

The VolksMeter II is a Seismometer / Tiltmeter. It is based on a unique, patented sensor technology that provides low frequency capabilities not found in *any* other seismometer, at a fraction of the price of conventional professional instruments. The VolksMeter requires a dedicated PC (Windows XP, 2000 or Vista) to perform data logging, display, analysis and, optionally, networking.

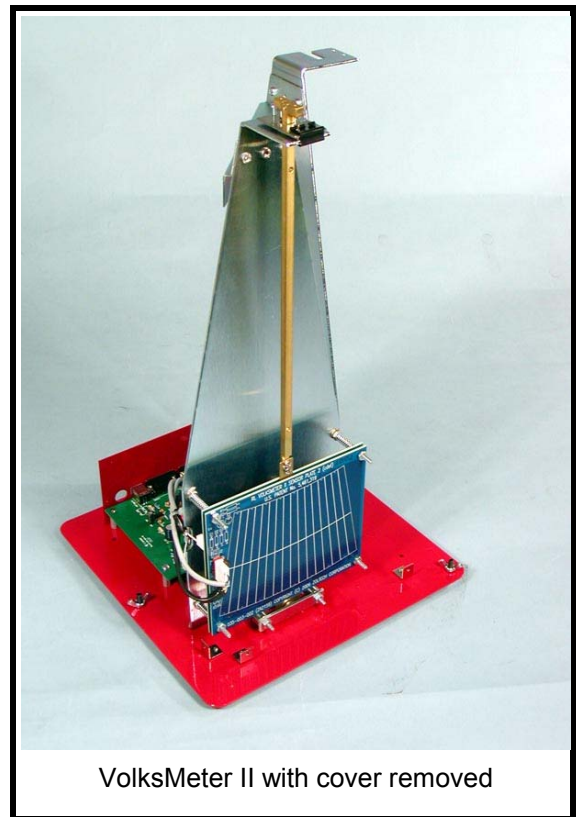
The VolksMeter is appropriate for use in geophysical research, education and by the amateur seismologist.

### Performance/Capabilities

- Detects and measures local and teleseismic earthquakes
- New window on VERY-LOW-FREQUENCY earth motions
- Sensitive Tiltmeter
- Optional GPS-based time standard

### Powerful, User-Friendly Software

- WinSDR for data acquisition & recording
- WinQuake for display & analysis
- Compatible with USGS "Earthworm" seismic recording package
- Easily generate TRUE power spectral densities (planned)

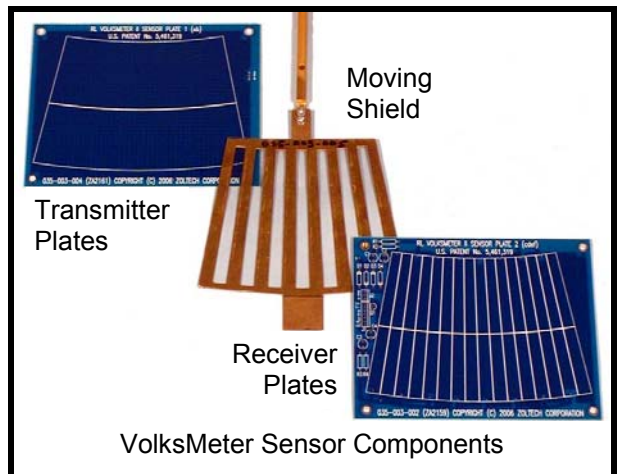


VolksMeter II with cover removed



VolksMeter II, RS232-C & USB I/O, with cover in place

The VolksMeter uses a unique, patented\*, Symmetric Differential Capacitor (SDC) array sensor to detect and measure minute accelerations and tilts. The sensor consists of two fixed printed circuit boards holding the transmitting and receiving capacitor plates and a moving faraday shield array, mounted on the end of a pendulum. When subjected to accelerations or tilts, the shield array on the pendulum moves relative to the fixed plates and changes the amount of receiving plate that is exposed to or shielded from the transmitting plates. This, in turn, changes the overall capacitance of the sensor. A magnetic eddy damper, located below the sensor plates, damps oscillations of the pendulum. A direct



