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WHEN MEASUREMENTS MATTER

# UPDATE

Fourth Quarter 2012


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# IRGASON: A New Eddy-Covariance Analyzer

New Product

Eddy-covariance systems have long been one of Campbell Scientific's key offerings. Over the years we've worked hard to provide better measurements and a higher level of system integration for this specialized application. Our newest product, the IRGASON, is a continuation of these efforts. As its name suggests, the IRGASON is an infrared gas analyzer (IRGA) and 3D sonic (SON) anemometer combined into a single sensor. Having a single sensor for eddy-covariance measurements provides several key advantages in co-location, synchronicity, and aerodynamics. These advantages distinguish the IRGASON as the best open-path eddy-covariance sensor available on the market today. Specifically, the IRGASON simultaneously measures absolute carbon dioxide and water vapor densities, air temperature, barometric pressure, three-dimensional wind speed, and sonic air temperature.

*The EC150 $CO_2$/$H_2O$ Open-Path Gas Analyzer and CSAT3A 3D Sonic Anemometer will continue to be sold for situations where separate turbulence and gas measurements are desired.*

Traditionally, turbulence and gas measurements are provided by two separate instruments mounted close to each other. If these sensors are too far apart, the flux is underestimated, and a variable lag is introduced that depends on the wind speed and direction. The IRGASON avoids these problems by measuring turbulence and $CO_2$ and $H_2O$ densities in the same volume. If a traditional gas analyzer is mounted too close to a sonic anemometer, it distorts the wind measurements. The IRGASON integrated sensor provides less wind distortion than two separate sensors. With a common set of electronics, the gas analyzer and sonic anemometer measurements are also temporally synchronized. This avoids flux error due to timing jitter between a separate anemometer and gas analyzer.

The IRGASON is field rugged. It is tolerant to window contamination, and the IRGA optics feature angled windows to better shed water. Easy access to chemical bottles makes it serviceable in the field. Very low power consumption (5 W at 25°C) minimizes flux errors due to body heating and makes solar-powered applications more economical and convenient.

The EC150 $CO_2$/$H_2O$ Open-Path Gas Analyzer and CSAT3A 3D Sonic Anemometer will continue to be sold for situations where separate turbulence and gas measurements are desired.

With the two principal eddy-covariance measurements now combined into a single instrument, the IRGASON brings a new level of integration to our open-path eddy-covariance systems. The IRGASON provides truly simultaneous and co-located measurements, reduced flow distortion, and easier installation for most eddy-covariance applications.

Learn More Here
*campbellsci.com/irgason*


CAMPBELL SCIENTIFIC UPDATE

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# Larger Memory Cards Now Supported


New Product

Campbell Scientific's CR1000 and CR3000 dataloggers now support CompactFlash (CF) memory cards that are larger than 2 GB. We now offer the CFMC16G, providing 16 GB of measurement data storage. This is especially relevant to high-frequency measurement applications that generate large quantities of data in short periods of time. We commonly see such applications in micrometeorology, geotechnical, and automotive areas of research. The CFMC16G is a 16 GB, industrial-grade CompactFlash card that has been selected specifically to provide optimum performance and extreme reliability. It is used with the CFM100 or NL115 to expand a datalogger's memory and to transport data, camera images, programs, and operating systems without having to use a PC.


To accommodate large-capacity cards in an efficient manner, a new mode of operation for the CRBasic **TableFile()** instruction has been added to version 25 of our datalogger operating system. Using a **TableFile()** format option of "64" brings features similar to **CardOut()** to **TableFile()** for managing the CRD: file system. More details can be found in the CRBasic help for **TableFile()**, but here is an example in action:

**TableFile***("CRD:" & Status.SerialNumber & "_Test_",64,-1,0,24,Hr,0 ,0)*

You can update your CR1000 or CR3000 to OS version 25 using the following links:

- To determine your datalogger's current operating system, please visit: www.campbellsci.com/datalogger-os-updates.
- To download a datalogger operating system and compiler, please visit www.campbellsci.com/19_1_763.
- A tutorial for updating a datalogger operating system can be found at www.campbellscicom/19_1_9999_159.

All of our CF memory cards are industrial grade and therefore offer a number of advantages over less expensive commercial-grade CF cards: they are less susceptible to failure and data loss, operate over a wider temperature range, have faster read/write times, offer better vibration and shock resistance, and have longer life spans (more read/write cycles). Additionally, CF cards in general offer a variety of advantages over Secure Digital (SD) cards, including ruggedness, ease of handling, and connection reliability. For these reasons, we have chosen to offer CF cards that are industrial grade over SD cards. More specifically, we offer and recommend the FMJ brand after having performed stringent testing for compatibility, speed, current drain, and electrostatic discharge (ESD) endurance.

