2 Installation

Before you can use the VolksMeter, it must be "Installed". Installation of the VolksMeter consists of the following steps:

1. Unpack
2. Setup for initial test; configure Interface Board.
3. Install WinSDR and WinQUAKE software on support computer. Connect VolksMeter to support computer.
4. Check and adjust alignment if necessary.
5. Configure WinSDR
6. Rough level the VolksMeter and verify operation.
7. Select Permanent Site.
8. Move the VolksMeter to the permanent site, connect and level.
9. Configure software for long-term data recording. (This step is discussed in Chapter 3, Software Setup for Operation.)

2.1 Unpack The VolksMeter

Upon opening the shipping carton, you should remove the following items from the box:

- This User's Manual
- The Communications Cable (USB or RS232-C)
- The AC Power Adapter
- The Tool Kit
- The GPS Receiver and Cable (Optional item)

When all items have been removed from the top-level cavities of the shipping box, carefully pull the upper styrene block out of the box to expose the

VolksMeter instrument itself.

Lift the instrument from the box and place it, with the flat Base Plate down, on a sturdy, hard surface.

For initial alignment checking and adjustment, the instrument should be placed in a well-lit, accessible location, close to the support computer. After initial testing, the VolksMeter can be moved to its' permanent location.

Save the shipping box and inserts in case you have to re-ship the VolksMeter.

Note that the Leveling Screws protruding below the Base Plate have sharp points on the ends, so choose or protect the surface accordingly.

Unpack the Tool Kit. There will be a 6-in-1 Multi-tool, a 3/32" Hex Driver and a 3/32" Hex L-Key. Unwrap the multi-tool, pull out the shaft, reverse it

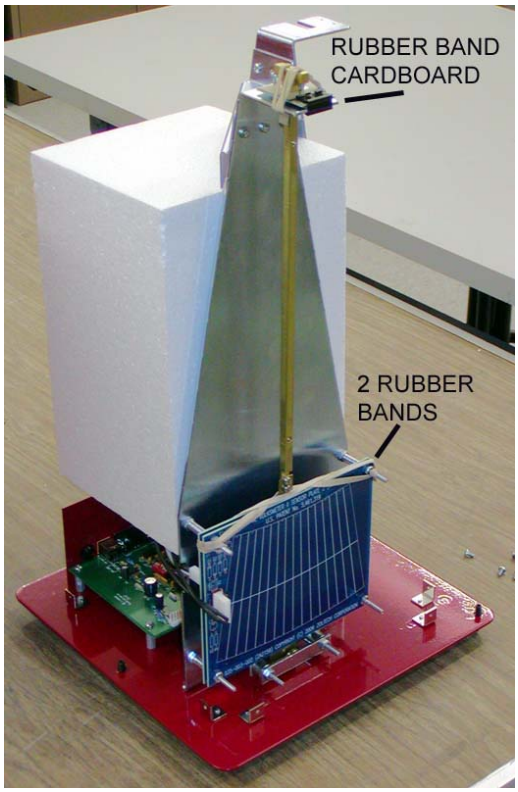
to expose the #2 Phillips screw driver and reinsert the shaft into the handle.

Use the Multi-tool to remove the screws that hold the VolksMeter Cover to the Base Plate. There are seven such screws located along the lower edge of the Cover. There are two screws on each side of the Cover except for the side with the I/O Panel, which has a single screw. Remove and save all seven screws.

Note that there are Torx-head screws along the vertical and top edges of the Cover. These screws are used to hold the two parts of the Cover together and normally should never be removed.

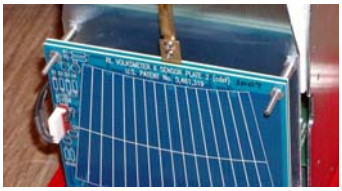
Lift the Cover straight up from the Base Plate until the Cover is clear of the internal components of the VolksMeter. Set the Cover aside for now.

Remove the shipping restraints on the Pendulum Assembly.



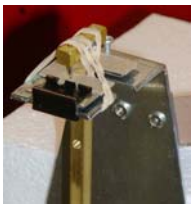
First remove the two rubber bands from the bottom of the Pendulum Bar / Sensor Assembly:

One Rubber Band Removed

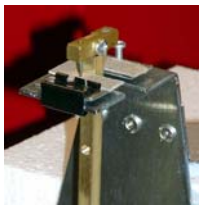


Both Rubber Bands Removed

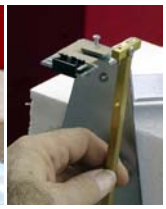
Next, remove the rubber band and the cardboard part from the top of the Pendulum Bar / Pivot Point Assembly:



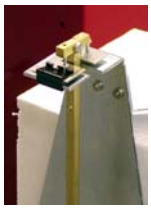
Rubber Band and Cardboard in place



Rubber Band removed



Lift the Pendulum Assembly to remove the Cardboard



Place the Pivot Points in the cups on the Pivot Plate

Save the Cardboard in case you re-ship the unit.

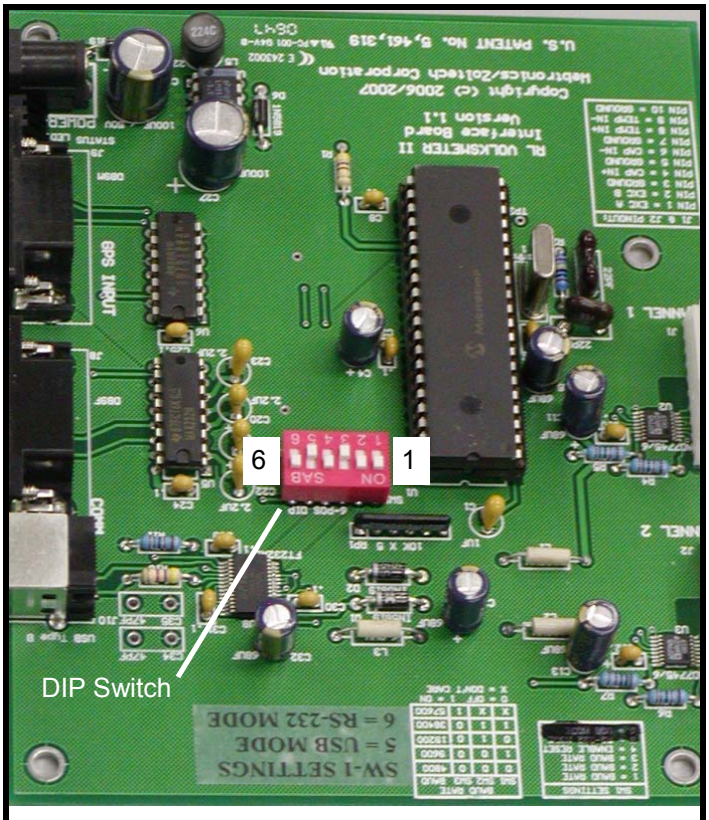
Repeat the removal of shipping restraints on the second channel Pendulum Assembly, if present.

This completes the Unpacking step.

2.2 Setup for Initial Test

Your VolksMeter was tested for proper operation prior to shipment. However, because unexpected things may happen during shipment, we recommend that you confirm the operation of the instrument prior to placing it in its' permanent location and placing it in operation.

As suggested in the prior section, the VolksMeter should be placed on a sturdy table, relatively level (±1°), well lit, hard surface, near a suitable support computer (you will need to be able to see the screen and operate the keyboard/pointing device during testing).



Interface Board showing configuration DIP Switch

If your VolksMeter includes the USB interface, it will be shipped with a 10ft USB cable (unless otherwise specified), otherwise it will have a 10ft RS232-C cable. The Interface Board mounted on the Base of the VolksMeter, below the styrene Thermal Insulating Block, must be configured for the desired communication interface, USB or RS232. The board was configured to use the interface corresponding to the supplied cable at the factory. The communications interface of the VolksMeter is configured by setting a DIP Switch on the Interface Board. Check the Interface Board DIP Switch for the correct configuration for your installation. The DIP Switch has six individual switches numbered from 1 to 6. When a switch is positioned toward the edge marked ON, then it is ON (or 1). If positioned toward the edge opposite of ON, then the switch is OFF (or 0).

If you are using the USB interface between the VolksMeter and the support computer, then switch 5 must be ON and switch 6 must be OFF. The positions of switches 1-3 do not matter if using the USB interface.

If you are using the RS232-C interface, then switch 6 must be ON and switch 5 must be OFF. Switches 1-3 control the data rate for the RS232-C interface according to table:

Data Rate	SW1	SW2	SW3
4800	0	0	0
9600	1	0	0
19200	0	1	0
38400	1	1	0
57600	X	X	1

RS232C Data Rates

38400 baud is the default setting. Unless you have a reason to change this, leave it alone.

When used with the provided WinSDR software, switch 4, ENABLE RESET must be ON. This is the default setting.

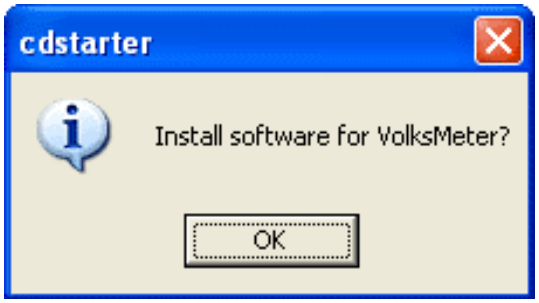
2.3 Install Software

The VolksMeter requires a support computer and dedicated software in order to be used. The required software includes WinSDR, WinQuake and, possibly, USB/serial communication drivers. As mentioned in the Introduction, the support computer must run a version of MS Windows that supports a CD-ROM and a USB or RS232 port.

The installation procedure described below assumes the support computer is running Windows XP. Other supported operating systems will be similar.

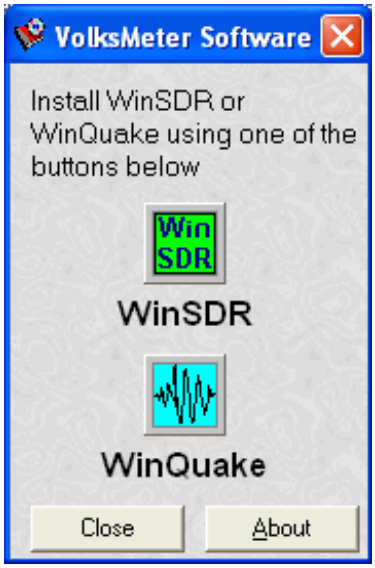
The support computer should be displaying the Desktop with no other applications running. Install the provided software by performing the following steps:

1. Load the VolksMeter II Software CD-ROM disk into the CD-ROM drive. The message "Install Software for VolksMeter?" should appear.



