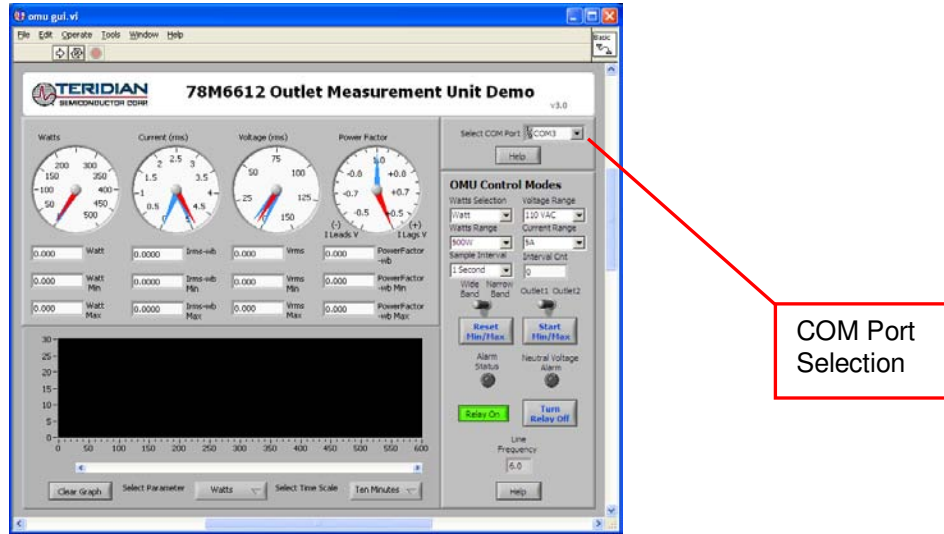
8. Copy the OMU GUI V3p0.exe application file from the CD to your PC.
9. Restart your computer.

3 Operating the Dashboard GUI

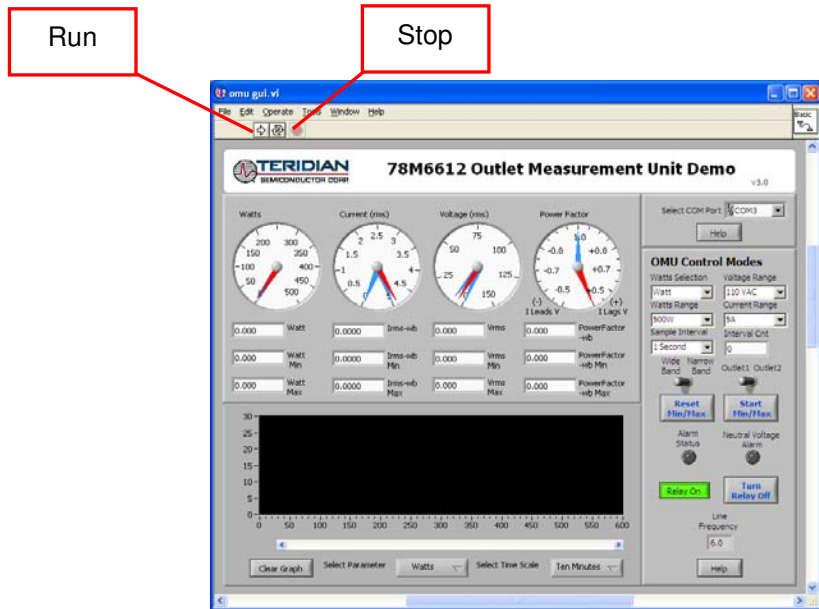
Start the Dashboard Program using launching **Teridian OMU GUI V3p0.exe**.

3.1 Port Selection

The COM port must be selected before data can be received from the OMU1. Select the appropriate COM port assignment previously defined on the Device Manager screen in [Section 2.2](#).



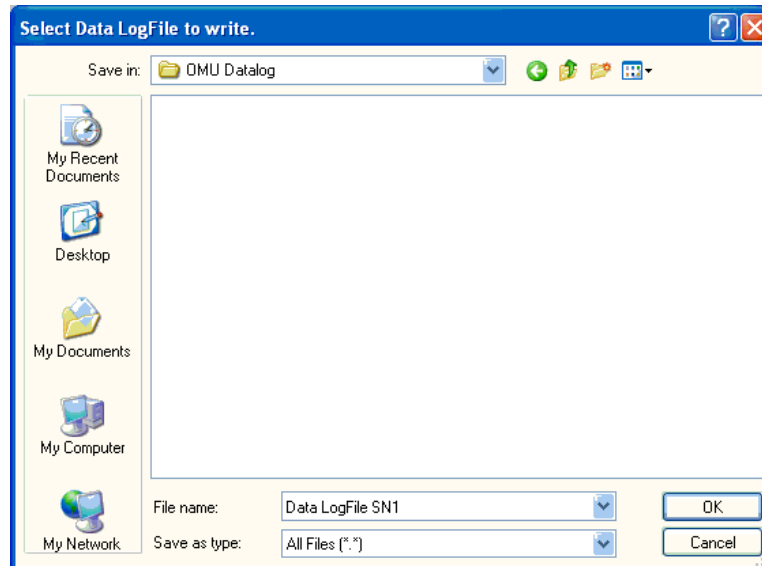
The **Run** and **Stop** buttons are located above the Teridian logo.