VolksMeter Sensor Components

\* U.S. Patent Number 5,461,319

# RLL INSTRUMENTS

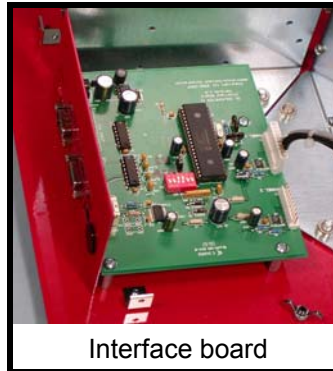
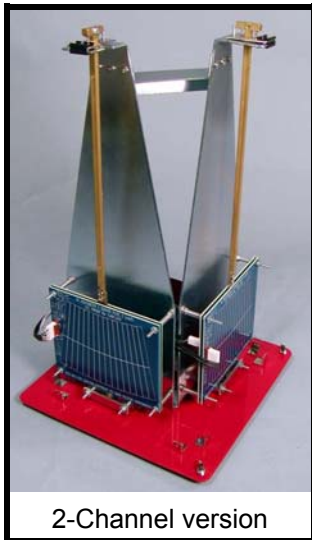
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# VolksMeter II

## Seismometer / Tiltmeter

Capacitance-To-Digital-Converter (CDC) chip converts the current capacitance of the sensor array to a 24-bit number. An interface board in the VolksMeter controls the CDC



chip and formats the acquired data for transmission to the support computer.

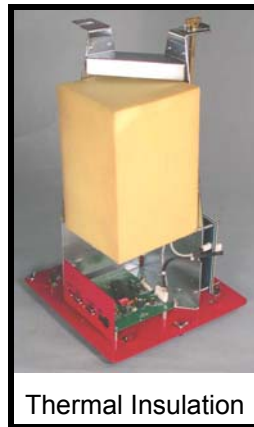
The VolksMeter is available in 1 or 2-channel versions. If ordered in the 2-channel version, the two sensor arrays are mounted at a 90° angle to each other, and thus can provide useful correlation information or tilt in two dimensions.

In order to minimize convective air currents within the VolksMeter case, a block of insulating material is mounted above the Interface Board.

**WARRANTY** The VolksMeter II is warranted against defects in material or workmanship for a period of one year from the date of purchase.

### SUPPORT COMPUTER

A user-supplied support computer is required to provide control and data logging (at a minimum) for the VolksMeter. A PC running MS Windows XP, Windows 2000 or Vista is required to run the software supplied with the VolksMeter (Windows 95, 98 and ME are reported to work but are not supported). The PC requires a CD-ROM (to load the software) and a USB or RS232-C port (to connect to the VolksMeter). Networking operations require a network interface (usually ethernet) and network connection. Normally, the PC should be dedicated to the VolksMeter, but a multi-tasking system that is capable of accepting a data packet every 200mS from the VolksMeter will work. If the PC is not ready to accept the data packet when the VolksMeter sends it, gaps in the data record will result.



### INSTALLATION CONSIDERATIONS

The VolksMeter may be installed on any hard, flat surface with a good connection to the earth. While an isolated pier is ideal, the VolksMeter performs well on ordinary concrete slabs. For demonstration purposes, hardwood floors and even solidly built tables or lab benches have been used successfully. For best results, the VolksMeter should be protected from air currents, radical temperature changes, and local sources of electrical and mechanical disturbance. Because of cable length limitations, the support computer should be located within 10 feet of the VolksMeter (a USB or RS232 Booster may be used to increase this distance). The support computer may be controlled and monitored from a remote location via LAN (typically ethernet-based) and/or TCP/IP over the Internet using standard remote-access software.

**ELECTRICAL POWER** Operation of the VolksMeter requires 9-24VDC. A 110VAC input power supply is included. The VolksMeter may be run on 12V battery power but the support computer must also be powered.



### POWERFUL, USER-FRIENDLY SOFTWARE

The software supplied with the VolksMeter consists of two primary components: WinSDR and WinQuake. WinSDR provides control, data display, and data storage functions. WinQuake provides data analysis, processing and formatting functions. The software package also includes USB drivers, if required.

The version of WinSDR that is supplied with the VolksMeter has been specially modified to control and acquire data from the VolksMeter instrument. It supports data resolutions up to 24 bits per sample. One or two channels (plus integrated pseudo-velocity) may be collected at sample rates from 5 to 80 samples per second. RS232-C and USB connections are supported. WinSDR offers pre-processing of the data in the form of signal averaging, low and high-pass filtering and event triggering. Collected data may be displayed in real-time, either in helicord or single channel formats. Data may be time-stamped precisely using an optional GPS-based time standard (see below). Data may be saved in a variety of formats, including PSN, SAC Binary and MiniSeed with Steim 2 encoding. Data files are automatically saved to disk for post-event analysis. Data files may be automatically uploaded to an FTP server. TCP/IP Server/Client mode and MiniSeed Data Server functions are supported. Data may be sent to the USGS Earthworm Seismic Processing System.