*Tip Says: As with all of our other memory cards, don't forget to press the card removal button and wait for the green light before powering down the datalogger or ejecting the card.*

Learn More Here
*campbellsci.com/cfmc16g*

# New Soil Probe Insertion Tool

New Product

The new CS650G makes inserting water-content reflectometer sensors easier in dense or rocky soils. It makes pilot holes in the soil to help keep the sensor rods parallel during insertion. This tool can be driven into the soil with force that might damage the sensor if the CS650G were not used. Its simple, rugged design replaces both the 14384 pilot tool and the 14383 installation tool, which were used together for the same function as the new CS650G, so you only need to order one part instead of two separate parts.

Learn More Here
*campbellsci.com/cs650g*

# New and Improved Pressure Transducers

New Product

Since we released our CS450 and CS455 pressure transducers a few years back, they have seen great success, with hundreds of them in operation throughout the world. These transducers have demonstrated excellent quality, reliability, and measurement accuracy. We have taken another step forward with the release of the CS451 and CS456, which replace the CS450 and CS455, respectively.

The new transducers have a smaller gap between the water ports and the diaphragm. A smaller gap means less trapped air that the user must remove during deployment. Trapped air causes the transducers' readings to drift as the air slowly dissolves into the water.

As with the previous models, the CS451 has a 316L stainless-steel case that can be submerged in most canals, wells, ponds, lakes, and streams; the CS456 has a rugged titanium case that allows it to be used in saltwater or other harsh environments. The transducers' output remains unchanged, with SDI-12 and RS-232 signals. The high-accuracy option, providing an accuracy of ±0.05 percent full-scale range, is still available.

Learn More Here
*campbellsci.com/cs451*

# Snow Water Equivalent Sensor Updates

Updated Product

Not long ago Campbell Scientific released a new snow water equivalent sensor. The CS725 (formerly known as the GMON3) uses an innovative, non-contact method of monitoring snow water equivalent (SWE) for any type of snow or ice. It measures SWE by passively detecting the change in naturally occurring electromagnetic energy from the ground after it passes through snow cover.

The CS725 has many features that make it an excellent replacement sensor for the traditional snow pillow and snow scale. Its wide measurement area (approximately 100 $m^2$) is five to ten times larger than the measurement area of the closest competitor. Additionally, the CS725 is not affected by adverse weather, does not cause snow drifting, and requires less site preparation than snow pillows.

Testing has shown that sites free from wooded vegetation and man-made structures (within a 48 m radius), or sites that will experience lower SWE values (< 300 mm) may not require the collimator. Because of this, we've made the collimator optional, which in some cases will reduce costs and greatly simplify installation.

SWE measurements are used in a variety of applications including surface water runoff modeling, water cycle studies, and climate prediction. Our CS725 is ideal for providing the data used in these studies, and we look forward to the contributions this sensor will make to these applications.

Learn More Here
*campbellsci.com/cs725*

# Decisions, Decisions, Decisions . . .

Tips and Tricks

We all know that our Campbell Scientific dataloggers are really good at taking measurements and storing data. But did you know that they can also make decisions and control other devices? It's true! Your datalogger can turn a cellular phone modem or GPS receiver on and off to conserve power. It can trigger a water sampler to collect a sample or a camera to take a picture. It can activate an audio or visual alarm. What do you need to control? Have the datalogger do it!

Typically, your devices are physically connected to the datalogger using one of the digital I/O ports (C1-C8) or the SW12V (switched 12 V).

***"Excuse me, Tip. Why are the digital I/O ports labeled C1 through C8?!?"***

I'm glad you asked. Back in the old days, before CRBasic dataloggers, those ports were called control ports. They have a lot more capability now but haven't lost that feature.

Each digital I/O port can be set low (0 Vdc) or high (5 Vdc) using the **PortSet()** or **WriteIO()** instruction. A digital I/O port is normally used to operate an external relay driver circuit because the port itself has limited drive capacity.

There are also synchronous devices for measurement (SDMs) (www.campbellsci.com/sdm) that can get the job done. In addition, some SDM devices are continuous analog output (CAO) modules. CAO modules output continuous adjustable voltages required for strip chart and variable control applications.