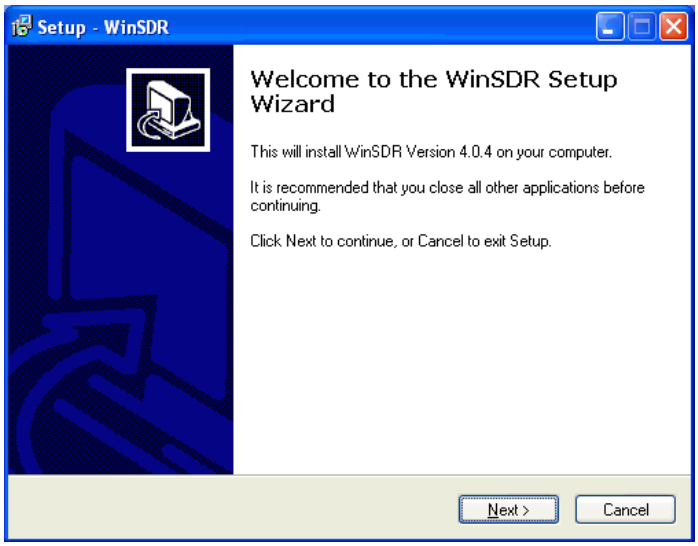
Click OK to continue.

2. A window with the message, "Install WinSDR or WinQuake using one of the buttons below" will appear.

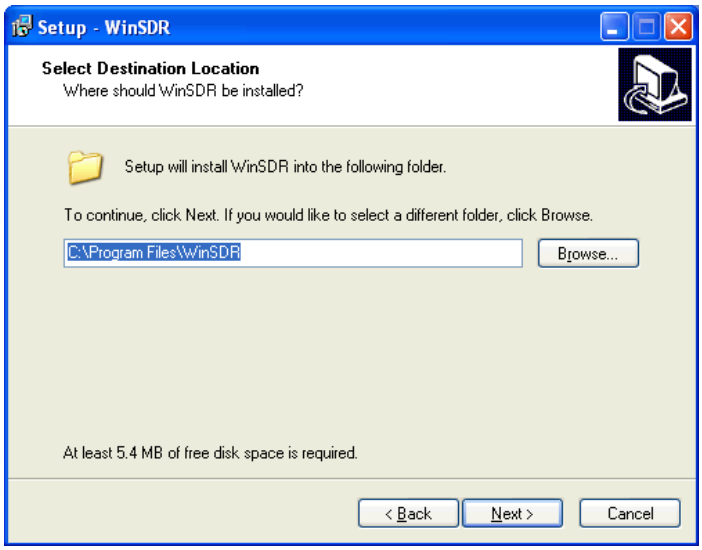


Click the WinSDR button to continue.

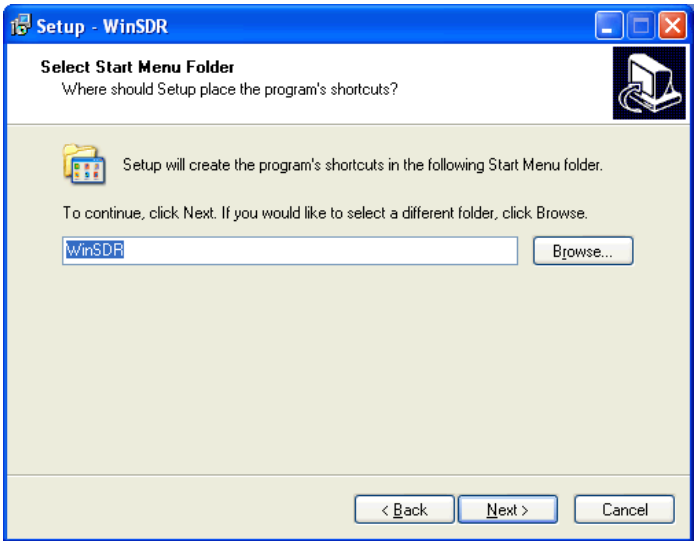
3. The WinSDR Setup Wizard will appear.



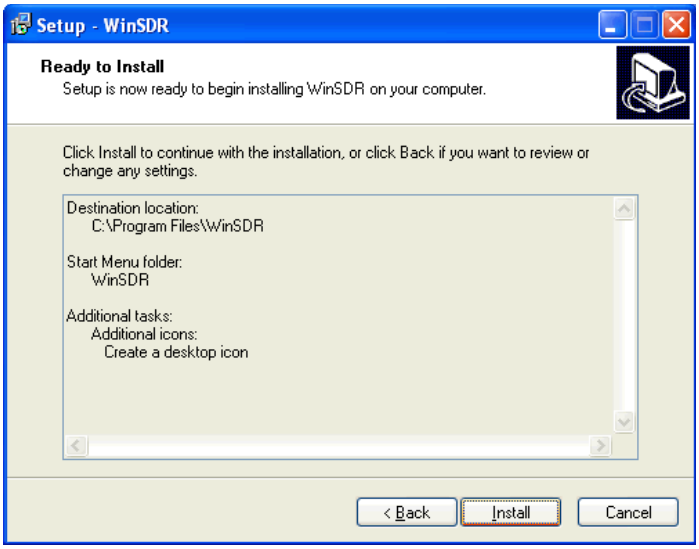
Click NEXT to continue. Follow the instructions displayed by the Setup Wizard.



Specify the folder where the WinSDR program will be installed. We suggest tht you accept the default location: C:\Program Files\WinSDR. Click NEXT to continue.

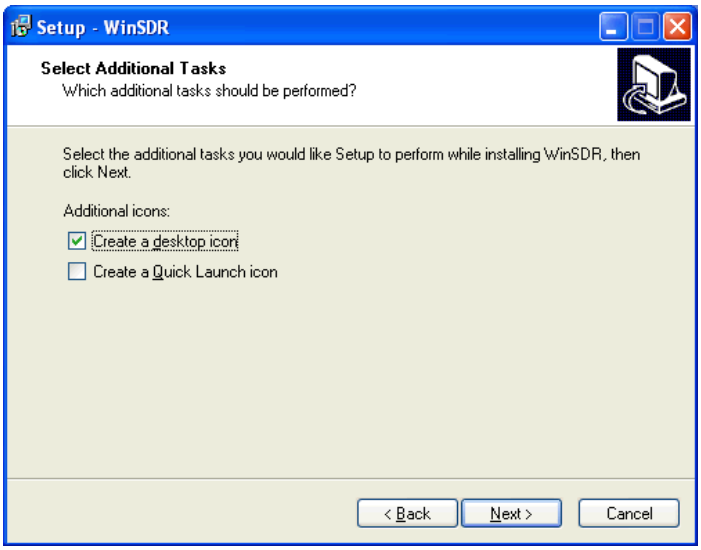


Specify the Start Menu folder. We suggest that you accept the default: WinSDR. Click NEXT to continue.

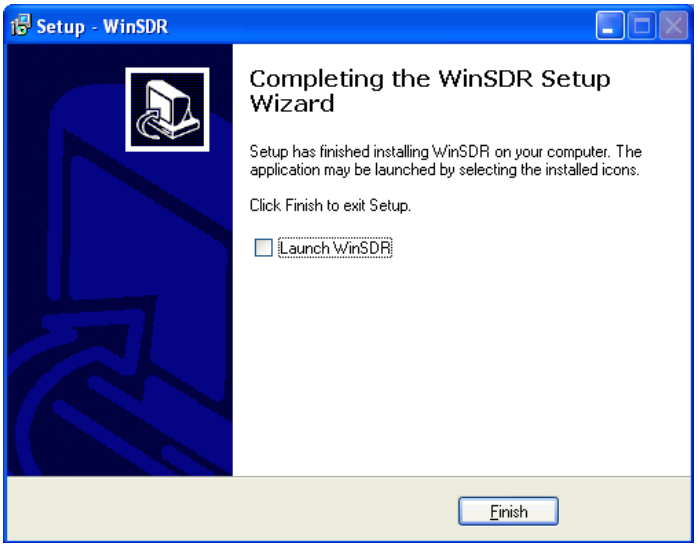


Ready to Install. Confirm your installation selections. Click INSTALL to proceed.

You will see a progress window while WinSDR is being installed. When the installation is complete, the Finish window will be displayed.



Select Additional Tasks. We suggest that you check the "Create a desktop icon" box to place a WinSDR icon on your desktop. Click NEXT to continue.

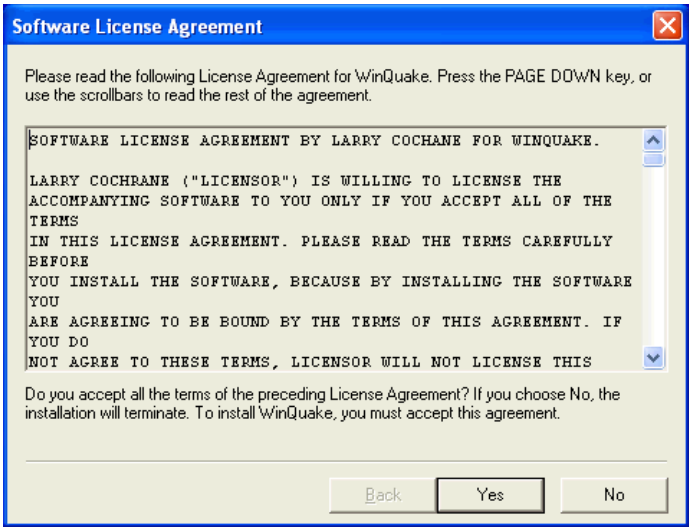


Uncheck the Launch WinSDR box. DO NOT launch WinSDR upon completion of the installation. Click FINISH to return to the Windows Desktop.

You will now install WinQuake by performing the following steps:

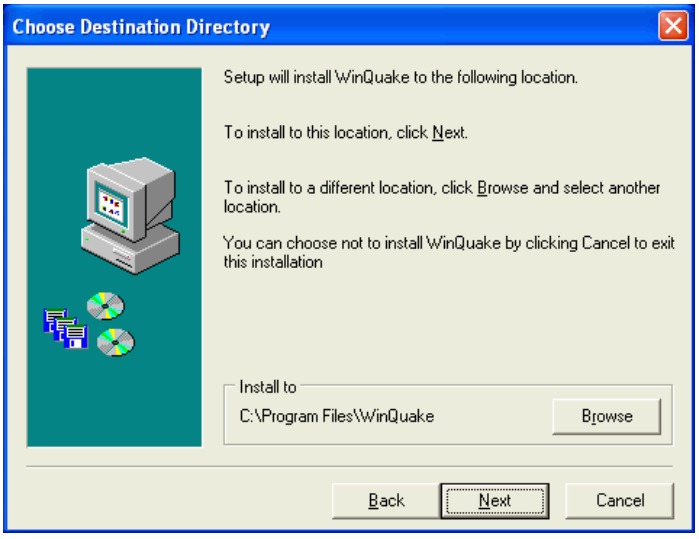
1. At the VolksMeter Software window, click the WinQuake button.

