



## Permafrost Monitoring

Versatile, rugged monitoring stations for harsh environments



### Overview

Campbell Scientific provides rugged, low-power data-acquisition systems for monitoring temperature profiles and other environmental data in extreme freezing conditions. The versatility of our dataloggers, including the availability of various communication ports, supports a wide range of communication options to retrieve data, including satellite options such as Argos, Iridium, GOES, and Inmarsat BGAN.

From single research stations to large networks, Campbell Scientific monitoring systems are commonly used worldwide in permafrost research. Additionally, permafrost monitoring is important in infrastructure development (mine sites, air strips, construction sites), as disturbing the permafrost may result in consequences

to infrastructure from permafrost thawing. Our systems are widely deployed in both high latitude and high altitude applications, facing the coldest and harshest conditions. Our flexible equipment is used for cold climate structural research, and has measured permafrost, hydrological, and meteorological conditions in the Arctic, sub-Arctic, and Antarctic, and on the world's great mountain peaks. Long-term, unattended station operation is achieved with low-power use, batteries and solar panels, wireless data retrieval, and large on-board data storage capacity. For example, stations installed in the summer have the capability to monitor conditions while overwintering. For all this capability, our dataloggers can be quite small, making them easily transportable in a backpack.

### Custom Systems

Most of the systems we sell are customized. Tell us what you need and we'll help you configure a system that meets your exact needs.

### Temperature Profiling

We offer multiple temperature profiling options, which are useful for measuring and monitoring permafrost. The CS230 and CS225 probe assemblies include multiple temperature sensor points that are maintained within the profile. Each probe includes a simple wiring system that eliminates the need for a multiplexer and is easy to connect to almost any datalogger through SDI-12 technology. Our temperature profiling equipment is extremely rugged, thoroughly tested, and can be buried, submerged, or integrated directly into structures.



More info: 780.454.2505

[campbellsci.ca/permafrost](http://campbellsci.ca/permafrost)

## Dataloggers

Our monitoring stations are based around a programmable datalogger that measures the sensors, then stores and transmits the data. We designed our dataloggers to provide a high level of station customization. They have programmable execution intervals, operating temperature ranges down to  $-55^{\circ}\text{C}$ , on-board instructions for commonly used sensors, and adequate input channels to accommodate many different sensor configurations.

If needed, channel capacity can be expanded using multiplexers, including a model designed specifically for thermocouples. Our dataloggers interface directly to most sensors, eliminating external signal conditioning. Powerful on-board instruction sets allow unattended control decisions based on time or conditional events. For example, peripherals such as heaters or specialized sensors can be actuated based on temperature, wind speed, solar radiation, or some other measured parameter or event. These instruction sets contain programmed algorithms that process



measurements and output results in the desired units of measure. Wind vector, wet bulb, histogram, and sample on maxima or minima are all standard to the datalogger instruction sets.

Measurement processing and data storage are programmable, but measurements are typically processed and stored at hourly and daily intervals (e.g., maxima, minima, averages). True averages can be calculated and stored by the dataloggers. Conditional outputs can also be processed and stored. For example, data can be stored at faster intervals based on events such as increased wind speeds or subnormal temperatures.

## Sensors

Almost any sensor can be measured by our dataloggers, allowing stations to be customized for each site. Sensors used with our stations can measure relative humidity, solar radiation, wind speed and direction, temperature (air, water,



and soil), precipitation, snow depth, snow water equivalent, barometric pressure, soil moisture, and water quality. Our stations can monitor strain gages, accelerometers, pressure transducers, GPS receivers, linear potentiometers, Time Domain Reflectometry, and many other sensor types.

## Communications

We offer multiple communication options for data retrieval, allowing stations to meet exact needs. Telecommunication options include radio frequency, satellite (Iridium Short Burst Data & RUDICs, GOES), telephone (landline, voice-synthesized, cellular), short-haul, Wi-Fi, Ethernet, and multi-drop. On-site options include storage module, laptop computer, and datalogger keyboard/

display. Robust error-checking and low-power use ensure your data arrives uncorrupted and as scheduled. We can even help you post your data to the Internet.



## Software

Our PC-based support software simplifies the entire data acquisition process, from programming to data retrieval to data display



and analysis. Our software automatically manages data retrieval from networks or single stations. Robust error-checking ensures data integrity. We can even help you post your data to the Internet.

