



**CAMPBELL  
SCIENTIFIC, INC.**

**MEASUREMENT & CONTROL  
SYSTEMS**

# Transportation

[www.campbellsci.com/transportation](http://www.campbellsci.com/transportation)

## Benefits of Our Systems

1. Real-time and historical GPS data can be integrated with measurements of temperature, RH, voltage, water content, etc.
2. Nearly every available sensor can be measured.
3. Data from remote or mobile sites can be transmitted to a base station via radio, cell-phone, satellite, meteor burst, and other options.
4. Long-term operation is provided by batteries; solar panels can be used in many applications.
5. Systems operate reliably in harsh environments.
6. Dataloggers provide on-board statistical and mathematical capabilities.
7. Multi-vehicle applications are easily expandable—add new vehicles or measurements any time.
8. Powerful software supports programming, data retrieval, and data display.



CR10X



CR1000



*Because of their rugged design and battery-powered operation, our systems are ideal for monitoring cargo aboard a variety of transport vehicles, including trucks, trains, ships, and airplanes.*

Campbell Scientific data acquisition systems provide reliable and flexible solutions for many applications within the transportation industry. Our capabilities range from monitoring the state of transported goods, to monitoring transportation infrastructure and the vehicle itself, to providing real-time information to warn or inform the public. The compact size, rugged design, and reliability of our systems make them ideal for transportation applications where they may be exposed to harsh conditions such as extreme temperatures or vibration. Low-power consumption, battery power, and wireless data transfer also optimize their use. Systems can be configured to monitor almost any combination of parameters.

## Transporting Goods

Our systems provide a continuous record of the state of transported goods by monitoring temperature, relative humidity, vibration, or other parameters essential to the well-being of the cargo. Whether transport takes place in a semi-trailer, airplane, train, or cargo ship, our systems provide a continuous time-stamped record of events. GPS data can also be synchronized with other measured parameters, providing location information. Our measurement systems operate reliably under high levels of vibration, high altitudes, high speeds, and in extreme temperatures, such as refrigerated units. Systems are battery-powered, eliminating the need for external power sources. Depending on configuration, they can operate for months at a time without battery recharge or replacement. Data can be recorded on-board for later analysis or transmitted continuously to a base station during transport.

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## Transportation Infrastructure

Stand-alone monitoring of transportation infrastructure can provide data for research, maintenance, and public safety. Vibration, stress, temperature, and other parameters can be monitored on roads, runways, railroad tracks, bridges, and overpasses. Slope stability and subsidence can be monitored in unstable areas around infrastructure. Our systems are used for pavement studies to monitor different construction materials and techniques and the effects of traffic and weather over time. Weather stations provide data on icing conditions, excessive wind speeds, fog, and avalanche forecasting. Measurement stations provide continuous, around-the-clock monitoring and can provide real-time information via many different communications options.

## Public Information and Warning

In situations where public safety may be compromised (such as high winds, fog, ice, flooding, landslides, or avalanche potential) our systems can interface to electronic signs and signals to provide public warning and information systems. These systems feature quick response to measured conditions—without the need for human intervention. Data can also be telemetered to a base station computer, alerting public officials of conditions.

These types of systems are also useful for traffic management; traffic can be diverted or redirected based on congestion or road conditions ahead. This can help minimize congestion and serve commuters by indicating routes around problems. In ports, crane operators and incoming and outgoing ships can receive real-time wind speed and direction data. Ferries and ships can be instrumented with GPS equipment and weather stations, providing scheduling and safety information.

## Transport Vehicles

Our systems can also monitor the transport vehicle itself. Average speed, fuel efficiency, stops, event counting, shock, vibration and many other parameters provide information for vehicle maintenance scheduling and operation efficiency. Research vehicles can be instrumented to improve design and operation. In many cases, our measurement systems can monitor parameters affecting both the cargo and the transport vehicle.

## Instrumentation

All of our measurement systems are based around programmable dataloggers that measure the sensors, then process or store the data. Our dataloggers allow a high degree of flexibility. Measurement types, scan rates, and recording intervals are all programmable. Onboard processing instruction sets contain programmed algorithms that process measurements and output results in the desired units of measure. Our dataloggers can also control external devices, such as valves and samplers. Most sensors, even those made by other manufacturers, interface directly to our dataloggers. Multiple communications options for data retrieval are available and can be mixed within the same network. Telecommunications options include telephone (landline, voice-synthesized, cellular), radio, satellite, meteor burst, multidrop, and short-haul. On-site options include storage module, heads-up-display, PDA (specifically Palm brand), and laptop computer.



*Track integrity, cargo conditions, and locomotive performance have been monitored by our systems.*



*Weather stations and GPS systems aboard Washington State Ferries provide information for scheduling and public safety.*