2. The WinQuake Software License Agreement will appear.



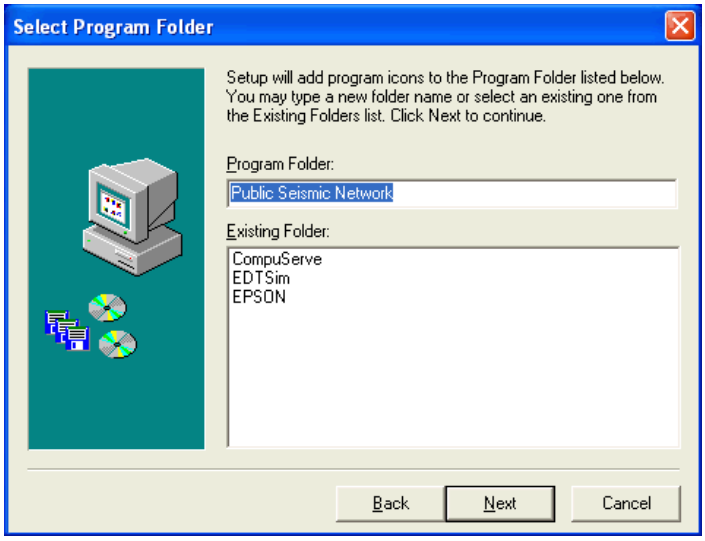
Click YES to accept the software license agreement.

3. The Software Installation Wizard will appear.



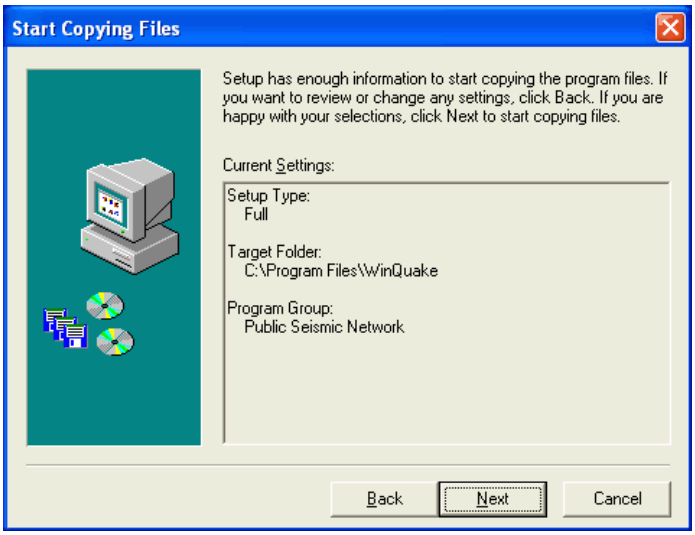
Click NEXT to accept the default and continue.

4. The Select Program Folder window will appear.



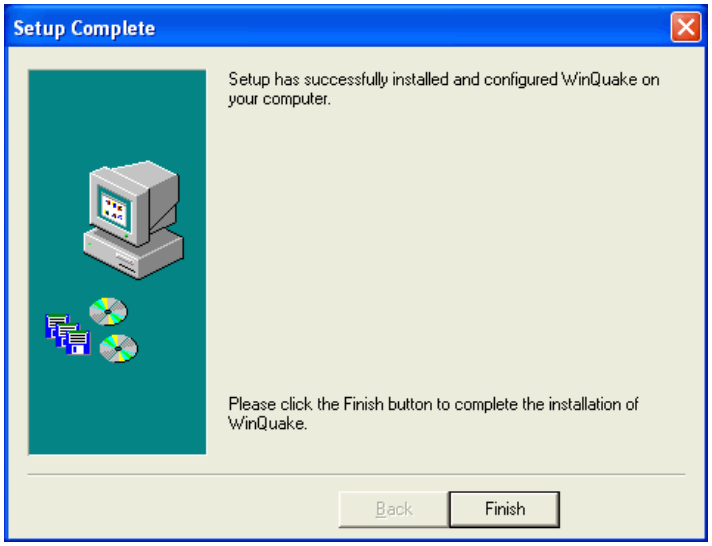
Accept the default, “Public Seismic Network” and click NEXT to continue.

5. The Start Copying Files window will appear.



Confirm your choices and click NEXT to continue.

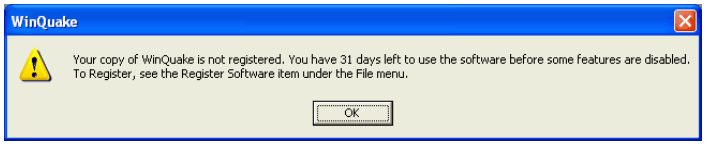
6. The Setup Complete window will appear.



Click FINISH to complete the installation.

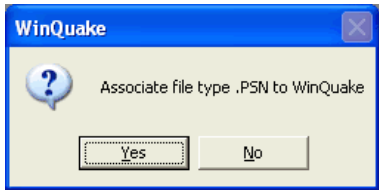
7. Click CLOSE to close the VolksMeter Software window.

8. Register WinQuake by clicking: START | ALL PROGRAMS. From the applications list, select the folder that you specified for WinQuake (PUBLIC SEISMIC NETWORK is the default). Since this support computer is presumably dedicated to the VolksMeter, copy the WinQuake shortcut to the Desk Top. On the Desk Top, click on the WinQuake icon to start WinQuake. WinQuake will open and a message window notifying you that WinQuake is not registered will appear.

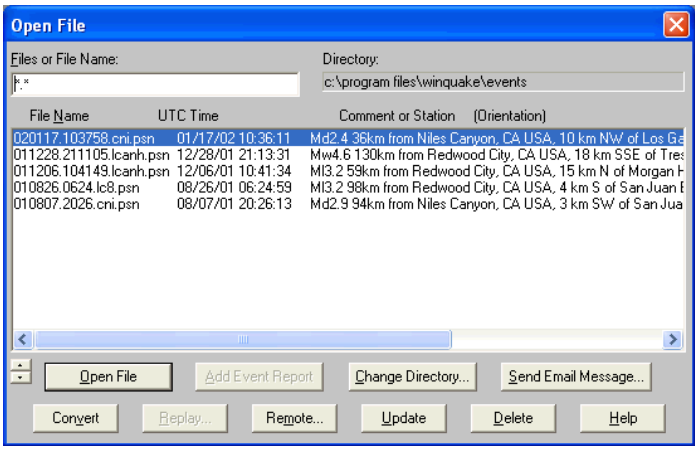


Click OK to continue.

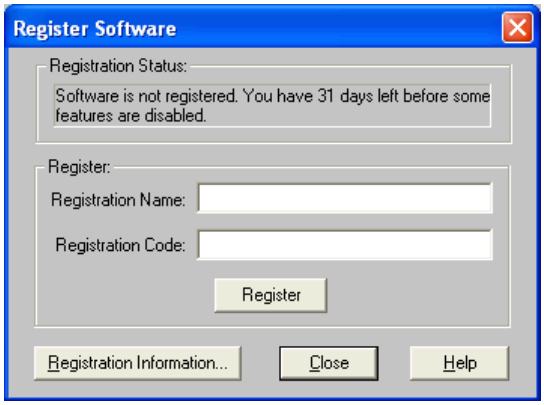
9. Another message window will appear.



Click YES to continue. Then click OK to acknowledge the file association. An OPEN FILE window will appear.



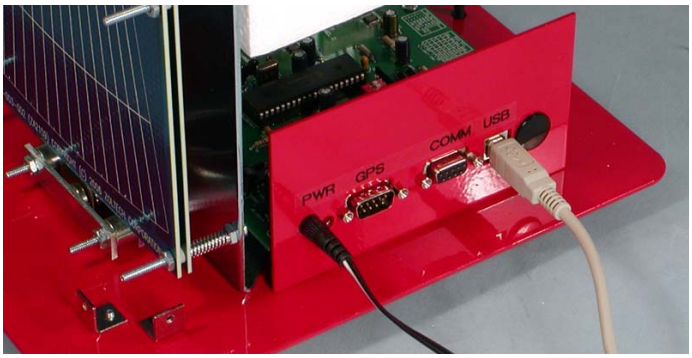
10. Ignore the OPEN FILE window and, on the menu bar, click FILE | REGISTER SOFTWARE... to open the Register Software window.



Enter the Registration Name and Registration Code (exactly as supplied) that are printed on the sticker on the back of your VolksMeter CD-ROM container. Click REGISTER. Click CLOSE. Click FILE | EXIT to shut down WinQuake and return to the Windows Desktop.

Next the USB drivers will be installed, if you are using a USB communications link. (Specific driver installation is not normally required if you are using an RS232-C communications link. In this case, proceed to section 2.4 Check and Adjust Alignment.)

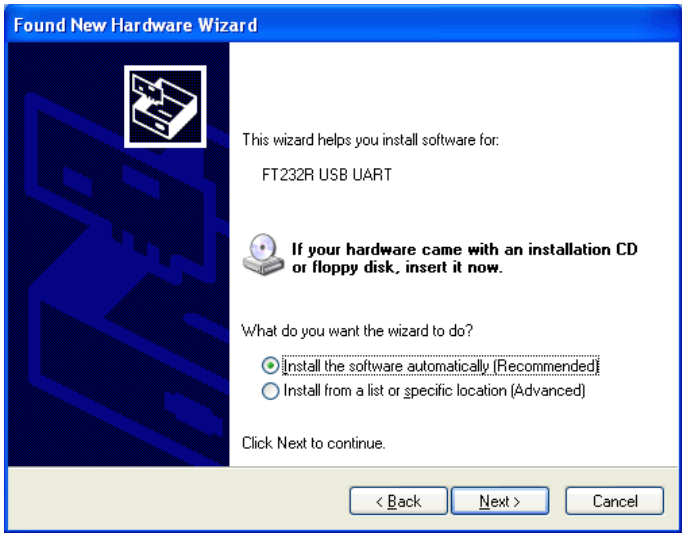
1. Apply power to the VolksMeter by plugging the supplied AC Adapter into an AC outlet. (The standard AC Adapter is limited to 120VAC/60Hz power. A Universal AC Adapter is available as an option.) Plug the DC connector from the Adapter into the PWR connector on the I/O Panel of the VolksMeter. After a few seconds, the LED indicator next to the PWR connector will begin to blink rapidly (~5 times per second), confirming that the Interface Board is powered and initialized.



2. Connect the USB cable between the VolksMeter USB connector and a USB port on the support computer. The Windows "Found New Hardware" wizard should start.

Select "No, not at this time." and click NEXT to continue.

2. The Wizard should display "FT232R USB UART" as the hardware found.



Accept the default "Install Software Automatically" and click NEXT to continue.

