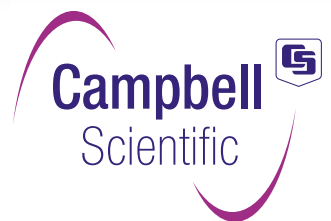


Weather Stations



Trust Campbell with your weather data



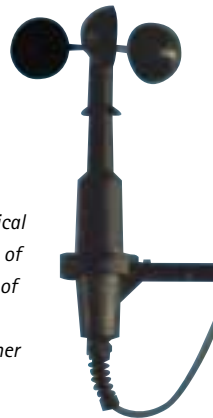
Weather Stations

Campbell Scientific weather stations have become the worldwide standard for meteorological monitoring. In use on every continent and virtually every country, our weather stations are known for their precision, rugged reliability, wide operating temperature range, and low power consumption. Campbell Scientific weather stations offer the flexibility to easily change sensor configurations, data processing, and data storage and retrieval options.

A Campbell weather station can be used for climate research, hydro-meteorological stations or combined systems, for instance meteorology and air quality, or structural and weather studies.

Campbell Scientific's equipment is at the heart of a multi-site monitoring system utilized by the 'Corporation of London' to monitor pollutant levels and environmental parameters in Central London. Seven sites across London can be interrogated from a central PC sited at the Dept of Environmental Services offices and will use GSM connections to link to the main site.

Each site uses a Campbell CR10X datalogger to gather information from a variety of air quality and meteorological sensors. The CR10X's adaptability and compatibility with a wide range of third party sensors was one of the reasons it was elected for the job. Staff at The Corporation of London can now monitor historic and real time data from all of the remote sites, which provide information on local trends and levels of nitrogen dioxide, carbon monoxide, sulphur dioxide, ozone and airborne particulates (PM10) as well as meteorological parameters that are also monitored and collated.



A CR10X-based weather station provides data critical to the application of pesticides as part of the North Dakota Agriculture Weather Network.



A Sample RTDM screen showing data captured for the Corporation of London application.



High atop Nevado Sajama in the Bolivian Andes, a Campbell Scientific weather station monitors conditions relevant to global warming.



A Campbell AWS on a glacier near the Argentine Research Base, Primavera.

Tough Enough for the Extreme, Inexpensive Enough for the Routine

From frozen polar and alpine regions to the fiery Sahara, our weather stations have endured the elements for more than 25 years to provide accurate meteorological measurements. Most of our equipment has a standard operating range of -25° to $+50^{\circ}\text{C}$; extended ranges are from -55° to $+85^{\circ}\text{C}$.

At the heart of every Campbell Scientific weather station is the datalogger. Every datalogger we manufacture is calibrated and tested over the temperature range to ensure accurate, reliable performance. The dataloggers are designed and built to operate

with low power consumption and use alkaline or rechargeable batteries charged by solar panels or AC power. Rugged, low power, reliable, fast, flexible and accurate. You'd think Campbell systems would carry a high price tag. But to us, the customer's needs are paramount and our pricing policy bears out our commitment to customer satisfaction.

A Campbell station operated by the German Impetus Projekt at Iriki in Morocco.



Campbell Scientific provide weather stations tailored to your individual requirements

Over the years, we have come to realize that there is no such thing as a 'standard' weather station.

The flexibility and long-term reliability of our weather stations have resulted in their widespread use in scientific, commercial, and industrial applications.

For us, our standard product is a non-standard weather station, configured to a user's requirements using research-grade instruments and flexible programming.

Specialist Systems

The Climate Data Logger (CDL) is a powerful weather station that uses professional grade sensors and equipment configured and approved by the UK Met Office. Initially designed for climate monitoring in the Met Office's Observation Network, the CDL includes a reliable Campbell Scientific datalogger with processing and output programmed by the Met Office.

Evapotranspiration (ETo) systems for irrigation and agricultural uses include our ET Weather Station. Irrigation specialists Toro® and RainBird® use Campbell weather stations for automating turf grass irrigation, especially at Golf Course sites. ETo is calculated to their requirements using

A highly portable fire weather station monitors conditions during a controlled burn.