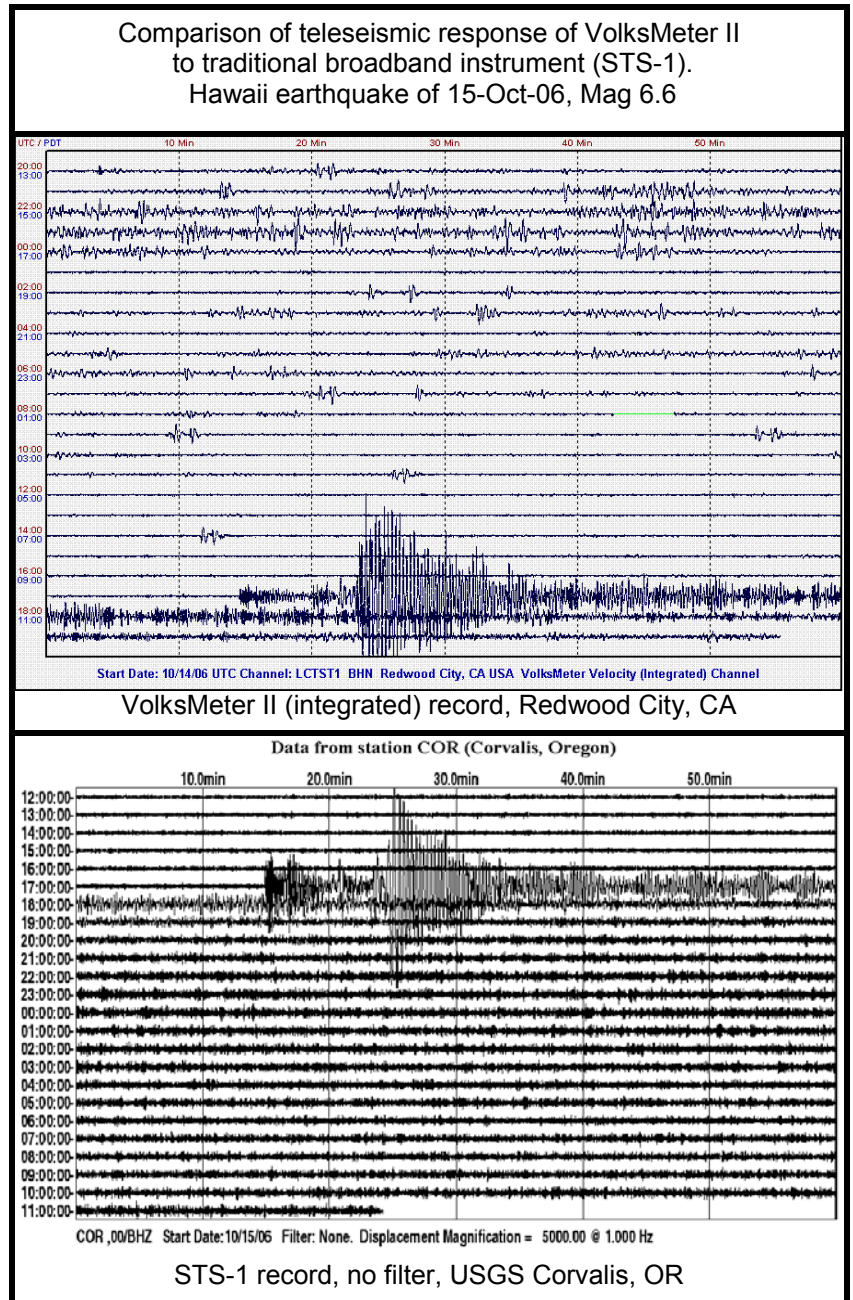
WinQuake reads the data files output by WinSDR (as well as other sources of seismic data) and provides a variety of signal processing and analysis functions. These functions include calculating the event distance and magnitude. The frequency spectrum (FFT) of a data set may be calculated and displayed as well as the true Power Spectrum Density (PSD). Highpass, lowpass, notch and bandpass filtering may be applied to a dataset. Data files may be converted between Public Seismic Network (PSN), Binary SAC and ASCII formats. There are many other seismic data processing functions: See [www.seismicnet.com](http://www.seismicnet.com) for more information.

### OPTIONAL GPS TIME STANDARD

The VolksMeter is equipped to use an optional GPS-derived time standard that provides a clock that is accurate to  $\pm 2\text{mS}$ . This is useful in teleseismic research where knowing the precise time of a seismic wave arrival is critical. The GPS unit consists of a GPS receiver and 16 foot long RS232-C cable that plugs into the GPS port on the VolksMeter. Extension cables may be used if necessary. The GPS receiver also provides a precise location (latitude and longitude) for the VolksMeter (more specifically, the GPS receiver, which may be positioned some distance from the VolksMeter itself). In the absence of the GPS option, the time stamp for instrument data is derived from the support computer, which may be off by seconds or more, depending on how the computer clock is set. The part number of the GPS clock option is VMII-GPS.