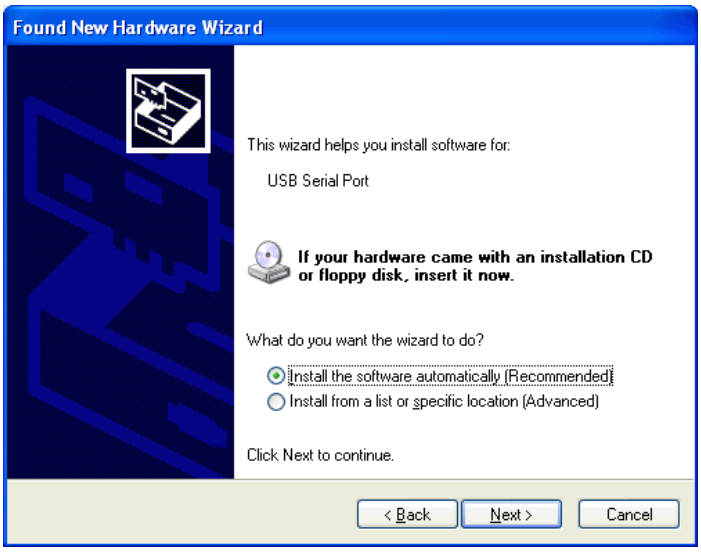
3. The Wizard will display a couple of progress messages followed by: "The Wizard has finished installing software for USB Serial Converter".

Click FINISH to continue.

4. The Found New Hardware Wizard will start again.

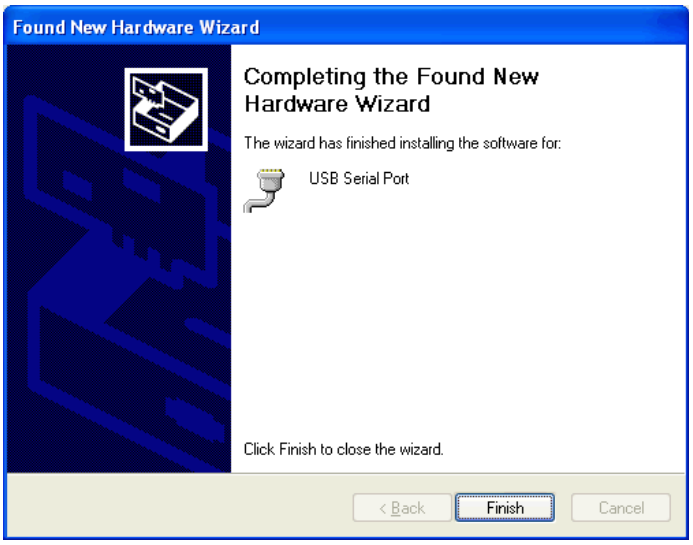
Select "No, not at this time" and click NEXT to continue.

5. The Wizard will display "USB Serial Port" (or, depending on your Windows XP update level, "%VID_403&PID_6001.DeviceDesc%") as the hardware found.



Accept the default "Install Software Automatically" and click NEXT to continue.

6. The Wizard should display "The Wizard has finished installing software for USB Serial



Port". Click FINISH to continue.

7. Windows should display "New Hardware is installed and ready to use."

The WinSDR and WinQuake software and USB drivers (if required) are now installed. Proceed to section 2.4 Check and Adjust Alignment.

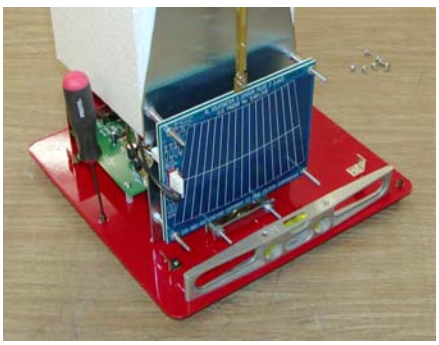
2.4 Check and adjust alignment

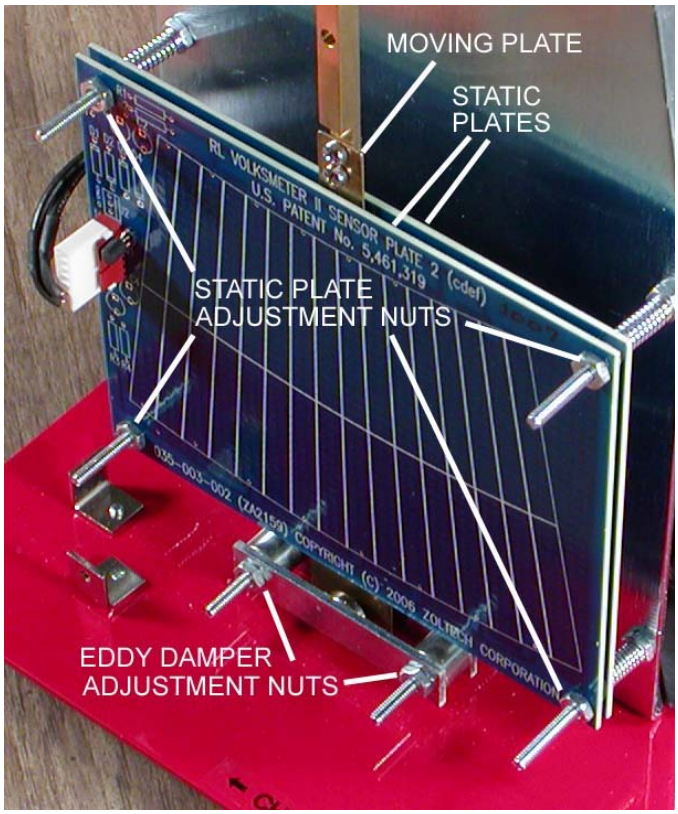
While the Pivot Plate, Sensor Plates and Eddy Damper Plates were aligned with the Pendulum Assembly prior to shipment, it is possible that some of the position setting screws shifted in transit. In this section you will check the mechanical alignment of these components and adjust them if necessary.

As suggested in prior sections, the VolksMeter should be on a hard, level, well lit surface, preferably a table or bench that allows easy inspection of the movement and clearances of the parts. Follow the procedure below to check the sensor alignments.

1. Level the Base. This initial leveling is most easily done with a small (~8" long) carpenter's bubble level or equivalent (user supplied). Use the 3/32" Hex Driver included in the took kit. Note that the Base has three leveling screws: two in corners and one in the middle of the opposite edge. Place the level between the two corner screws first and adjust these screws as required to level that edge.

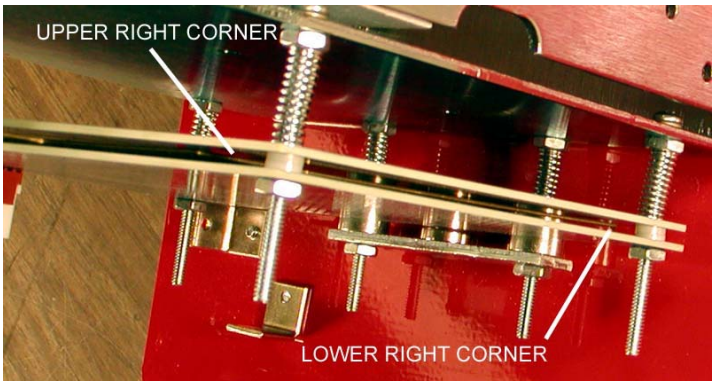
Then place the level parallel with an edge of the Base perpendicular to the edge between the corner screws. Use only the middle screw to level this edge. Move the level back to the original edge to make sure that edge is still level. Repeat as necessary. The Base of the instrument should now be level enough to check the alignment of the pendulum (or pendulii).



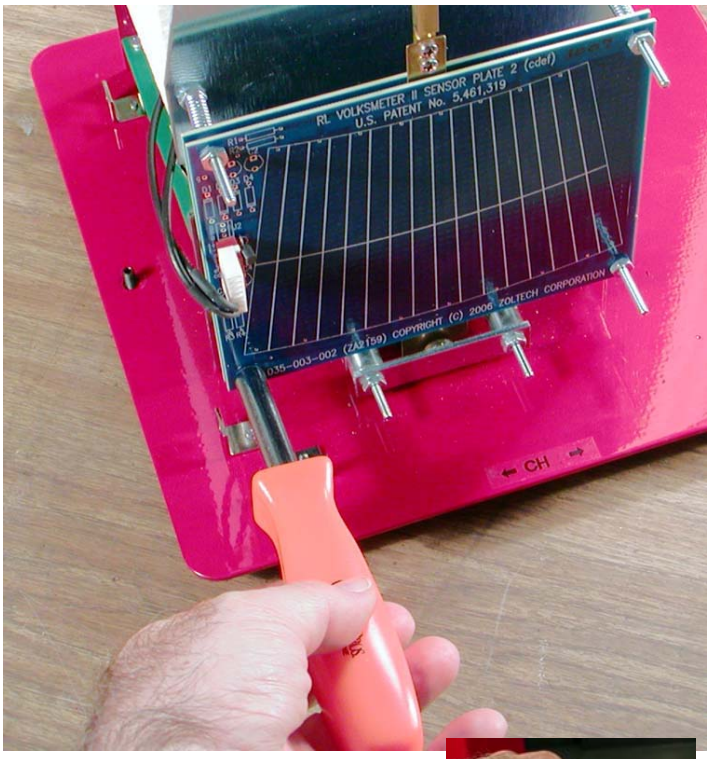


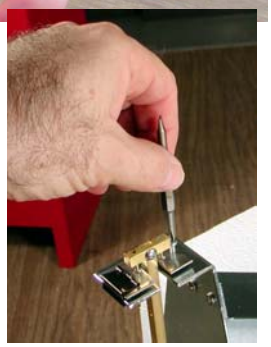
Examine the position of the Moving Plate at the end of the Pendulum Rod. If nothing shifted in transit, the Moving Plate should be parallel to the Static Plates and roughly centered between them. (Since, due to the manufacturing process, the Moving Plate is rarely perfectly flat, it is not possible to perfectly center it between the Static Plates at all points across its' surface, nor is this necessary for the proper operation of the instrument.) More importantly, the Moving Plate must not be in contact with either Static Plate. Under correct alignment, the Moving Plate will be able to swing freely through its' entire arc (which is limited by the tab at the bottom of the Moving Plate and the spacers at each end of the Eddy Damper Plates).

Generally, if you look at each corner of the main body of the Moving Plate; two top corners and two bottom corners, and they are not in contact with either Static Plate, then the Moving Plate as a whole will not be in contact with the Static Plates.
If the Moving Plate is touching one or both Static Plates, the position of the Static Plates can be adjusted by using the Multi-tool's 5/16" nut driver to turn the adjustment nuts at each corner of the outer Static Plate. If the Moving Plate is touching

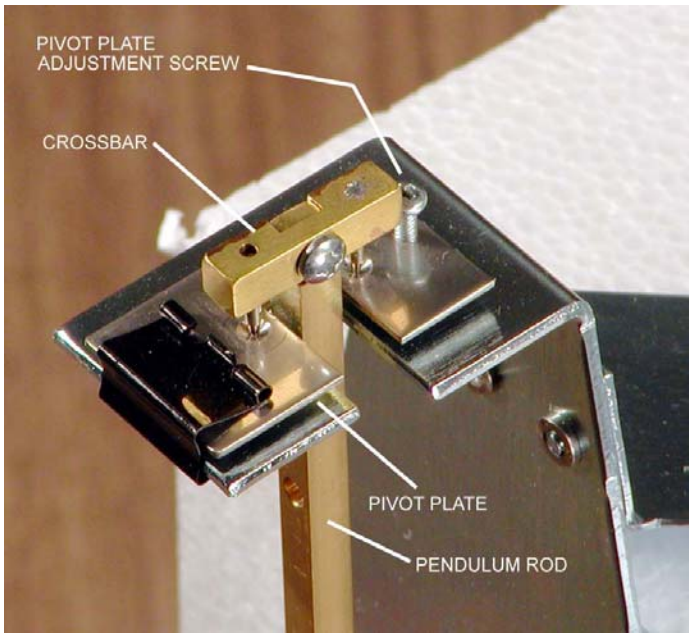


the outer Static Plate at a corner near an adjustment nut, turn that nut counter-clockwise to move that corner away from the Post and the Moving Plate. Turn the nut clock-wise to move the Static Plates toward the Post at that corner. Repeat as needed at each corner. This is an iterative process, since freeing one corner may cause the other corners to shift.





