



Seismic instruments for educational projects



Earth sciences projects in schools and colleges provide a rare opportunity to give students hands-on experience with genuine scientific instrumentation.

In addition, the ability to make one's own studies of seismic events provides a tangible connection with geological processes, and emphasizes the relevance of science in the real world.

Until recently, opportunities for seismological experiments in schools were limited by the poor resolution of the instruments available.

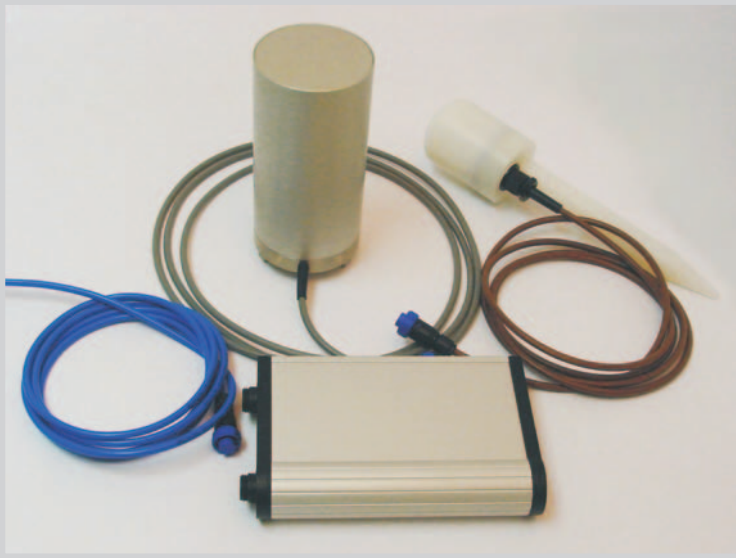
Standard short-period sensors are only capable of detecting local events, a serious disadvantage in areas of low seismicity.

Even where local events occur regularly, the ability to study both nearby and distant earthquakes across a wide band of frequencies opens up a wide range of teaching possibilities.

Guralp Systems have 20 years' experience in the design and manufacture of force-feedback seismometers for science, engineering, and education. Our cost-effective CMG-EDU single-axis sensor is well established as the backbone of projects in the US and elsewhere, whilst the CMG-6TD is a true research instrument with configurable digital output and networking capabilities.

Distributed by:

CMG-EDU single-component system



The CMG-EDU is a complete and compact digital seismometer, specially designed for use in education.

Simple connections and colour-coded cabling allow the system to be set up and connected to a PC in minutes.

The CMG-EDU uses research-quality components in specially-designed robust cases. Installed in a basement or another quiet location, the system can provide low-noise measurements of distant earthquakes as well as local events.



The seismometer is a CMG-6 vertical single channel velocity sensor with a flat response between 30 s and 50 Hz, whilst the digitizer is a CMG-CD24E1 single component 24-bit module with direct RS232 serial output.

The output port of the digitizer can be connected to the serial port of any PC. With Güralp Systems' freely-available Scream! software, seismic signals can be explored in real time.

For more information on this system, please see the separate CMG-EDU data sheet.

CMG-6TD three-component system



For more thorough investigations, it is important to measure all three directions of ground motion.

The CMG-6TD is a compact and robust triaxial sensor with direct digital output. A digitizer module is not required.

Like the CMG-EDU, the sensor components are based on our CMG-6 technology. The response of the standard CMG-6TD is flat to velocity between 30 s and 50 Hz, but options of 1 s and 10 s are available at the low-frequency end, and the high frequency corner can be extended to 100 Hz.

The built-in CD24 digitizer offers 24-bit output at high resolution for all three channels. The whole system consumes under 0.9 W under normal operation.



The instrument is sealed inside a rugged aluminium casing. Good results can be obtained in quiet areas within a building, or with the sensor buried in a shallow pit outdoors.

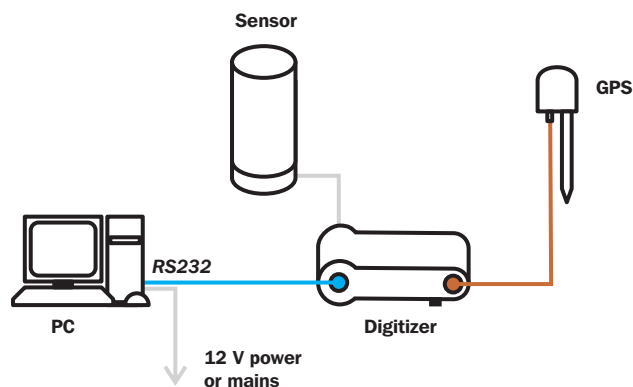
Using an optional protective rubber sleeve, the CMG-6T can be dropped from a height of 50 cm without suffering damage.

The CMG-6TD can be fitted with optional Ethernet or Wi-Fi (802.11b), allowing digital signals from the instrument to be studied from anywhere on the local network.

For more information on this option, please see the separate CMG-6TD data sheet.

Networking options

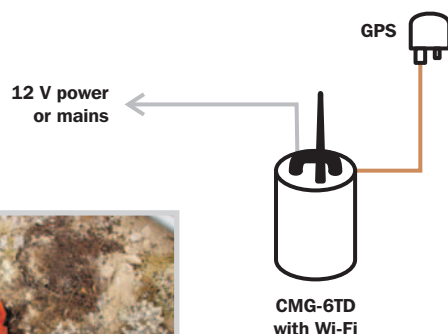
Güralp Systems' hardware is designed for maximum mutual compatibility, providing a wide range of installation possibilities and ways to upgrade.



Example 1: A complete CMG-EDU system. The sensor, digitizer, GPS receiver and all required cables are supplied together.