Sue Ferguson, US Forest Service

Tripods and Towers

We offer corrosion-resistant tripods and towers that provide sturdy support for sensors, solar panels, and enclosures. Tripods are available in 2m or 3m heights; towers are available in 3m, 7m or 10m heights. Mounts for attaching wind sets, pyranometers, and temperature/relative humidity sensors are also available.

Easy Set Up

Our weather station installation manuals provide step-by-step instructions supplemented by

We can configure a weather station to meet your exact needs, from simple wind measurements to stations that monitor not only meteorological sensors but also other parameters such as soil moisture content, water levels or air quality. Just as you are not limited in your choice of station, nor are you restricted in your choice of sensors.

We offer several choices for each component used in the station, and our dataloggers are adept at reading a huge number of sensors, including SDI-12 and they can be used to control external devices or trigger alarms on a monitoring PC.

See the range of sensors, loggers, software and peripherals available on pages 6 & 7.

software supplied by Toro® and RainBird®.

Campbell provides a Bowen Ratio System that includes all the equipment needed for specialist and automatic measurements of eddy covariance and H₂O and CO₂ fluxes.

The BWS is Campbell Scientific's low cost weather station for monitoring the four most common meteorological parameters: wind speed and direction, air temperature and relative humidity with a standard program and user friendly software. Other parameters can be added if required.

Many tourist resorts use stations that include sunshine sensors or snow depth sensors, depending on their market requirements, whilst companies involved in renewable energy share common requirements for wind and rainfall measurements.

Our weather stations can be tailored to provide data to assist in flood management systems or forest fire warning applications, either individually or as part of larger networks.

For more information about specialist monitoring stations, please contact us.

detailed illustrations. Station set-up time for most customers is a few hours.

Installation service

Campbell Scientific offers a full installation service including site survey, installation, repair and re-calibration. We can help with programming your datalogger or setting up your data management.



Applications

Meteorology

Met Office approved weather stations for data you can count on

- **Individual Weather Stations** record site-specific conditions for meteorological research and routine weather measurement applications.
- **Weather Station Networks** provide regional and local real-time data for weather monitoring, forecasting, local warnings, and climatic modeling.
- **Air Quality and Diffusion Modeling** applications use the datalogger to monitor and control gas analyzers, particle samplers, and visibility sensors.

Other Meteorological Applications

- Hydro-meteorological applications
- Flood management systems
- Fence-line monitoring of fugitive emissions
- Landfill monitoring
- Sports sites
- Ground Truth for Satellite Imagery
- Forest Fire risk Weather Stations
- Home Weather Stations

Agriculture

Campbell Scientific began in the UK in 1985 to provide systems for agricultural users.

- Crop Management Decisions such as irrigation scheduling, integrated pest management, plant pathology, and frost prediction are based on data provided by our stations.
- Evapotranspiration is calculated on-board using a Penman-Monteith equation sanctioned by the Food and Agricultural Organization of the United Nations.

Other Agricultural Applications

- Erosion Studies
- Food Processing and Storage

The Norwegian Crop Research Institute operates a network of 52 automated weather stations in Norway. The main goal of the network is to reduce the use of pesticides, resulting in better crops at lower costs in a better environment. Data from the stations is used in forecasting models that seek to provide early warning of conditions such as apple scab, potato late blight, cabbage moth, cereal diseases and turnip moth. The stations measure air temperature, relative humidity, wind speed, leaf wetness and global radiation. Some also measure rainfall, soil temperature and sunshine duration.

A Campbell Weather Station has been monitoring at Lake Vida in Antarctica since 1995. Photo: Thomas Nylen, Department of Geology, Portland State University.



One of the more unusual applications. The Halo Trust use Campbell AWSs as part of the Mine Detection Dog Programme.



A weather station measures conditions at an Australian vineyard. Telemetry allows the grower to monitor conditions real time from their home or office.

Courtesy Steve Bailey, Campbell Scientific Australia

Alpine & Polar Research

The operating temperature range of Campbell's rugged systems make them ideal for long-term remote monitoring.