Once the moving plate is aligned with the fixed plates, check the Pivot Plate at the top of the Pendulum Rod.



If the Pivot Plate is level, then both Pivot Points will be resting in the bottoms of the two cups in the Pivot Plate. Confirm this by gently applying torque (twisting) to the Crossbar in a plane parallel to the Pivot Plate. If the Pivot Plate is level, the Crossbar will not twist under gentle torque. If one of the Pivot Points is not resting on the bottom of its' cup, the Crossbar WILL twist about the Pivot Point that is at the bottom if its' cup.

If the Pivot Plate requires leveling, use the small Phillips screw driver from the Multi-tool to turn the Adjustment Screw. Turning the Adjustment Screw clockwise will raise that side of the Pivot Plate. Note that adjusting the Pivot Plate may shift the Moving Plate at the bottom of the Pendulum Rod with respect to the Static Plates. Thus, after leveling the Pivot Plate, you should confirm that the Moving Plate is still centered between the Static Plates and re-adjust the Static Plates if necessary.

Repeat the adjustment of the Pivot Plate and the Static Plates as necessary to have a level Pivot Plate and the Moving Plate centered between the Static Plates.

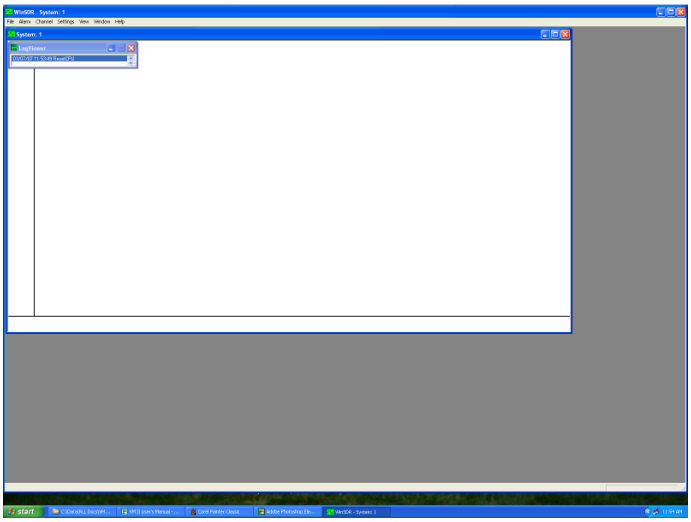
Repeat the Static Plate alignment and Pivot Plate leveling on the second channel sensor, if present.

2.5 Configure WinSDR

Now you will run the WinSDR software and configure its' parameters to talk with the VolksMeter. This is just an initial configuration, enough to verify operation of the VolksMeter. More complete WinSDR configuration, for long-term data recording, is discussed in Chapter 3.

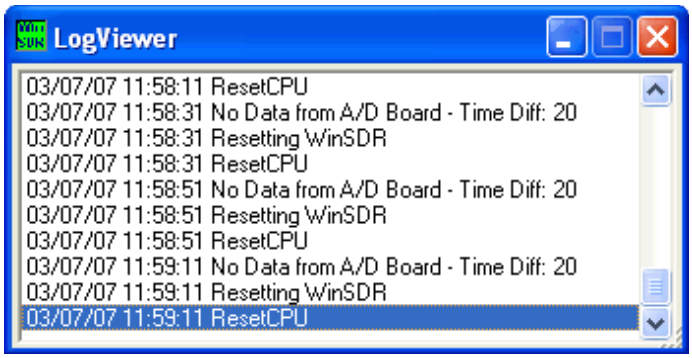
Confirm that power is applied to the instrument by observing the status LED next to the PWR connector on the I/O Panel is blinking. Verify that the communications cable (USB or RS232) is connected to both the VolksMeter and the support computer.

Start the WinSDR program for the first time (if you did not do so during the software installation, you may want to place a copy of the WinSDR icon on the Windows Desktop to facilitate subsequent startups).



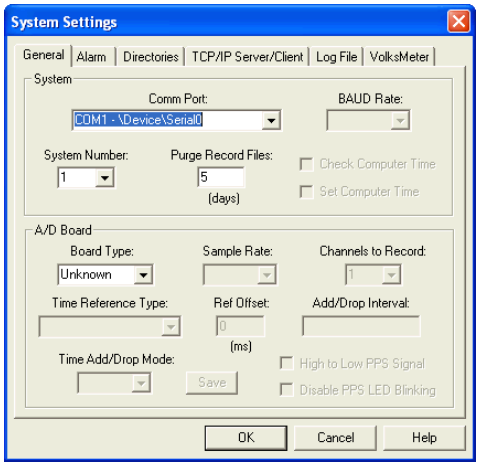
The program will attempt to initialize and communicate with the VolksMeter. The program defaults will probably not match your actual hardware configuration and this attempt will fail.

The Log Viewer window, when expanded, will repeatedly display its' attempts to communicate with the instrument.



This is normal for a new installation.

Click on the System: 1 Menu Bar to change focus to the main window. Bring up the **System Settings** dialog box by pressing the [**F6**] key or, on the Menu Bar, click **ALARM** | **System Settings**. In the **System Settings** dialog box, click the **General** tab.



In the **System** box;

If the VolksMeter is connected to the support computer via an RS232 cable, select the **Comm Port**, from the drop down list, to which the cable is connected. The default is COM1.

If the VolksMeter is connected via a USB cable, them open the **Comm Port** list and select the "Virtual" Comm Port associated with the USB port. This port is usually listed in the form: "COMx - \Device\\VCPx" (**VCP** stands for **V**irtual **C**omm **P**ort). Usually there will be only one VCP entry on the list. Select it. If there is more than one VCP

entry, select the last one (most recently installed) on the list.

In the **A/D Board** box;

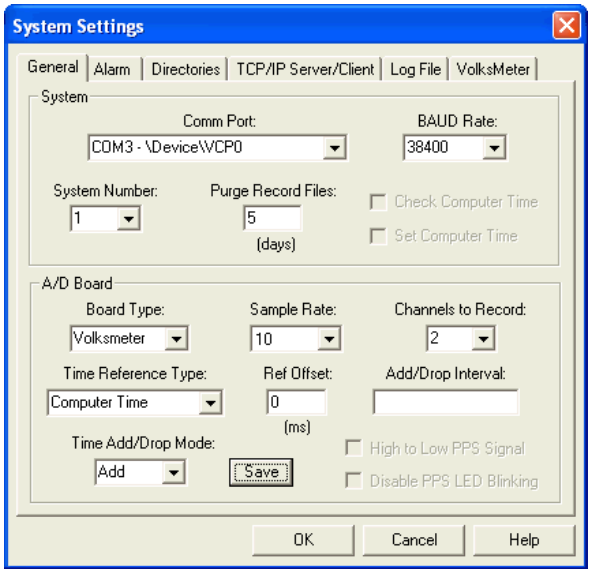
From the **Board Type** list, select **VolksMeter**. The default is Unknown.

Set the **Sample Rate** to **10**. Default is 25.

Set **Channels To Record** to **1** or **2** to match the number of channels on your VolksMeter. Default is 1.

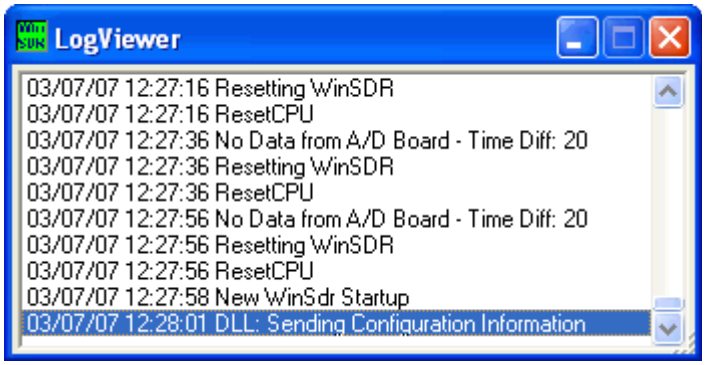
Back in the **System** box;

Once you have selected the **Board Type** in the **A/D Board** box, the **Baud Rate** setting becomes available. The default is **38400**. Unless you set the Interface Board in the VolksMeter to a different value, leave the **Baud Rate** at its' default value. Otherwise, change the **Baud Rate** to match the Interface Board. The value of the **Baud Rate** setting does not matter if you are using a USB connection .



Click **OK** at the bottom of the **System Settings** box to save the new settings. You will get a warning about the old data not being viewable with the new settings. Click **OK** again to continue.

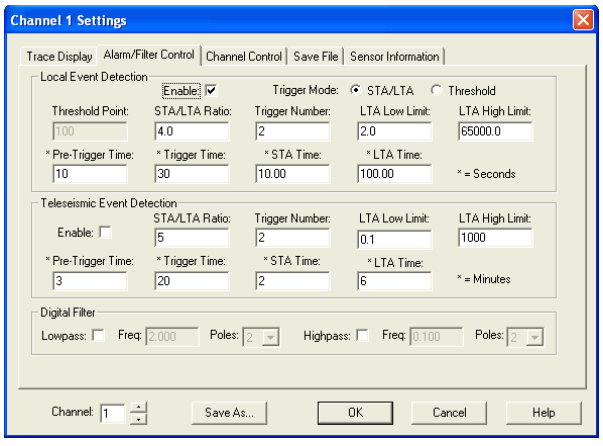
If all is well, at this point the Log Viewer should display: "DLL: Sending Configuration Information".



and the Real-Time (System: 1) window should begin updating the time display at the bottom. Depending on the display settings, you may or may not see the VolksMeter output data trace in the window. Also, the Log Viewer may begin displaying various system status messages every few seconds. Close the Log Viewer window or move it out of the way.