Optional GPS Time Standard



### PERFORMANCE

The figures above compare the integrated (pseudo-velocity) output of a VolksMeter to a broadband STS-1 for the same teleseismic earthquake (Mag 6.6,  $>3850\text{km}$  from both instruments). The VolksMeter is detecting horizontal motion while the STS-1 is detecting vertical motion. The VolksMeter is somewhat less sensitive to teleseismic events than broadband force-feedback instruments such as the STS-1 or -2 ( $-150\text{dB}$  vs  $-180\text{dB}$ ), but as the above records show, it can still be effective with a sufficiently strong signal in a low-noise environment.

## SPECIFICATIONS

Configuration: 1 or 2 horizontal channels, pendulum with Symmetric Differential Capacitive sensors

Outputs, Acceleration/Tilt/Time stamp Data

Direct digital connection (RS232-C or USB) to support computer

Sensitivity, Acceleration: 1 part in 16.7 million across a range of  $\pm 0.0034g$

Sensitivity, Tilt: 1 part in 16.7 million across a range of  $\pm 3.55mRad (\pm 2^\circ)$

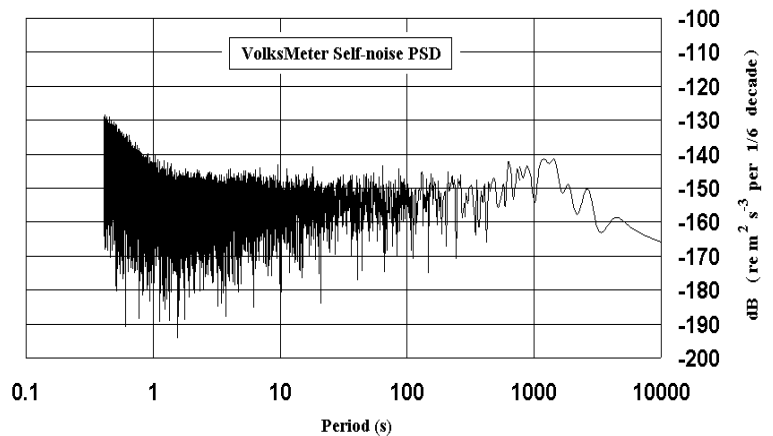
Dynamic Range:  $>140dB$

Bandwidth:  $\sim 40Hz$  to DC Natural frequency,  $f_0$ :  $0.92Hz$

Note: Sensitivity (resolution) is inversely proportional to sample rate. For  $40Hz$  max., a sample rate of 80 samples per second is required. At this sample rate, only 15 bits (1 part in 32,000) resolution is available due to noise considerations, for full 23-bit + sign resolution (1 part in 16.7million) the sample rate must be limited to 10 samples per second or less. At a 10 s/sec rate, the maximum frequency is 5Hz

Linearity: Due to the nature of the sensor and the limited travel of the moving plate, the output is inherently linear across the range of motion.

Additional information regarding performance of the VolksMeter II is available at our website:  
<http://www.rllinstruments.com>



Power Requirements: 9-24VDC Note: Current draw is a function of supply voltage and the presence or absence of the GPS option

Supply Voltage	Current Draw Without GPS	Current Draw With GPS Option
9 VDC	45mA	90mA
12	33mA	68mA
15	30mA	54mA
20	22mA	44mA
24	20mA	38mA

A 110VAC input, 15VDC/500mA output, power supply is included with the VolksMeter. The user-supplied support computer will have power requirements of its' own.

### Environmental Characteristics

Operating Temperature:  $+5^\circ C$  to  $+55^\circ C$  ( $41^\circ F$  to  $131^\circ F$ ) non-condensing.

Storage Temperature:  $-40^\circ C$  to  $+85^\circ C$  ( $-40^\circ F$  to  $185^\circ F$ ) non condensing

### Physical Characteristics

Size: 10.75"W x 10.75"D x 19.5"H

Net Weight: 23 lbs (2-channel version)

Shipping Weight:  $\sim 30$  lbs (including GPS)

Included with standard models:

VolksMeter II instrument

WinSDR / WinQuake software on CD-ROM

110VAC Power Supply Installation Tools

RS232-C or USB cable User's Manual

### Order These Part Numbers:

VMII-1RU Single Channel, RS232-C & USB

VMII-2RU Dual Channel, RS232-C & USB

Options:

VMII-GPS GPS Time Standard

VMII-UACA Universal AC Adaptor (110-240VAC)

Special Order:

VMII-xR RS232-C only version (x= 1 or 2)

Please specify USB or RS232-C Cable

**SPECIFICATIONS ARE SUBJECT TO CHANGE WITHOUT NOTICE**