- Snow Science/Avalanche Control



Energy

Renewable energy companies rely on the accurate data they get from Campbell weather stations

For more than a decade, Campbell equipment has been helping wind power companies to evaluate potential wind farm sites and monitor performance of established farms.

The particularly demanding world of offshore wind farm development poses few problems for Campbell systems. Whilst monitoring a proposed wind farm near Prestatyn in North Wales, some 8km offshore, a single CR10X datalogger needed to monitor seven anemometers, three wind vanes, two temperature sensors and a pressure transducer. Data was downloaded on a regular basis and the CR10X even controlled a foghorn!

Campbell Scientific Weather Stations are in operation at Tan y Grisiau (200m) and on the Stwlan dam (550m) in the Moelwyn Mountains in Wales. These AWS's, operated jointly by the University of Wales Bangor and First Hydro Company, are used to provide on-line information for pump-storage hydropower generation.

The weather stations help to control the release of excessive rainfall water in the two-reservoir systems used



Weather conditions and power output can be monitored at wind power facilities



The Campbell AWS on the Stwlan dam in Wales

by First Hydro at Dinorwig and Ffestiniog. This excess rainwater must be monitored and then released into local rivers according to best environmental practice. Wind and air temperature affect evaporation losses from the lake surfaces and are included in the water balance calculations.

The Quiebrajano Dam in Spain is a good example of several Campbell systems operating together. Whilst a network of dataloggers and peripherals monitors the dam structure itself, high on the hills above the dam, a Campbell AWS delivers meteorological data to the dam monitoring station to provide a full picture of the conditions of the dam and its environment.



Campbell AWS on a hill overlooking the Quiebrajano dam.



Weather measurements on the Sphinx provide input for its preservation.

Conditions affecting marine larvae distribution are monitored at Exuma Cay, Bahamas. Heinz Proft, Caribbean Marine Research Center

Other Applications

- City wide air quality monitoring
- Ecological/Biological/ Microclimate Studies
- Historical Preservation/Museum monitoring
- Hydro-meteorological Stations
- Mining/Mineral Extraction/Earth Science
- Road Studies/Traffic Management
- Harbours and ports
- Bridge Safety



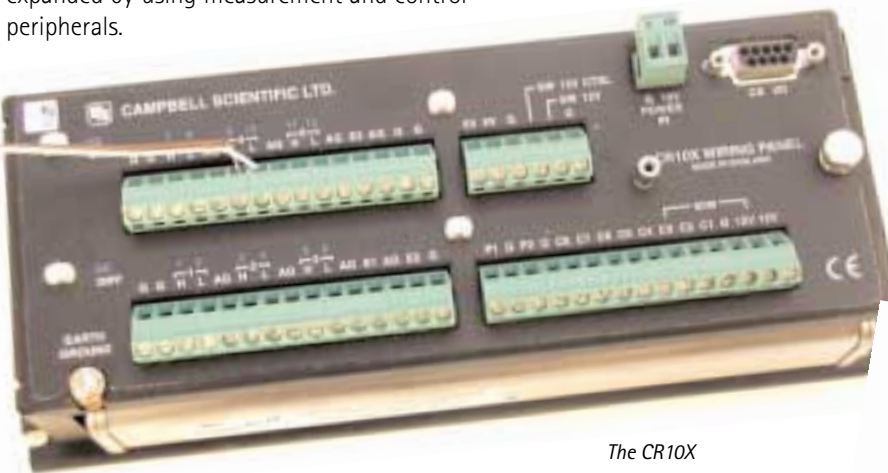
We have a huge range of products that can be used to ensure you get the data you want, when you need it, where you like to see it. Your weather station can be built around these components...

Dataloggers

Campbell Scientific weather stations are based around a programmable datalogger (typically a CR10X or CR23X) that measures sensors and stores data. Data can be stored in your choice of engineering units (e.g., wind speed in miles per hour, metres per second, knots). Sensor measurements are typically processed and stored as hourly and daily arrays (e.g., maxima, minima, averages). Conditional outputs, such as rainfall intensity, can also be processed and stored.

PC-based software is available to simplify datalogger programming, data retrieval, and report generation. You can modify the datalogger program at any time to accommodate different sensor configurations or data processing requirements.