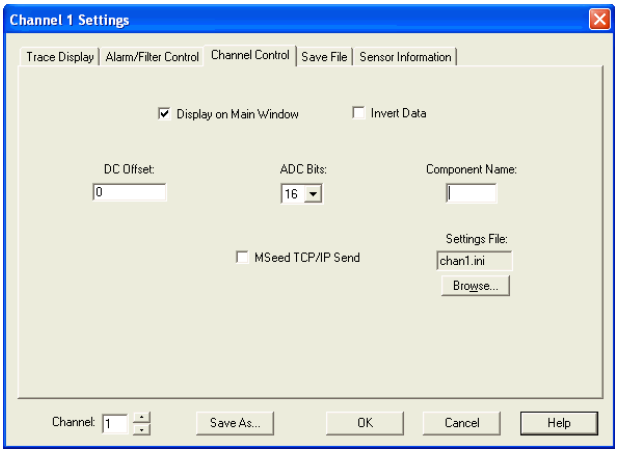
The default settings for the Real-Time (System: 1) window are X:4 (the X-axis is 4 minutes wide before a new line is started) and Y-CH1: 100 (the Y-axis for Channel 1 has a compression factor of 100). Initially (before rough leveling), the data will typically be off-scale, too positive or too negative to appear on the display at this point.

Open the **Channel 1 Settings** box by pressing [**Ctrl+1**] (press and hold the CTRL key and then press the 1 key) or Menu Bar **SETTINGS | CH1**. Click the **Alarm/Filter Control** tab.



In the **Local Event Detection** box, disable Local Event Detection by unchecking the **Enable** box. In the **Teleseismic Event Detection** box, **Enable** should also be unchecked. The **Digital Filters, Lowpass and Highpass** should be unchecked.

Select the **Channel Control** tab. **DC Offset** should be 0 (zero). Change the **ADC Bits** value to **16**.



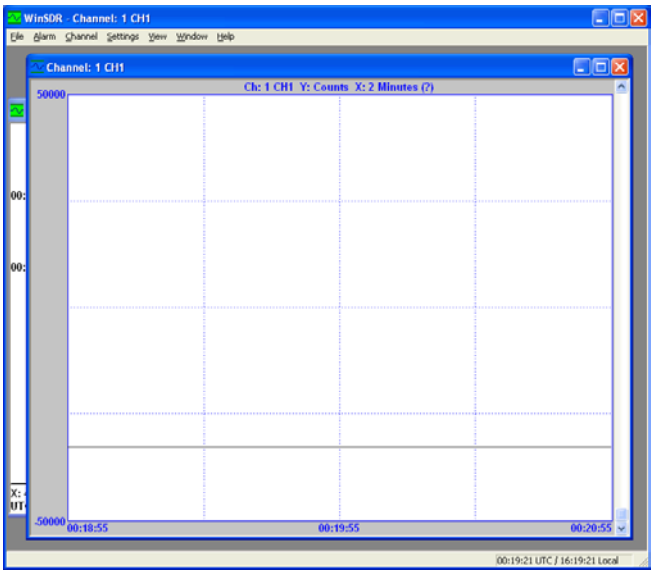
Click **OK** at the bottom of the box to save the new settings.

At this point WinSDR should be properly configured to communicate with the VolksMeter , acquiring and recording data from the sensor.

2.6 Verify Operation and Rough Level

In this step, you will use the WinSDR program to display the sensor readings, use the Base leveling screws to perform "rough" leveling and verify the basic operation of the system.

Open the **Single Line** display window by clicking on Menu Bar **VIEW | Single Line Display**. Move the Vertical Scroll Bar slider to the bottom of the screen. The output data trace for channel 1 will appear on the screen. Right-click on the Single Line Display , select **Last** from the context menu and click on **1 Min.** This will set the horizontal scale of the Single Line Display window to one minute, making it easier to see changes in the data .



In the **Single Line** display window, the position of the Vertical Scroll Bar slider controls the Y-scale of the window. This scale ranges from ±1 when the slider is at the top of the window to ±50,000 when the slider is at the bottom of the window. When the VolksMeter is the sensor being displayed, the Y-units are "counts" and represent the measured capacitance value of the sensor array. Changes in this value result from accelerations and tilts applied to the instrument.

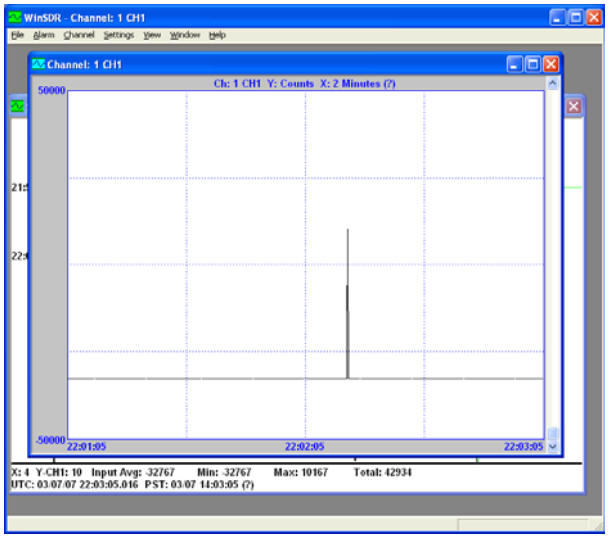
When the **ADC Bits** are set to **16**, the limits of the **count** range are ±32,767. Thus the data trace is guaranteed to appear on the **Single Line** display if the Y-scale is set wide enough.

The **Last** selection in the context menu (right-click in the Single Line display) allows you to specify the horizontal scale of the display in terms of time. The range is 1 minute to 12 Hours.

Click and hold the lower right corner of the Single Line display window and drag it toward the upper

left so that at least the bottom two text lines of the Real Time window are visible when the Single Line display window is on top. This will allow you to observe the actual (1-second averaged) value of the displayed data. This value is labeled "Input Avg" on the bottom of the Real Time window.

If you specified 2 Channels to Record in the System Settings earlier, then both channels are being displayed in the Real-Time window and data values for an individual channel is NOT being displayed. In this case, click on the Real-Time window to bring it to the top, right-click in the window to activate the context menu, select Display Channel and click on CH1 in the drop-down list. The data value for channel 1 will now be displayed at the bottom of the window. Click on the Single Line display window to bring it back to the top.

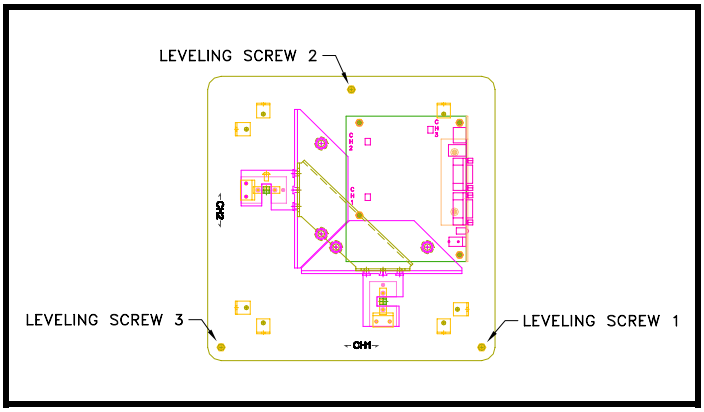


Slowly move the Vertical Scroll Bar slider toward the top of the window until the data trace is visible at the top or bottom edge of the window. Assuming that you are seeing a data trace that is not absolutely flat, you have now verified the basic operation of your VolksMeter: The instrument, the cable, the support computer and the WinSDR software are all working!

The screenshot above shows the data value "pinned" at -32768 due to the Base being a bit high on the left of the channel 1 sensor assembly, even after "initial' leveling with a bubble level. The spike resulted from a gentle tap on the Pendulum Rod causing it to swing and return to its' stable position. The spike also serves to verify the correct operation of the system.

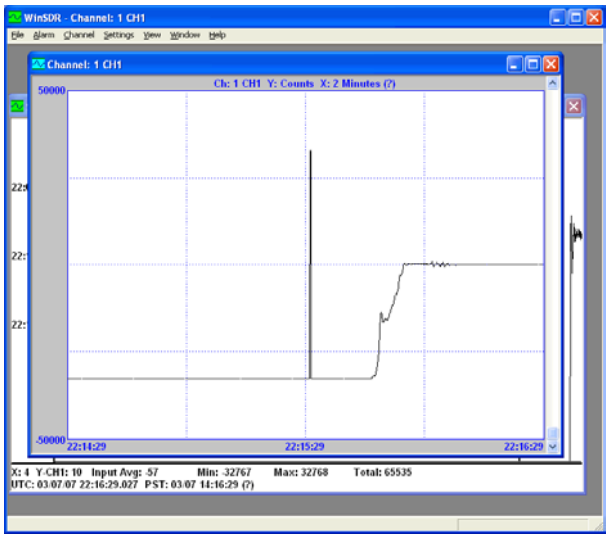
If the data trace appears completely flat and does not respond to gentle finger pressure on the Base or the Pendulum Rod, then the Moving Plate is probably touching one of the Static Plates. Readjust the sensor assembly as described in section 2.4 until the Moving Plate is free and the data trace responds to movement of the Pendulum. If the data trace does not change when the Pendulum is moved, then check the cable connections at the right edge of the sensor array Static Plates (inner and outer plates) and at the Interface Board. If that does not fix the problem, refer to the Troubleshooting section on the website.

You may now "Rough" level the instrument. (The leveling you did with the bubble level in section 2-4 is considered "Initial" leveling.) Use the 3/32" Hex Driver provided in the tool kit to turn the Leveling Screw corresponding to the channel you are observing. Level channel 1 first, then, if present, channel 2.



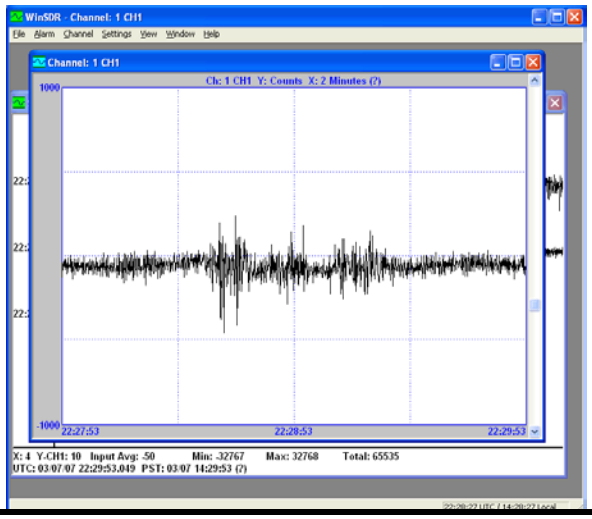
Channel 1 is located between the Leveling Screws in the corners of the Base (screws 1 & 3 in the figure). If you have a 2-channel VolksMeter, it is best to level channel 1 by adjusting screw 1, since this will have the minimum effect on channel 2.

Slowly turn the leveling screw until the data trace is even with the center line in the Single Line display window. Note that there is some lag in the update of the display (it is refreshed once per second) and there is backlash in the leveling screws. It may take a couple of tries to get the trace centered.