If the OMU1 is disconnected from the USB cable, close and restart the GUI to re-establish the USB COM port connection.

3.2 Creating a Measurement Data Log File

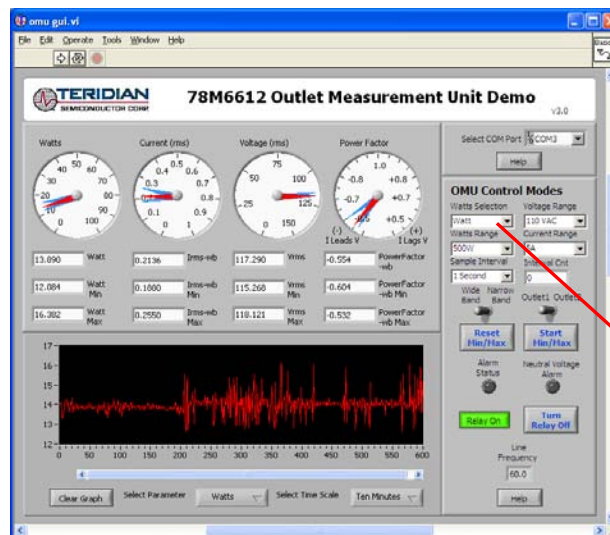
Upon clicking the **Run** button, a File Write dialog box appears. The GUI stores retrieved measurement data to a file for post processing. Enter the desired subdirectory and file name. Click **OK** to launch the main GUI display.



The measurement data is stored as text characters delimited by commas. Click the **Stop** button to close the text file and end the data logging function. New data log files are created wherever the **Run** button is clicked. The data log capture automatically stops after 12 hours. 12 hours of data results in a 12 MB file. To import the data log file into Excel, see [Section 4.19](#).

3.3 Selecting the Power Display Parameter

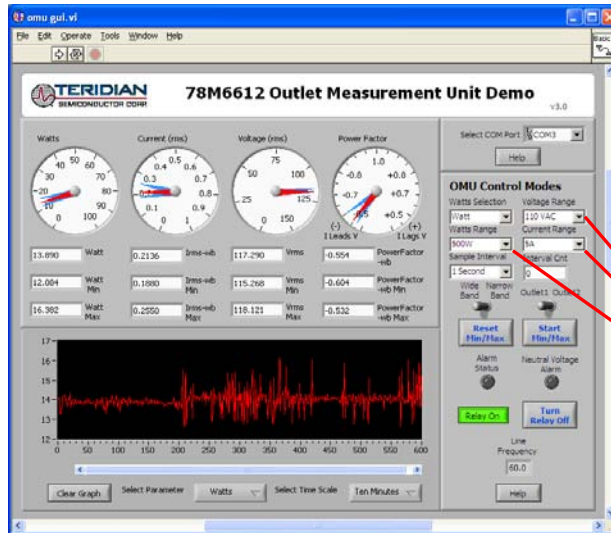
Using the **Watts Selection** menu under **OMU Control Modes**, select **Watt**, **VA** or **VAR** as the power display parameter.



Real power is the time average of the instantaneous product of voltage and current (**Watt**). Apparent power is the product of rms (root mean square) volts and rms amps (**VA**, volt-amps). Reactive power is the time average of the instantaneous product of the voltage and current, with current phase shifted 90 degrees (**VAR**, voltamps reactive).

3.4 Selecting the Display Scales

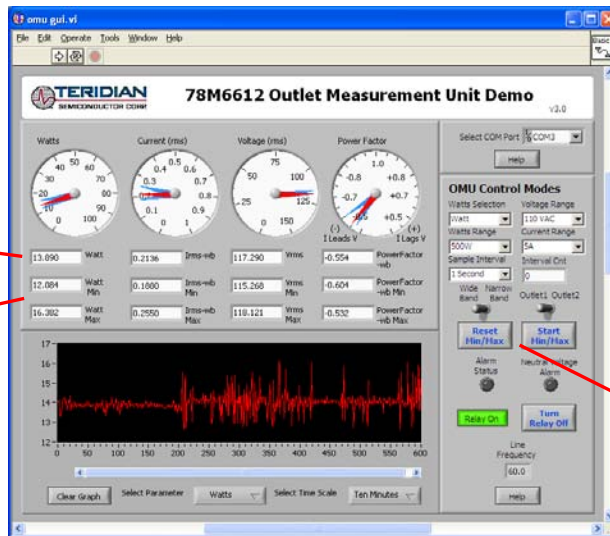
The range of values displayed in the **Watts** dial, the **Current (rms)** dial, and the **Voltage (rms)** dial can be changed. Use the **Voltage Range**, **Watts Range** and **Current Range** menus under **OMU Control Modes** to select the display scales for Watts, Current, and Voltage.



