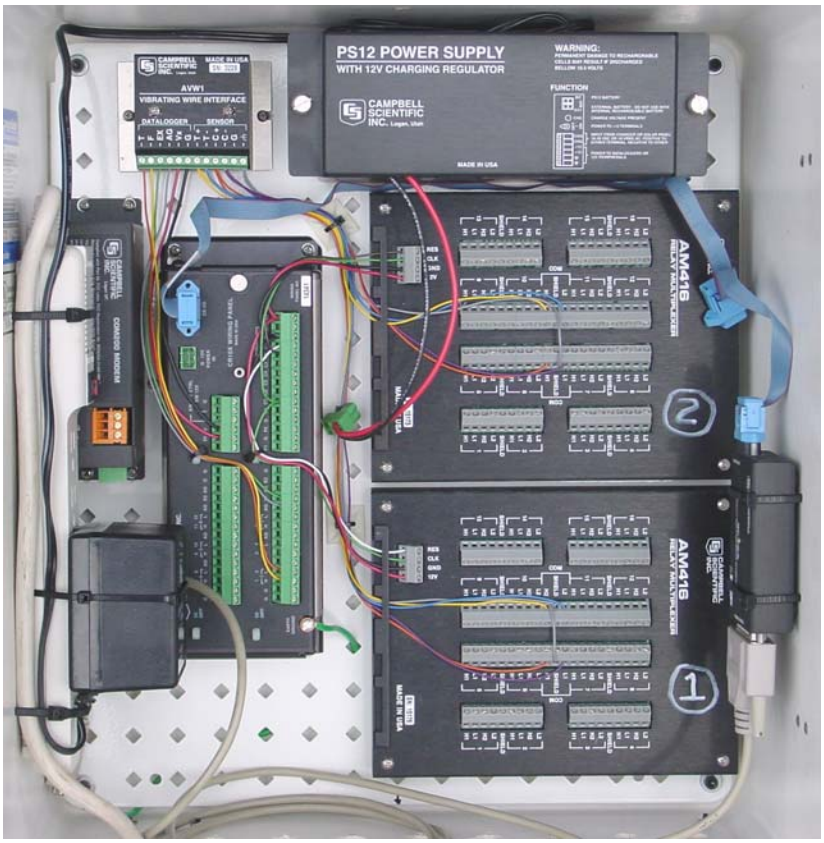
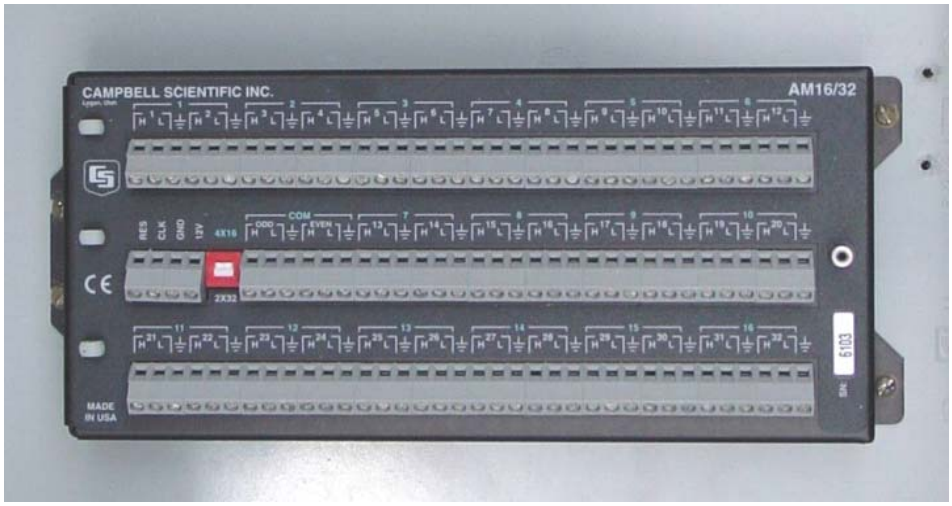
Setting Up the BDI Structural Monitoring System

The following general guidelines should be followed while using the BDI Structural Monitoring System after the sensors have been installed on the test structure. The BDI-SMS has been designed to be as easy to use as possible, however, careful notes and several photographs should be taken by the user during the entire testing operation to help when questions arise in the data reduction phase.

The datalogger and associated hardware is typically supplied in a weather-resistant fiberglass enclosure as shown below. The particular system shown is designed to handle 32 Geokon Vibrating Wire (VW) sensors which can consist of any combination of strain gages, crackmeters, tiltmeters, and others. In the configuration shown below, all 32 sensor cables must be routed to this unit so they can mounted to the two multiplexers (via screw lugs) shown. Another possible configuration consists of mounting one or more of the multiplexers in remote locations away from the logger as shown in the second photo.





This second configuration of using remote multiplexers can significantly reduce the amount of cable required for installation as just one specialized cable needs to run from the logger to the remote mux, rather than running 16 instrumentation cables back to the logger.

TRACKING SENSOR LOCATIONS AND CHANNEL NUMBERS: *Accuracy in this operation is very important because if data is taken, but it is not known which sensor it came from, it will be useless*. Each SMS will be supplied with one or more multiplexers (muxes) as shown below that use screw lugs for attaching the sensor wires.