The screenshot above shows the data trace visually centered (with a Y-scale at ±50000) and the Input Avg value at –57. At this stage, if the Input Avg value is in the range of ±500, that is acceptable.

Now move the Vertical Scroll Bar slider upward until the data trace is on or near one of the plus or minus 50% of scale lines on the Single Line display or until the width of the trace (due to noise) is about 5% of the height of the window.



The larger spikes around the center of the display are not an earthquake but are caused by my typing the previous paragraph while the VolksMeter operates on a table next to the computer.

Notice that the Y-scale in the previous screenshot is now ±1000, a 50X magnification over the ±50000 Y-scale in the initial displays.

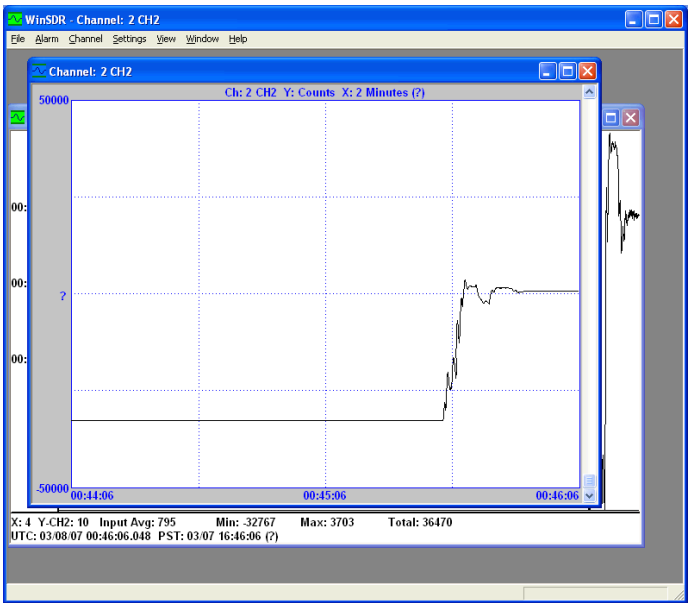
Once again, adjust the leveling screw to place the data trace on the center line of the window and get the Input Avg value as close to zero as practical. Getting the value to stay in the range of ±100 at this stage is acceptable, ±50 is very good.

Getting used to the display lag, the backlash in the leveling screw and the overall response of the sensor to small adjustments will take a few tries. Don't worry about getting right on. This process will have to be repeated when the VolksMeter is placed in its' permanent location. Right now you are just verifying operation and getting a feel for the sensitivity of the instrument.

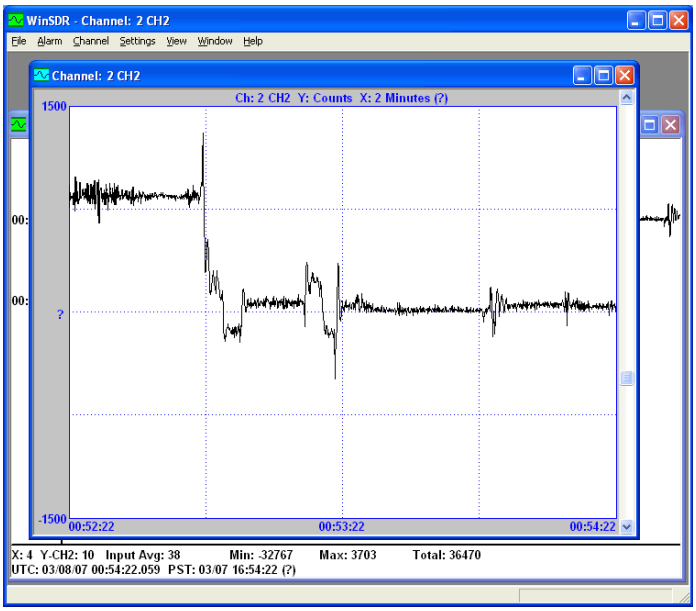
Some tips: Do not put weight on the leveling screw through the tool. Do not lean or rest your hand on the surface holding the instrument. Your very presence (weight on the floor) near the instrument will be detected and recorded. When you move away from the VolksMeter (just a few feet) after carefully centering the data trace, the trace will shift. This is normal and will be compensated for once the instrument is placed in its' permanent location.

If you have a 2-channel VolksMeter, you should now "rough" level channel 2. Click on the Real-Time window to bring it to the top. Right-click in the Real-Time window to activate the context menu and select CH2 from the Display Channel list. Click on the Single Line display window to bring it back to the top. Right-click in the Single Line display window to get its' context menu and select CH2 from the Channel list to begin displaying the channel 2 data trace.

If the trace is not visible, drag the Vertical Scroll Bar slider downward to increase the Y-scale range until the trace is visible. Confirm that channel 2 is being sensed by gently tapping the Pendulum Rod. The displayed data trace should react to the pressure. Using Leveling Screw #2 this time, center the CH 2 data trace to ±100 or better.

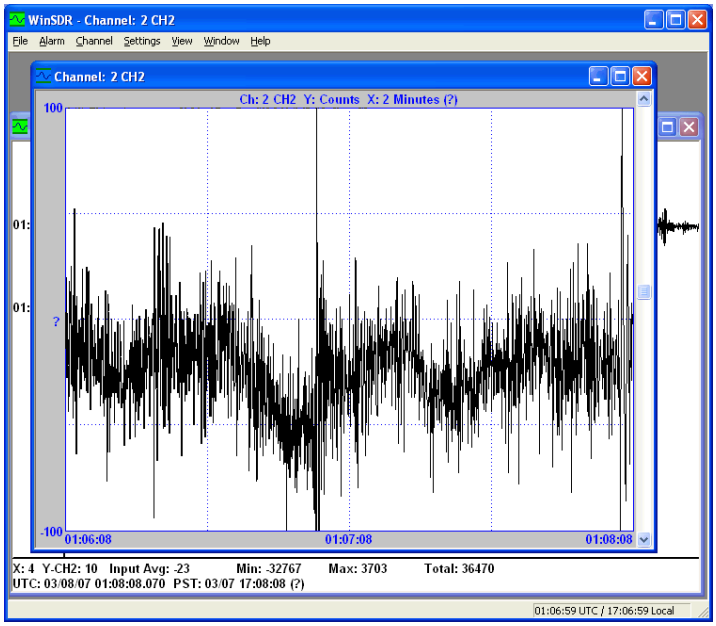


This screenshot shows the Y-scale at ±50000. The CH2 Input Avg value started at –32768 and, after a couple of overshoots and readjustments, settled at a value of 795.



In the next step, the Y-scale is changed to ±1500. Notice how the initial data value (on the left edge of the window) is still about +795 average, but is now slightly above the upper grid line, which represents a value of +750 (half of +1500). The Leveling Screw is adjusted, very gingerly, to bring the CH2 Input Avg value into the ±50 range.

Now switch the Single Line display back to CH1 (right-click, Channel | CH1) and see how much its' value has changed. If necessary, readjust Leveling Screw #1 to bring the CH1 value back to ±100 or better. Repeat with CH2. Note how much the value changes just from the weight of the tool in the Leveling Screw socket. See how much it changes if you walk a few feet away, wait for the value to stabilize and then walk back.



In this screenshot, the Y-scale is only ±100. A few tens of counts of high-frequency and low-frequency noise are normal at 16 bit resolution in an uncovered table-top environment with someone (you) moving around nearby.

You have now verified the proper operation of your VolksMeter. Proceed to section 2.7 Select Permanent Site.

2.7 Select Permanent Site

The permanent site for the VolksMeter is important because it will affect the overall performance of the instrument. Environmental noise and coupling to the earth are primary issues of any permanent site. The purpose of the instrument will also be a consideration. Instruments used for research may be more remote than those being used for education. Ease of access for setup and maintenance, availability of AC power and network connections also matter. Naturally, some of these considerations may conflict with others. It is up to you to establish your priorities and proceed accordingly.

From a strictly performance point of view, the best location would be an environmentally stable vault with an isolated pier set into bedrock. Since few will have access to such a facility, we list some more likely locations, in order of preference (all sites are assumed to be protected from the weather and wetness; the VolksMeter is not designed for unprotected outdoor use):

1) An isolated concrete pad or block set into the earth (rock if available, packed soil otherwise). In this context, "isolated" means that the pad or block the VolksMeter is placed on is not directly connected to the surrounding floor or structure.
2) A concrete floor, laid on grade (that is not isolated).
3) A hard surface (e.g. a metal plate or ceramic tile) set on a softer surface (e.g. wood or vinyl flooring) on the ground floor or lowest basement.
4) On a solid bench or table in a school or museum.

VolksMeter test site: On concrete slab in low-traffic area of RLL Instruments / Zoltech Corporation warehouse

The location will require enough space around the VolksMeter so that the Leveling Screws can be adjusted and the cables plugged in. If the instrument is placed adjacent to a wall or other object that limits access, there should be at least 8" clearance between the side of the VolksMeter Base and the obstruction. Keep in mind that the person adjusting the Leveling Screws must be able to get next to the instrument. Thus, the VolksMeter cannot be lowered into pit or borehole prior to leveling unless the installer can fit in with it. Nor can it be leveled on a test bench and then placed at its' permanent site, since it must be re-leveled each time it is physically moved and after it has had time to settle into its' new environment.

Both the VolksMeter and support computer will require a source of electrical power for operation. Typically this is AC mains power. The VolksMeter has an internal regulator that allows it to accept DC power in the range of 9-24VDC. This permits the instrument to be connected directly to 12VDC battery power. If the support computer can also be powered from batteries, and the batteries can be kept charged for the duration of the data acquisition period planned, then battery power is an

option.

In order to continue operating through a mains power failure, we suggest that an Uninterruptible Power Supply (UPS) be provided for both the VolksMeter and the support computer with enough endurance to provide power through any anticipated mains outage. If operation through power outages is a major consideration, laptop support computers usually use less power than desktop computers. They also include an internal battery backup.

The metal case of the VolksMeter will protect the sensors from incidental air movement. However, any wind or air movement that you can feel will likely be picked up by the VolksMeter as well. Air conditioning should be avoided in the area of the VolksMeter site or at least the airflow should be directed away from the instrument itself.

Once started, the WinSDR software will operate unattended indefinitely. If connected to a network, acquired data may be downloaded from the support computer and the VolksMeter may be monitored and controlled remotely, from another computer on the net that supports WinSDR.

2.8 Move to Permanent Site

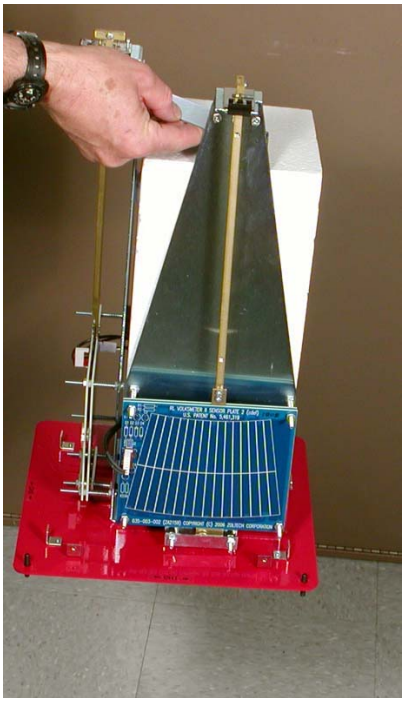
Now that the VolksMeter operation has been verified and a permanent site selected, the VolksMeter may be moved to that site.