The datalogger has programmable execution intervals, on-board instructions for commonly used sensors, and adequate input channels to accommodate all standard sensor configurations. If a large number of sensors is required, the station's capabilities can be expanded by using measurement and control peripherals.



*The CR10X
– a popular logger, in or out of a weather station.*

Our dataloggers are widely used away from weather stations. Their high speed and rugged portability makes them ideal for structural monitoring of buildings, dams, bridges and tunnels for instance and in automotive testing. Ask to see our datalogger brochures or visit www.campbellsci.co.uk/dataloggers for more information.

Sensors

Campbell Scientific offers high quality sensors for measuring the parameters listed below. All sensors we offer interface directly to our dataloggers. If measurement needs are specialized, our dataloggers have analogue, pulse counter, and digital inputs compatible with sensors offered by most manufacturers.

Standard sensor range:

- **Wind Speed:** cup, propeller, or sonic anemometers.
- **Wind Direction:** vanes that use precision potentiometers, sonic anemometers. (A single sensor assembly may measure wind speed and direction.)
- **Solar Radiation:** silicon cell or thermopile pyranometers, quantum sensors, net radiometers.

- **Temperature (air, water, soil):** thermistors, thermocouples, or RTDs.
- **Relative Humidity:** capacitive sensors that use integral signal conditioning. (RH and air temperature sensors are typically housed in a single body.)
- **Precipitation:** tipping bucket raingauges or weighing gauges. A snowfall conversion adapter that uses antifreeze or a heated tipping bucket can measure the water content of snow.
- **Snow Depth:** ultrasonic distance sensors.
- **Barometric Pressure:** resonant quartz technology.
- **Soil Moisture:** moisture blocks, analogue output tensiometers, or reflectometers.
- **Fuel Moisture:** thermistor and reflectometer in a Forest Service-approved ponderosa pine dowel.

Other sensors that may be used alongside a weather station:

Water quality; leaf wetness; Heat Flux; Water Conductivity. Ask about other sensors for your needs.

Our new CR200 series of dataloggers combines a low-cost rugged datalogger with a built in spread-spectrum radio to provide even more system flexibility.



Power Supply

The power supply consists of either a set of alkaline batteries or a sealed rechargeable battery; the rechargeable battery can be recharged via solar panel or AC power. Weather stations with high current drain peripherals (satellite, cellular phone) may require one of our larger capacity batteries.

Enclosures

Environmental enclosures house the datalogger, power supply, data retrieval peripherals and if desired, a barometer. The enclosures provide protection from dust, humidity, precipitation, sunlight and environmental pollution. Our enclosures are UV-stabilized and reflect solar radiation. Brackets with u-bolts allow our enclosures to mount easily to our tripods and towers.

Communications and Data Retrieval Peripherals

To determine the best option for your site, consider the accessibility of the site, availability of service (e.g., cellular phone or satellite coverage), quantity of data collected and time between data downloads.

On-site options include:

- Storage Modules
- Laptop Computer
- Datalogger Keyboard/Display
- Infra-red link

Telecommunication options include:

- Short-Haul Modems
- Telephone (including land line, voice-synthesized and cellular)
- Ethernet
- Radio Frequency (RF) Transceivers (including VHF, UHF, ELOS, Meteor burst and spread spectrum)
- Multidrop Interface (coaxial cable)
- Satellite Transmitters (including High Data Rate GOES, Argos and Inmarsat-C)

