## 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.

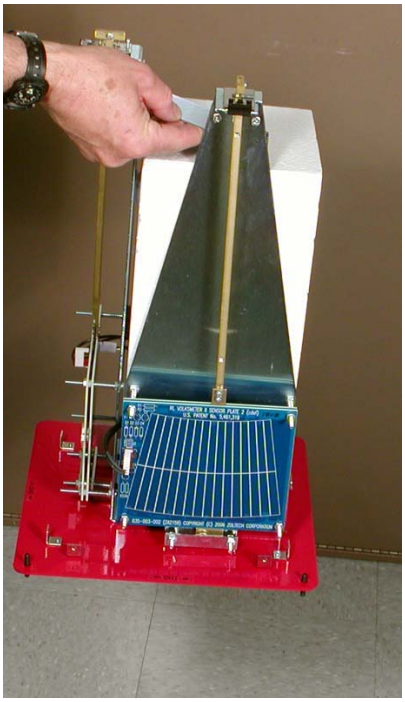
First, is the permanent site within hand-carry distance of the location where the operation verification was carried out? If so, the VolksMeter may be hand-carried without the necessity of locking down the Pendulum Assemblies. If the VolksMeter must be moved by vehicle, the moving parts must be locked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

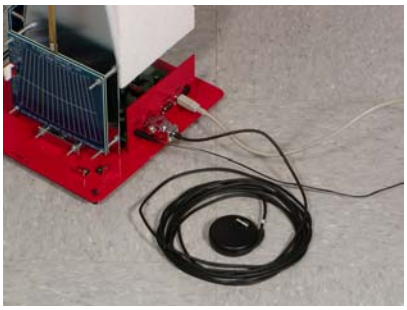
**Hand-carrying the VolksMeter to its' permanent site.**



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

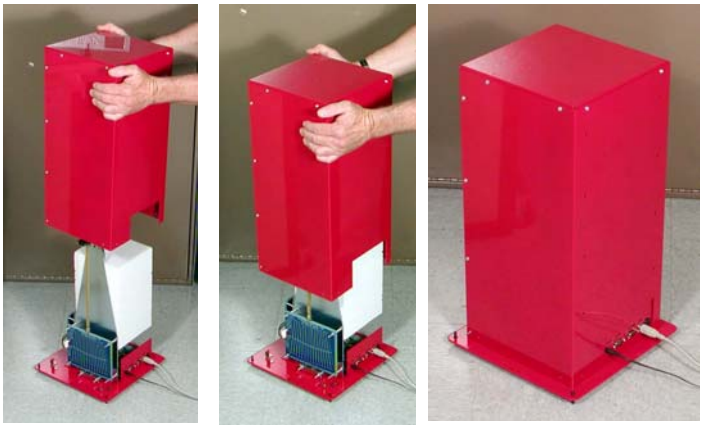
your sky access, it may take up to 5 minutes to re-build the database from incoming signals. The time reference status character will display an "N" during this period and then change back to "L" when finished.

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**. .

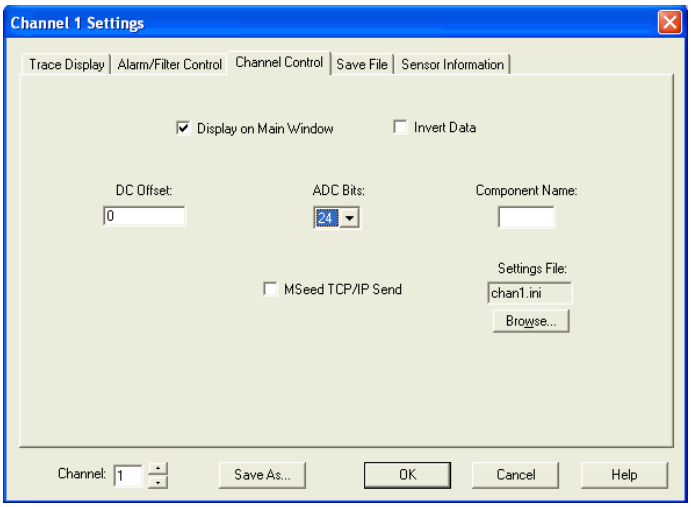
**Carefully place the Cover on the Base** . While holding the Cover with both hands on the sides near the top, align the rectangular opening in the lower edge of the Cover with the I/O Panel. Lower the Cover straight down over the VolksMeter. Try not to touch the Posts or Thermal Block with the Cover. 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**.