First, is the permanent site within hand-carry distance of the location where the operation verification was carried out? If so, the VolksMeter may be hand-carried without the necessity of locking down the Pendulum Assemblies. If the VolksMeter must be moved by vehicle, the moving parts must be locked down. Both situations will be described in detail below.

Reshipping the VolksMeter to its' permanent site.

Each Pendulum Assembly must be locked down in the same manner as it was shipped to you. Place the cardboard protector between the Pivot Points and the Pivot Plate. Secure the Moving Plate to the Static Plates with two rubber bands. Finally secure the Crossbar at the top of the Pendulum Rod to the top of the Post with a rubber band. Place the Cover on the Base and secure it with the provided screws. Place the plastic bag over the Cover and put the VolksMeter back into its' shipping box, in the lower styrene cavity. Place the upper styrene block over the instrument to secure it in the box. Place any other components that are shipping with the VolksMeter into the cavities in the upper styrene block. Reseal the carton and ship normally. Unpack within walking distance of the permanent site and set up using the procedure described in section 2.1. Check and adjust alignment per section 2.4. If the Volksmeter is not already in its' permanent location, hand-carry it there as described in the next paragraph.

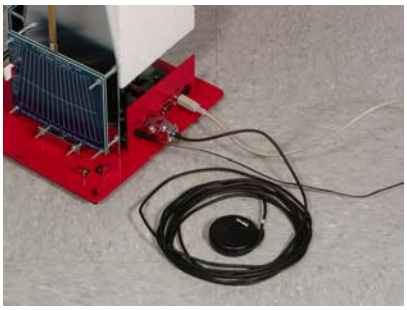
Hand-carrying the VolksMeter to its' permanent site.



The VolksMeter may be hand-carried for short distances, with the Cover removed, by grasping the Anti-Vibration bracket located between the tops of the two Posts.. The Pendulum Assemblies need not be removed or otherwise secured. The permanent site should be flat, hard and clean. Carefully place the VolksMeter on its permanent site.

Place the support computer near, but not too near, the VolksMeter. The support computer should be close enough to the VolksMeter so that you can see the WinSDR display during "rough" leveling but far enough away that the effect of your weight on the floor during "fine" leveling will be minimal. Five to 10 feet of separation should do the trick. Take care that vibrations and moving air from the support computer do no impinge on the Volksmeter. You may also move the support computer further away from the instrument after rough leveling as long as such movement does not place any force on the cables connected to the VolksMeter. Connect the The VolksMeter to the support computer but do not apply power.

Install the GPS Time Standard (VMII-GPS) if you have it. The GPS Receiver, inside the black disk at the end of the GPS assembly cable, requires radio frequency line of sight to the sky for proper operation. For optimal results, the GPS Receiver should be located outside, with maximum exposure to the sky. The GPS Receiver is weather-tolerant for most environments. Placing it adjacent to a window will also work if it can "see" a large portion of the sky through the window. Since the permanent site of the VolksMeter probably does not provide such access, you may have to place the GPS Receiver some distance from the VolksMeter itself. If the 16 foot (5 meter) cable attached to the GPS Receiver is not sufficient, you will have to add a DE9 extension cable. If the distance is greater than 100 feet or so, an RS232 repeater cable may be required. Connect the GPS Receiver to the connector marked **GPS** on the VolksMeter I/O Panel (VolksMeter power should be off).



Now you should apply power to the VolksMeter and start WinSDR. Activate the GPS Receiver by clicking **Settings | System** (or pressing [**F6**]). On the **General** tab, in the **A/D Board** section, under **Time Reference Type**, select **Garmin GPS 16/18.** Click **OK**. WinSDR will attempt to read time and location information from the GPS Receiver.

At the bottom of the Real-Time display window, at the right end of the local time readout, there will be a single character in parenthesis. If the character is a "**?**" (question mark), then no external time reference is selected in the System Settings box, repeat the prior paragraph. If the character is an "**N**", then WinSDR is attempting to get information from the GPS Receiver, but it has not yet locked on to the satellite signal. If the GPS Receiver is connected properly and working, depending on how good the sky access is, locking to one or more satellites may take up to five minutes. Once the GPS Receiver has locked on to a signal, the status character will change to an "**L**", indicating the "**Locked**" condition. All is well. Use of the GPS Receiver enables the time-stamping of data from the VolksMeter to be accurate within ± 5 mS.

Once "Locked" status is achieved for the first time, it is a good idea to Reset the GPS Receiver. (If "Locked" status is not achieved within five minutes, try Resetting the GPS Receiver.) Click **Settings | GPS | Reset GPS Receiver**. The internal database in the GPS Receiver will be cleared. Depending on

your sky access, it may take up to 5 minutes to re-build the database from incoming signals. The time reference status character will display an "N" during this period and then change back to "L" when finished.

You may use the GPS Time Reference to set the time in the support computer. In **Settings | System**, on the **General** tab, in the **System** box, check the **Set Computer Time** check box. This check box will only be available if the VolksMeter has the GPS Time Reference connected.

You may display your GPS location (more precisely, the location of the GPS Receiver) from the GPS Receiver. Click **Settings | GPS | GPS Location**. Check the **Enable Location Averaging** check box. The box will display the Latitude, Longitude and Elevation of the GPS Receiver. (This information may be transferred automatically to your Sensor Information box, as described later.) Per the Garmin GPS 18 Specification, the GPS Receiver location output is accurate within 15 meters 95% of the time and is accurate within 5-10 meters most of the time.

Initial level, check alignment and rough level as described in sections 2.4 and 2.6. .

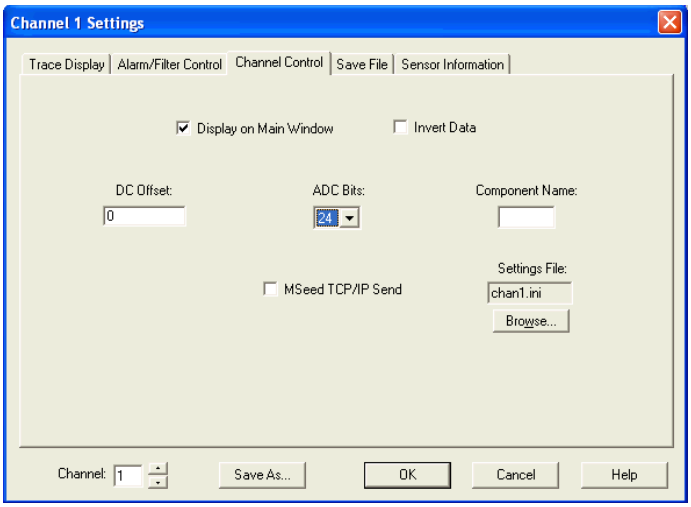
Carefully place the Cover on the Base . While holding the Cover with both hands on the sides near the top, align the rectangular opening in the lower edge of the Cover with the I/O Panel. Lower the Cover straight down over the VolksMeter. Try not to touch the Posts or Thermal Block with the Cover. Lower it slowly until the lower edge of the Cover rests on the Base, outside of the fastening brackets and the I/O Panel. If you do happen to nudge the VolksMeter slightly, it can be corrected with the Leveling Screws. It is normally not advisable to secure the Cover to the Base with screws at the permanent site. In fact, fastening the Cover screws will cause unnecessary deflection of the Base that will require more time to stabilize. Check the rough level. Re-adjust the Leveling Screws if necessary per section 2.6.



For more precise leveling than is possible with the Hex Driver in the tool kit, use the Hex L-Key with the long bar horizontal. The Hex L-key permits more precise movement of the Leveling Screws

Perform "Fine" leveling with the WinSDR software. At this point, after rough leveling, the output (in "counts") of the VolksMeter channel (or channels) should be in the ±100 range with a resolution setting of 16 bits. If your permanent site permits, move the support computer 5-10 feet from the VolksMeter in order to minimize the effect of your presence on the instrument.

In WinSDR, bring up the Channel 1 Settings box by pressing [Ctrl + 1] or, on the Menu Bar, ALARM | CH1 (under Settings…). Select the Channel Control tab.



Change the ADC Bits value from 16 to 24. Click OK to activate the change.

Bring up the Single Line display window for Channel 1. The data trace will probably no longer be visible in the window. Slide the Vertical Scroll Bar slider down until the data trace is visible again. At 24 bits of resolution, the data count may have a range of ± 16,777,216. Data that had an average value of +100 at 16 bits, for example, will have an average value of +25,600 (256 times the original value) due to the increase in resolution. With the Y-scale set to ±50,000 on the Single Line display, data values in the range of ± 25,600 will be visible.

Set the Real-Time display window to CH1 only so that you can observe the average CH1 data value. Depending on the noise in your environment, that average value may vary by a few thousand counts over a period of 10-15 seconds. Calculate a rough mental average of these values. You can also get a rough average by looking at the data trace on the Single Line display. Suppose, for example, that the data trace is centered vertically at about +25,000. Activate the Channel 1 Settings box and enter the inverse of the data trace center value in the **DC Offset** box. In our example, you would enter –25000 to offset data centered at +25000 to center that data at zero. While you may offset any raw data value, you should use mechanical (I.e. the Leveling Screws) to bring the raw average data value within the range of ± 50000 (at 24-bit resolution) in order to avoid limiting the maximum dynamic range too much. Always do mechanical "rough" leveling with the DC Offset set to zero.

If you have a 2-channel VolksMeter, repeat the Fine leveling procedure on Channel 2.

Fine leveling is now complete. The average data output value is centered on zero. Even in a quiet seismic environment, the output of the VolksMeter will have a tendency to drift away from zero over time. Even on an isolated pier, the VolksMeter Leveling Screw points will settle a bit into the surface they are resting on. A concrete slab or pier will compress detectably under the weight of the VolksMeter. Observe the output of the VolksMeter over a few 24-hour periods without doing any further leveling to get a feel for the settling as well as the daily (day-night) cycles of the environment. Short of a subterranean vault, almost any structure will exhibit a daily cycle of expansion and contraction due to solar heating. Structures that are air-conditioned during the week, but not on the weekends will exhibit a weekly cycle as well. There is nothing physical you can do about this except to note it and filter it from the data. Short term (1-7 day) settling of the VolksMeter in its' permanent location can be corrected by the Fine leveling procedure, or, if the raw (zero offset) data exceeds ± 100,000 (at 24-bit resolution), Rough leveling. In typical environments, the VolksMeter output data should stabilize within a week of installation and then long-term data recording may begin in earnest.

Proceed to Chapter 3 to configure the WinSDR software for long-term data recording.