LoggerNet

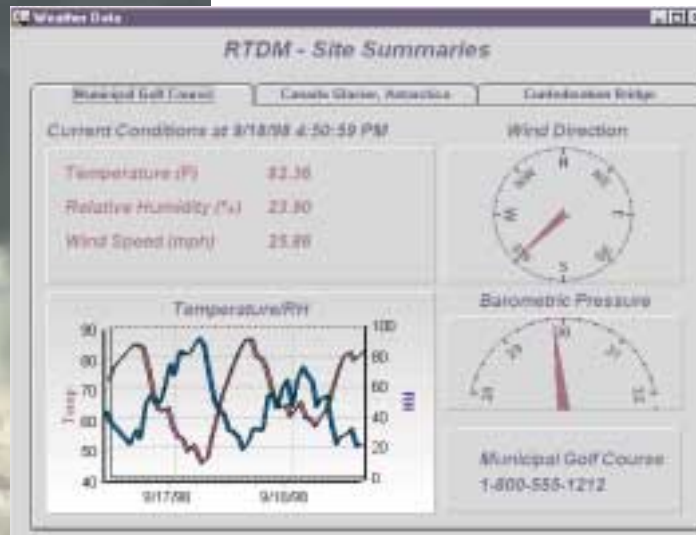
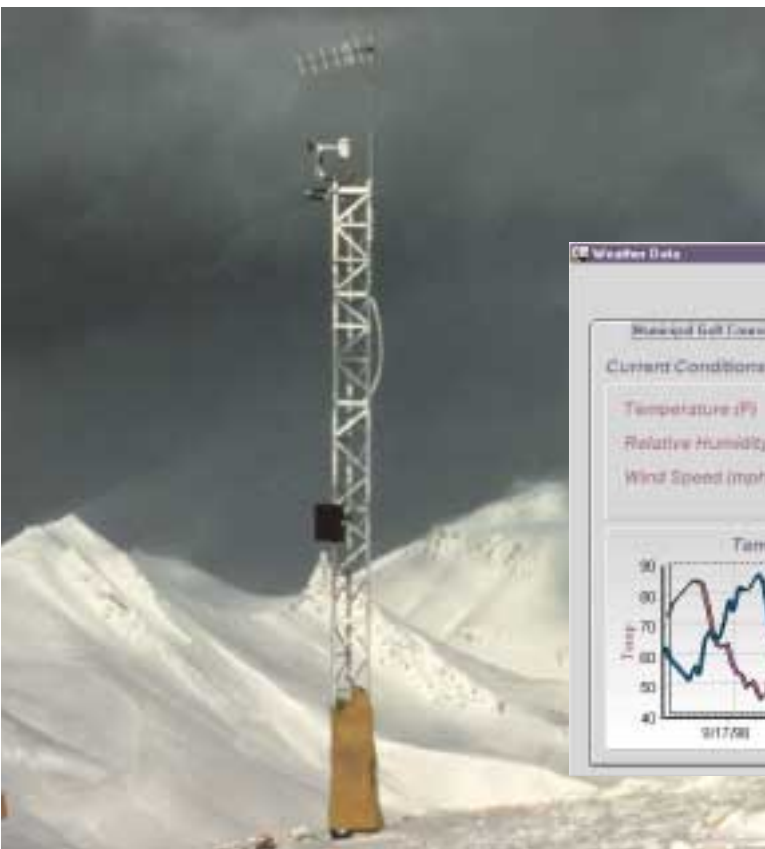
LoggerNet consists of a server application and several client applications integrated into a single product. The server runs on the main PC and uses serial ports, telephony drivers and Ethernet hardware to communicate with dataloggers via phone modems, RF devices and other peripherals, thereby allowing the user to program remote stations and to retrieve and process data from networks of remote sites. Users can customize programs and also their own display screen to view data or control flags and ports. The data can be easily transported into standard spreadsheets or presentation packages. The package incorporates Real-Time Monitoring and Control (RTMC) software, which includes an option for event driven alarms.

This powerful new package allows multiple users to access data simultaneously and without having to contact each datalogger in the network allowing users to choose the data they wish to collect and schedule automated collection.

SCWin Short Cut Program Builder creates weather station programs requiring only sensor measurement and data output. It supports the meteorological sensors listed on our U.K. price list.

PC200W Starter Software allows you to transfer the weather station program and collect data via a direct communications link (i.e., an optically isolated RS-232 interface or a similar device).

SCWin and PC200W are available from www.campbellsci.com/resource.html or from our demo CD.



RTDM

This versatile graphics software allows advanced users to create sophisticated screens that display real-time data. Controls and alarms can be set and the screens can include graphics to aid presentation.

RTDM screen shot

Meteorological conditions are measured at Lake Louise, Alberta, Canada.

The data are telemetered via phone-to-RF link to a base station.