Scale for Voltage, Watts and Current

3.5 Resetting the Min and Max Indicators to Their Current Values

The **Reset Min/Max** button sets the Minimum and Maximum display values to the current conditions. Press the **Reset Min/Max** button to store the measured values in the first row of the display into the second row (the Min values) and the third row (the Max values).



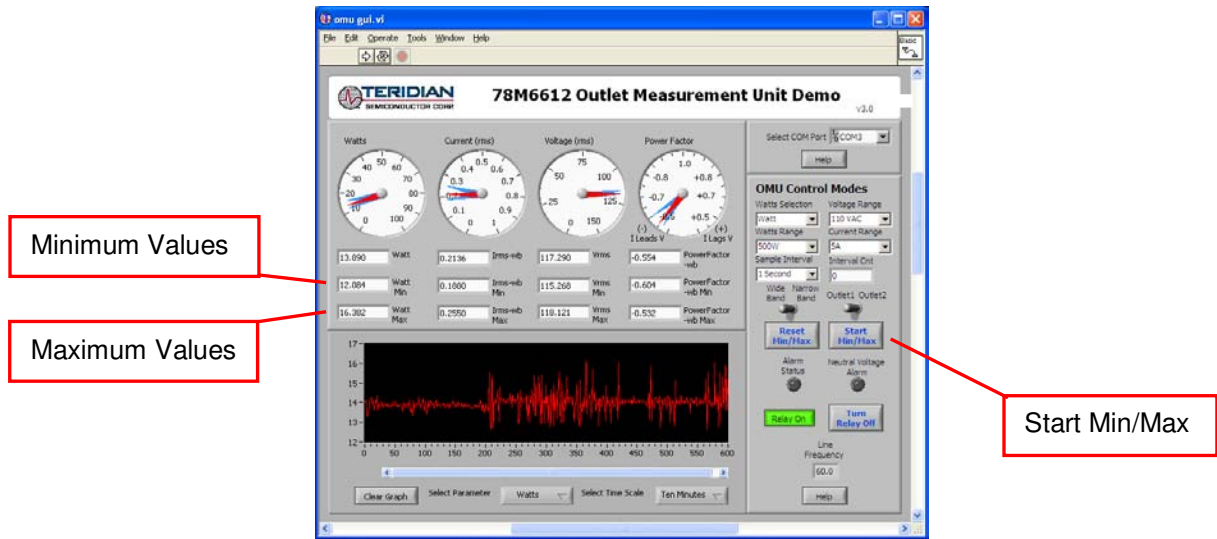
First Row – Current Conditions

Second & Third Rows – Minimum & Maximum

Reset Min/Max

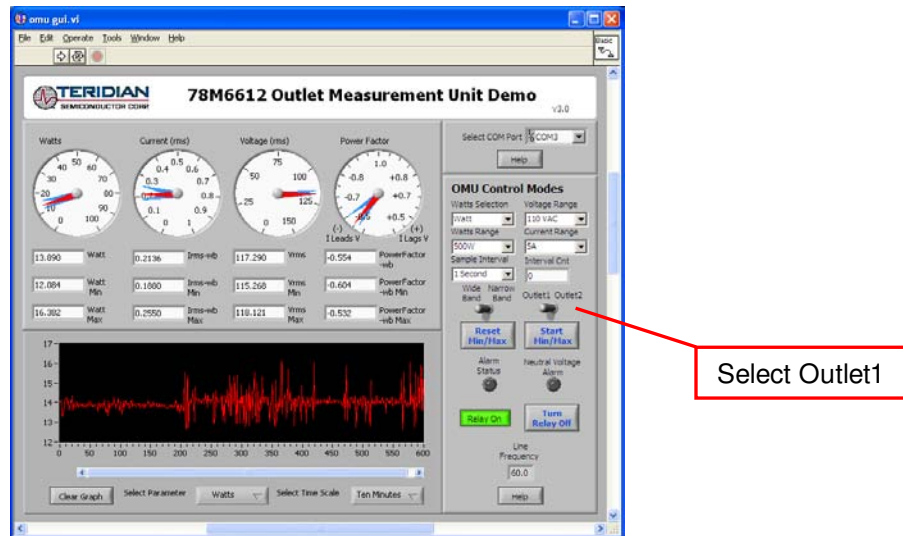
3.6 Begin Tracking Minimum and Maximum Conditions

To begin tracking minimum and maximum conditions as they occur, click the **Start Min/Max** button. Minimum values will display in the second row and maximum values will display in the third row.