Because of its small size, this system is ideal for installing in a quiet corner of a building in use.

Using Güralp Systems' freely-available Scream! software, seismic data can be recorded on a local PC and forwarded to any number of clients on a local network for observation and study.



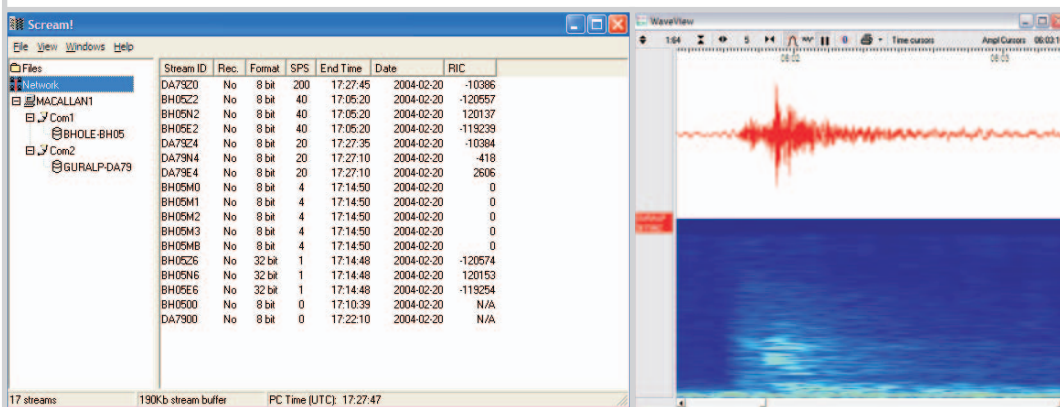
Example 2: Using the Wi-Fi or Ethernet output options, a complete CMG-6TD installation can be made from just the sensor, GPS and power source.

The standard Wi-Fi antenna can transmit real-time data to an access point up to 100 m away.

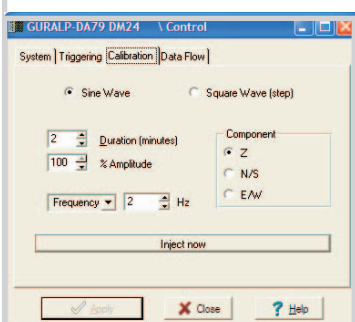
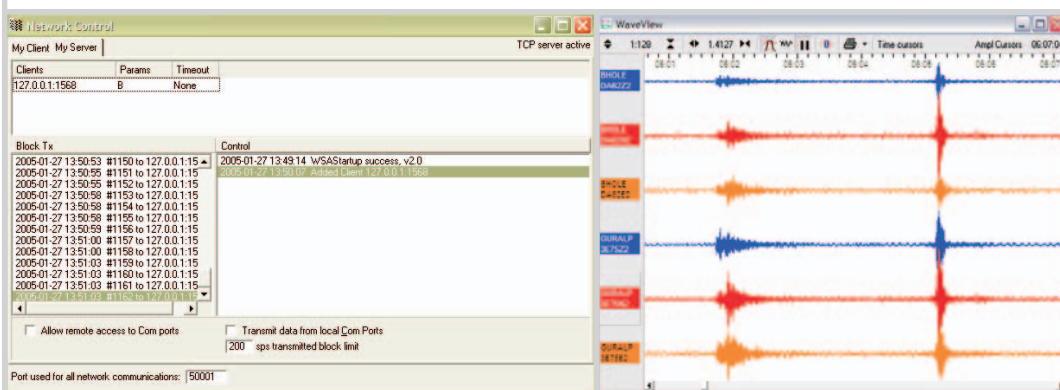
This setup means the instrument can be installed in a location without network access, or outdoors in a pit.

Scream!

A PC running Güralp Systems' free Scream! software can collect data from instruments and display it in real time. Students can view data streams in physical units, apply filters to pick out events, and produce real-time spectrograms.



Scream! can collect data from any number of instruments, whether they are connected to the PC's local serial ports, on a local area network, or anywhere on the Internet. Seismic traces from multiple locations can be instantly compared in a single window.



Scream! can convert data into a number of common formats, including . formats used for specific educational projects (e.g. PEPP). CMG-6TD sensors can also be fully configured and controlled using a graphical interface.

Comparison of specifications

	CMG-EDU	CMG-6TD
Axes of measurement	1	3
Velocity output band	30 s – 50 Hz	1 s, 30 s, 100 s – 100 Hz
Lowest spurious resonance	450 Hz	450 Hz
Linearity	> 95 dB	> 95 dB
Dynamic range	> 147 dB	> 147 dB (30 s option)
Self-noise below USGS NLNM	> 7 s to > 5 Hz	> 7 s to > 5 Hz
Data output format	GCF	GCF
Data output methods	RS232	RS232, optional FireWire, Ethernet, Wi-Fi 802.11b
Sample rates	40 samples/s	1 – 1000 samples/s
Digitizer resolution at 1 sample/s	> 21 bits	> 21 bits
Triggering	None	STA/LTA and level trigger algorithms
Operating temperature	–10 to +75 °C	–40 to +85 °C
Maximum tilt	±3 ° from horizontal	±3 ° from horizontal
Sensor casing	Hard anodised aluminium and stainless steel O-ring seals throughout	Hard anodised aluminium Gold plated contacts O-ring seals throughout
Weight	1.2 kg	2.7 kg
Power supply	10 – 36 V DC or mains <i>via</i> adapter	10 – 36 V DC
Current at 12 V DC	23 mA	65 mA
Calibration controls	Common signal and enable lines	Common signal and enable lines
Offset zeroing	Adjustable through case Optional remote control	Adjustable through case Optional remote control