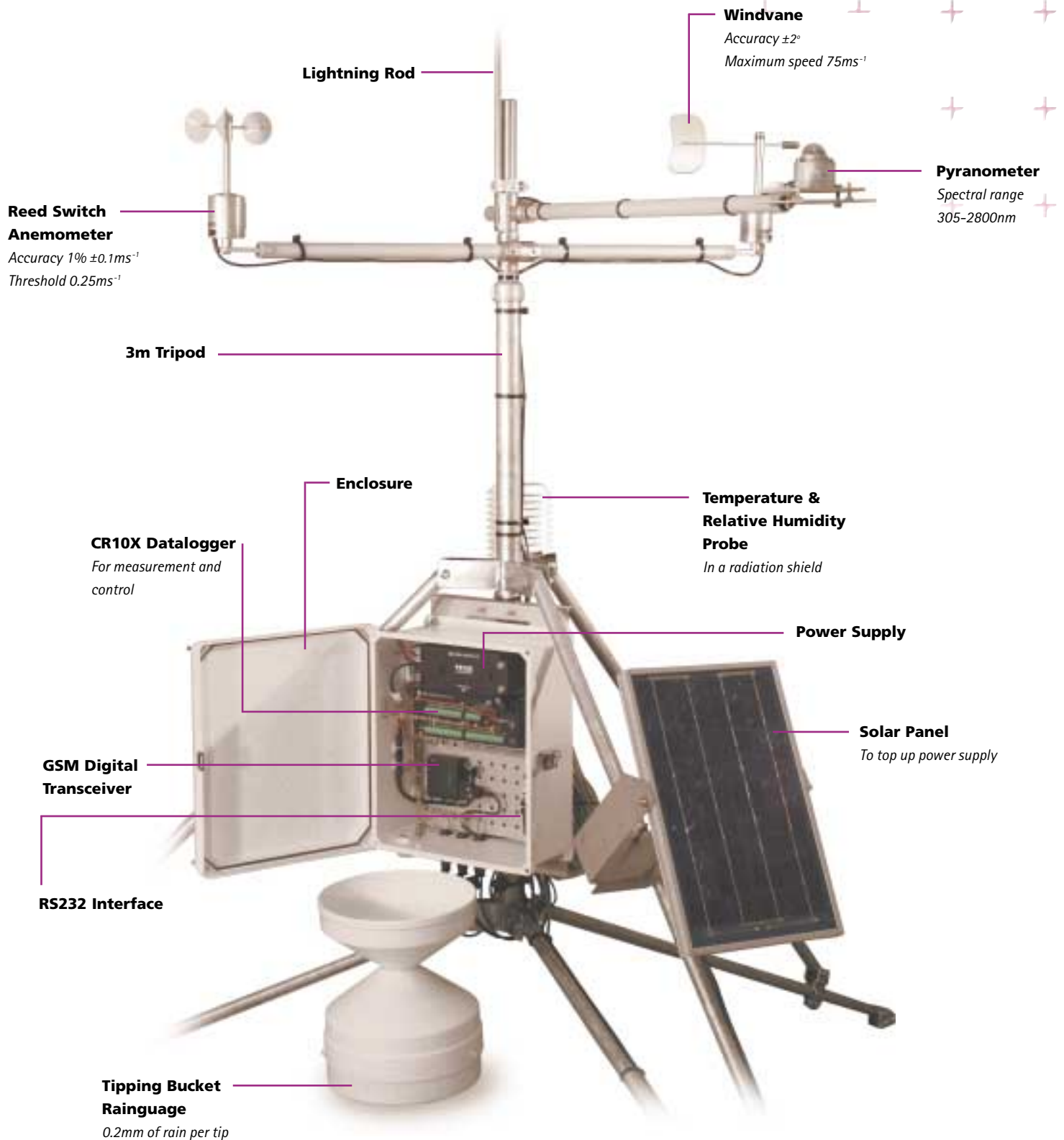
Claude Labine, Campbell Scientific Canada

Weather Station Software

Campbell Scientific software supports weather station programming, communications between the weather station and PC and data display.



Anatomy of a Weather Station



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