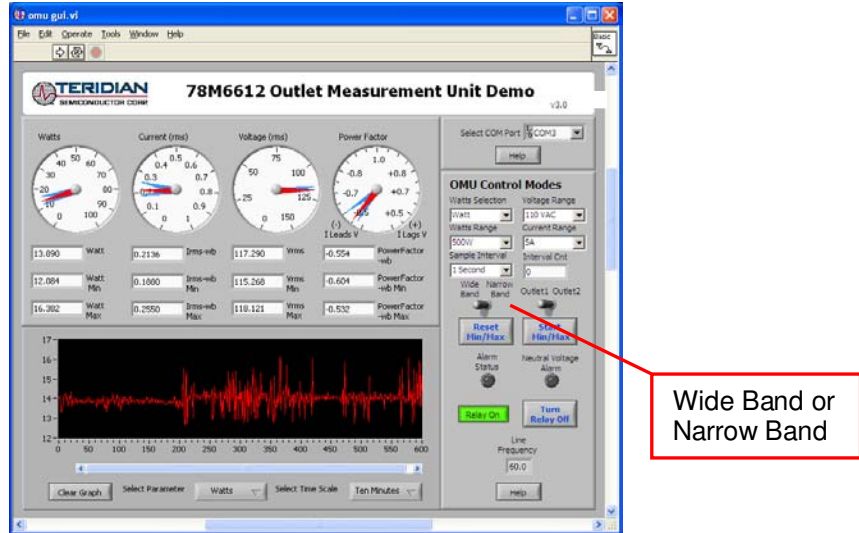
3.7 Selecting Outlet1

The GUI has provisions to display two loads: **Outlet1** and **Outlet2**. However, the OMU1-S-RF module contains only one load socket. Select **Outlet1** for use with the OMU1-S-RF module. All **Outlet2** power and current measurement displays show "0.00" due to the missing load circuit. Similarly, all Totals measurement displays mirror the Outlet1 results.



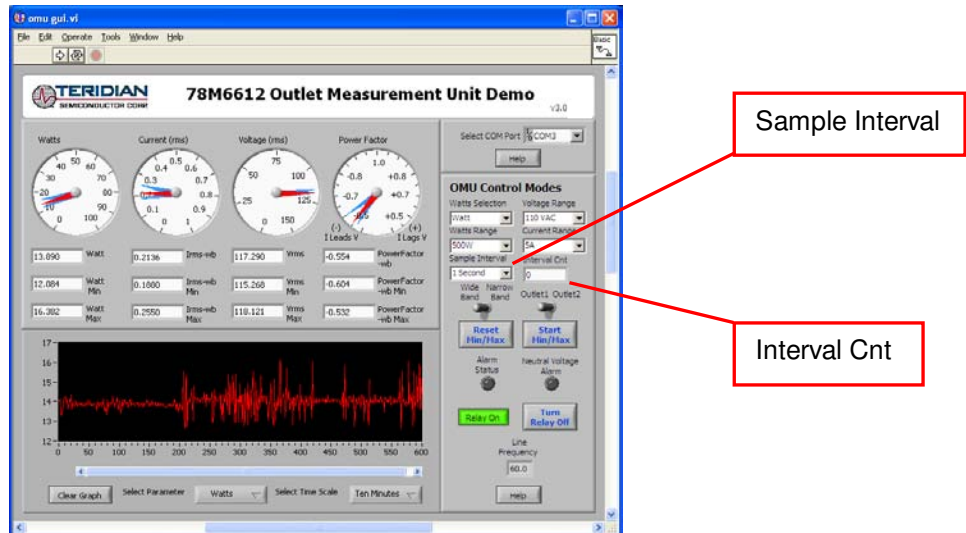
3.8 Selecting Wide Band or Narrow Band Measurement

The GUI provides for two measurement algorithm options. The **Wide Band** measurement method is optimal for measuring power from equipment with switching power supplies. The **Narrow Band** method works well with conventional loads. All measurement displays, dials and graph are updated with the appropriate data based on the **Wide Band / Narrow Band** selection.



3.9 Selecting the Sample Interval

Sample Interval provides a menu of sample sizes for display averaging. The 1 Second setting updates the display with every sample once a second. The 5 Seconds setting averages 5 samples and updates the display every 5 seconds, etc. **Interval Cnt** provides an index for the next display update. For example, if **Sample Interval** is set to 5 Seconds, **Interval Cnt** will count from 1 to 5.



3.10 Alarm Status

The **Alarm Status** indicator turns red if any Alarm Status Threshold is exceeded. See [Section 4.16](#) for more information.