One phase of the cable installation process will be to ensure that the sensor cables are labeled properly before being inserted into any conduit and run to the datalogger. Otherwise, a great deal of time will be spent trying to determine which cable belongs to which gage.

The channel numbers 1 through 16 are listed directly on the mux, with each channel accepting four wires from each Vibrating Wire (VW) sensor as follows:

Red – H (odd)
Black – L (odd)
Green – H (even)
White – L (even)
Shield (ground)

For example, under Channel 1, there is a “1” or “odd” channel and a “2” or “even” channel. It is very important strip the wires back approximately ¼” and to ensure that the screw lug is bearing directly on the bare wire and NOT on the insulation. Furthermore, the lugs should be fairly tight to ensure a good connection.

It is very important to note which sensor is hooked into which channel so that the proper calibrations factors can be applied in the SMS software. It’s best to group types of sensors together as this makes software configuration much easier. For example, VW strain gages should be in a group, followed by a group of crackmeters, and then a group of tiltmeters. It turns out that the VW strain gages all have basically the same calibration factors, while the cal factor for each crackmeter and tiltmeter are significantly different.

The alternative to our portable systems are the more permanently-installed systems. While these systems can still be removed and re-used on other structures, it will take a little more time for disassembly and re-assembly. The primary difference between these and the portable SMS systems is that the sensor cables in these systems are run through a hole in the SMS housing and attached directly to the SMS multiplexers with screw-type lugs.

Usually, the supplied software will already be configured for particular sensors in particular channels. However, if something changes for one reason or another, it can be easily reconfigured. Either refer to the supplied software manual or contact BDI.

EXTENSION CABLES: There is no practical length limit with the VW sensors as signals can be easily transmitted for more than a kilometer on the standard extension cable. On the Portable SMS systems, the extension cables are all the same type and vary only in length. They can therefore be plugged between any sensor and any receptacle on the logger housing. Each extension cable has a designation label (and its length) printed on each end. In order to obtain the information required for data reduction, be sure to record the sensor number, the extension cable number, and the SMS channel number that the extension cable is plugged into. The software then keeps track only of channel numbers. While reducing data, it is up to the user to correlate the channel numbers with their corresponding sensors.

POWER: The system has a built-in rechargeable battery that, ideally, should at all times be connected via the provided power outlet cord to 110V AC. The AC power will provide a constant trickle charge to the system battery and eliminate any power difficulties. If AC power is not available at the site, depending on the number of sensors, sample rate, and the frequency of other functions such as data downloading, the system battery should last approximately one week from a fully-charged condition. As a backup for this situation, the system should be powered by a 12V deep-cycle automobile battery and changed on a regular basis. One of the data channels (see Software Guide) records the system's battery voltage level and should be checked each time the data is downloaded. If the level is approaching 12.0 volts, then the battery should be either recharged via AC power or the deep-cycle battery replaced. Another option is a solar panel that will trickle charge the power supply battery during daylight hours.

DOWNLOADING DATA: A serial cable that mates the back of a portable PC has been provided. Follow the instructions outlined in the Software Guide in order to download data, change programs, or otherwise communicate with the data logger. On most systems, a modem is also installed that will accept a standard R-11 phone line jack. Data is then downloaded via telephone lines from a remote computer.

GROUND THE SYSTEM. If the system is to be placed where it is possible that lightning will strike in the vicinity, it is good practice to ground the data logger using the brass lug located on the bottom of the fiberglass cabinet. A heavy copper wire should be run to a suitable ground.

KEEP CABINET AND CONNECTORS DRY. If the cable connectors are going to be exposed to weather, they need to be protected to insure that they do not get wet. Using water-proofed connectors is cost-prohibitive, therefore, usually a small amount of tape and plastic (such as a kitchen bag) are often used. Often, several connectors can be "bunched" together and one piece of plastic used. This technique is sufficient for shorter-term monitoring situations (less than a few months). While most of the cabinet is water-resistant, the bottom panel that accepts the sensor connectors needs to be kept out of the weather so that the electronic signals do not become shorted. The more permanent SMS systems are better suited for inclement weather because the extension cables will usually be spliced at the sensor end and encased in waterproof material, and the other end is terminated in the SMS cabinet.

ROUTING CABLES: If there are several long cables of similar length to be run, time can often be saved by grouping them in bundles of four or six and wrapping them in zip ties along their length before going to the field. Also, since the system is often used where construction is ongoing, it is a good idea to bundle wires along a safe path and periodically tie them together to keep people from tripping over "loops".

REQUIRED TOOLS AND OTHER SUPPLIES: It is recommended that a well-equipped tool kit be assembled before installing the system in the field. In addition to the tools and supplies described in the instructions for installing particular sensors, the installation will require tape measures, wrenches, a hammer, clean rags, screwdrivers, various grinders (AC power and/or battery-operated), zip ties, duct tape, flashlights, extension cords, power generator, spare gasoline, and other miscellaneous items. It is also recommended that spares of most everything listed above be obtained as often tools will get lost or broken in the field.