CAMPBELL SCIENTIFIC, INC.

MEASUREMENT & CONTROL SYSTEMS

Structural & Seismic Monitoring

www.campbellsci.com/structural-seismic

Benefits of Our Systems

1. Processing for rainflow & level crossing algorithms can accommodate a large number of cycles.
2. Onboard, programmable, precision excitation is provided for ratiometric bridge measurements.
3. Systems provide triggered output with pre-trigger data capture capability.
4. Most sensors and communications options can be used, allowing systems to be customized to meet exact needs.
5. Systems operate reliably in harsh environments.
6. Scan rates range from a few hours to 100,000 times per second.
7. Systems can report conditions by calling out to pagers, radios, or phones.
8. Systems support long-term, unattended data storage and transfer.
9. Pick-and-click software facilitates programming.

CR9000X

Campbell Scientific data acquisition systems make reliable structural measurements, even in harsh, remote environments. The 13 km Confederation Bridge that connects Prince Edward Island with mainland Canada was instrumented to document strain during ice impacts and to observe weather.

Campbell Scientific data acquisition systems' versatile capabilities make them ideal for structural and seismic monitoring. Our dataloggers have been used in applications ranging from simple beam fatigue analysis, to structural mechanics research, to continuous monitoring of large, complex structures. Highway overpasses, roads, buildings, bridges, retaining walls, and amusement park rides are the types of structures for which our systems provide remote, unattended, and portable monitoring. Our data acquisition systems are known for making accurate, reliable measurements, even in harsh environments.

Monitoring and Control

The versatility of our systems allows them to be customized for each application. We offer a range of dataloggers from the most basic system with just a few channels, to expandable systems that measure hundreds of channels. Scan rates can be programmed from a few hours to 100,000 times per second, depending on the datalogger model. Measurement types, processing algorithms, and recording intervals are also programmable. Dataloggers not only provide advanced measurement capabilities, but can also control external devices.

Onboard processing instruction sets contain programmed algorithms that process measurements and output results in the desired units of measure. For example, data can be displayed as rainflow or level crossing histograms. These rainflow and level crossing algorithms allow processing for extended periods of time, not

just a limited number of cycles. The instruction sets also allow for triggered output with pre-trigger data capture capability. Triggers can be based on sensor output, time, and/or user control. For example, if an overpass is being monitored, data collection can be triggered by a sensor detecting the approach of a car, an earthquake, pre-programmed times, or by pushing a button.

The control functions of our dataloggers combined with their programmability allow them to sound alarms, actuate electrical devices, or shut down equipment based on time or measured conditions. Systems can also call out to phones, pagers, radios, and other devices to report site conditions. Voice-synthesized modems are available, so the system can actually call and tell you what is happening.

Our dataloggers collected data for a structural joint damping experiment aboard the Space Shuttle Endeavor (STS-69).

Sensors

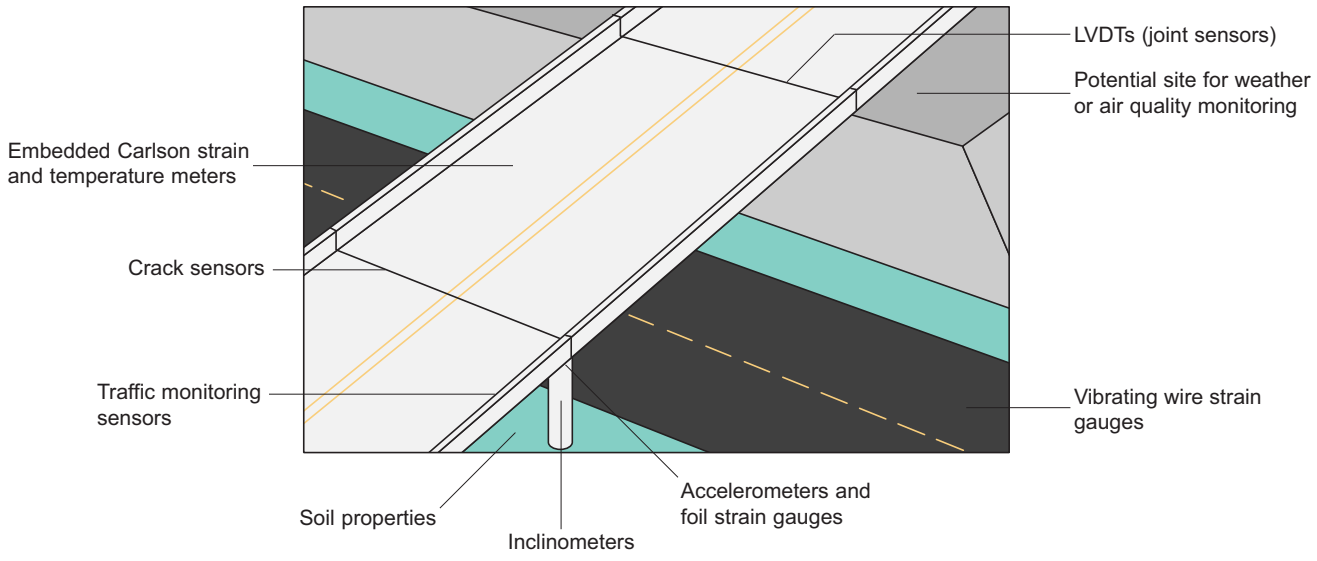
Because our dataloggers are compatible with nearly every commercially available sensor, you can use the sensors that best meet your application. Typical sensors used for structural and seismic monitoring by our systems include: Carlson strain meters, vibrating wire strain gauges, foil strain gauges (set up in quarter, half, or full bridge strain configurations), inclinometers, crack and joint sensors, and tilt sensors, as well as piezoresistive, piezoelectric, capacitive, borehole, and servo force balance accelerometers. Because our dataloggers have many channel types and programmable inputs, all these sensor types can be measured by one datalogger. Channel types include analog (single-ended and differential), pulse counters, switched excitation, continuous analog output, digital I/O, and anti-aliasing filter. Using switched or continuous excitation channels, our dataloggers provide excitation for ratiometric bridge measurements. Our configurable datalogger model, the CR9000X, allows you to customize a system with the channel types that best fit your application. The number and type of channels on most of our dataloggers are expandable using multiplexers and other measurement peripherals. Our dataloggers have input resolutions to 0.33 microvolts, allowing strain measurements with a resolution of a single micro-strain.

Communications

The availability of multiple communications options for retrieving, storing, and displaying data also allows systems to be customized to meet exact needs. Communication interfaces include direct connection to a PC or laptop, PC cards, storage modules, and datalogger keyboard/display. Telecommunication options include short-haul, telephone (including voice-synthesized and cellular), radio frequency, multidrop, and satellite.

Example Application: Structural Monitoring of an Overpass

Campbell Scientific's monitoring systems are used for a variety of structural and seismic applications. Monitoring possibilities on an overpass include:



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