CAMPBELL SCIENTIFIC, INC.

MEASUREMENT & CONTROL SYSTEMS

# Plant Physiology

www.campbellsci.com/plant-physiology

## Benefits of Our Systems

1. Bowen ratio, eddy covariance, TDLAS, and automated weather stations available.
2. Fluxes can be computed in real time, or the raw data archived for later analysis.
3. Systems operate reliably in harsh environments.
4. Batteries and solar panels allow long-term, remote operation without AC power (for some systems).
5. PC software collects and processes time-series data.
6. Compatible with a variety of micrometeorological sensors—configure a system to meet your needs.
7. Communications options include storage modules, spread spectrum radios, and short haul modems. On-site or remote data retrieval is also available.

*CR5000*

*CR10X*

Campbell Scientific manufactures research-grade instrumentation for a variety of micrometeorological applications. Our systems include Bowen ratio and eddy covariance flux measurement systems, trace gas analyzers, and automated weather stations. Designed for field use, these systems provide reliable, accurate measurements for applications such as:

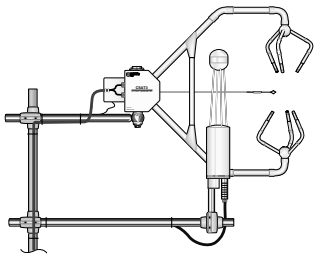
- Surface/atmosphere interactions
- Carbon, energy, & water balance
- Plant respiration research
- Air dispersion modeling
- Atmospheric stability
- Global climate change
- Agricultural research
- Ecosystem research

## Weather/Evapotranspiration Measurements

Our weather stations provide long-term, stand-alone monitoring of meteorological parameters for all types of agricultural research applications. Programmable dataloggers allow multiple options for station configuration, measurement and output intervals, and data retrieval. Almost any meteorological sensor can be used, including: wind speed and direction, solar radiation, temperature (air, water, soil), relative humidity, dew point, precipitation, leaf wetness, and barometric pressure. Wind vector, wet bulb, histogram, and sample on maxima or minima are standard in the datalogger instruction sets. Data are typically viewed and stored in the units of your choice (e.g., wind speed in mph, m $s^{-1}$, knots). Pre-programmed stations calculate potential evapotranspiration using the Penman-Monteith equation; other evapotranspiration algorithms can be entered by the user.

## Flux Measurements

Our flux measurement systems are designed for solar-powered field use and measure fluxes using gradient or eddy covariance techniques. Our gradient systems use energy balance Bowen ratio techniques to measure water vapor, carbon dioxide, and temperature fluxes. Our integrated eddy covariance systems are based on a three-dimensional sonic anemometer and can be configured to measure the fluxes of temperature, water vapor, and carbon dioxide. Other gas species, such as $N_2O$, $CH_4$, and $NH_3$, can be measured with the TGA100A Trace Gas Analyzer, which uses tunable diode laser absorption spectroscopy technology.



*CSAT3 and LI7500*

## Trace Gas Measurements

$N_2O$, $CH_4$, $NH_3$, $CO_2$, water vapor, and many other gases can be measured with the TGA100A Trace Gas Analyzer, which uses tunable diode laser absorption spectroscopy technology (TDLAS). The TGA100A is a rugged, reliable, portable instrument designed for use in the field with minimal protection from the environment. It can measure trace gas fluxes as part of a gradient or eddy covariance system. For gradient measurements, the TGA100A automatically controls the switching valves and computes the mean concentration and mean gradient at one or multiple sites, then stores the results to a disk and displays the data in real-time. For eddy covariance measurements, it is designed to collect three-dimensional wind data from a sonic anemometer while synchronously measuring gas concentrations. It can also collect data from other instrumentation through a datalogger, or through its own auxiliary analog inputs.

## Soil Measurements

We can measure nearly every commercially available soil sensor, including tensiometers, heat flux plates, thermocouples, psychrometers, lysimeters, and gypsum blocks.

Our soil water instrumentation is used extensively to monitor water content and matric potential. Our time-domain reflectometry (TDR) systems provide accurate, reliable measurements of soil volumetric water content and bulk electrical conductivity in soils over a wide range of textures and soluble salt concentrations. We offer both long-term, multi-point (up to 512 probes) systems and a portable system for instantaneous soil water content readings. Our sensors that measure soil water matric potential use heat dissipation and electrical resistance methods.

## Dataloggers

All of our measurement systems are based around programmable dataloggers that measure the sensors, then process or store the data. We designed our dataloggers to 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.

## Sensors and Analyzers

Most sensors and analyzers, even those made by other manufacturers, interface directly to our dataloggers. Common sensors used in our micromet systems include sonic anemometers, hygrometers, fine wire thermocouples, and open and closed path gas analyzers, including the LI7500 (LICOR's LI-7500). A wide variety of meteorological and soil sensors can also be used.

## Data Retrieval

We offer multiple communications options for data retrieval, including, direct connect, storage modules, phone, RF, and the Internet. PC-based software simplifies datalogger programming, data retrieval, and report generation. Robust error-checking ensures your data arrives uncorrupted and as scheduled.

 (435) 753-2342 (435) 750-9540 fax info@campbellsci.com www.campbellsci.com Printed May 2005