That's the hardware we need to do control. What would the program look like? Often, the decision to do something is based on time, an event, or a measured condition. Let's take an example of turning on and off a cell phone based on time. The modem requires 12V power, so, we'll connect its power wire to the datalogger's SW12V. For ten minutes at the top of the hour, the phone will be on. The **TimeIntoInterval()** instruction is great for doing something based on the datalogger's clock. We'll embed it in an if/then logic statement like this:

**If TimeIntoInterval***( 0,60,Min)*
**Then PortSet** *(9,1) 'Port "9" is the 'SW12V Port. Turn phone on.*
**If TimeIntoInterval***(10,60,Min)*
**Then PortSet** *(9,0) 'Turn phone off.*

Remember, if you turn a piece of hardware on under datalogger control, you also need to turn it off. Just having a condition be false does not change the state of the port.

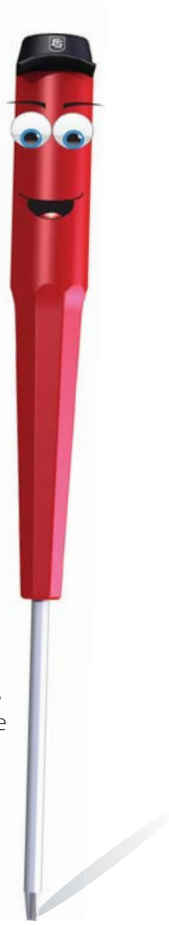
Use your datalogger to:

- Turn on and off the heater to your anemometer to extend the sensor's life
- Move a head gate to regulate water flows in a canal system
- Control pH dosing and aeration for water quality purposes
- Turn on and off devices such as a gas analyzer when temperatures become too low
- Control irrigation scheduling

The possibilities are endless!

Always out of control,

Tip



# How Do You Run?

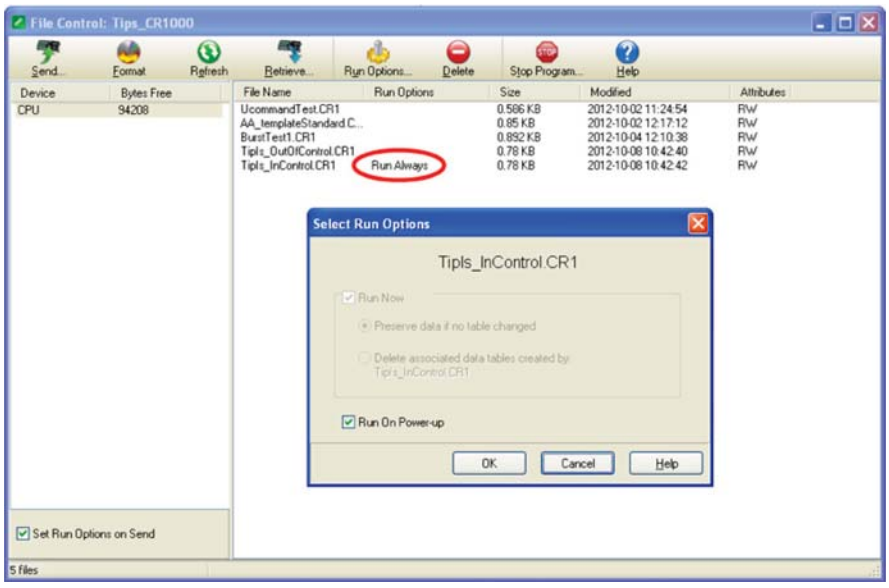
Tips and Tricks

To safeguard your data in case of power loss, make sure your datalogger program is set to run on powerup. Next time you connect to your datalogger, check to make sure your program is set to Run Always. Do that from File Control.

The other options you may see are Run Now and Run On Power-up. Most people, most of the time, want the same program that is currently running to also run on power-up. Use the Run Options to set both Run Now and Run On Power-up so your program will Run Always.

Always on the run,

Tip



# Florida Water Diversion Control

Case Study

Florida's Melbourne-Tillman Water Control District (MTWCD) includes levees to protect the area from flooding by the Upper St. Johns River (USJR), and a canal network to improve drainage. Prior to 2010, the main canal for this drainage network directed storm runoff into Turkey Creek toward the Indian River Lagoon (IRL) estuary. This resulted in reduced freshwater flow in the USJR, limiting the water supply available for downstream users. At the same time, the increased storm-related freshwater discharge into the IRL periodically depressed salinity below desirable levels for prolonged periods, producing increased stress on the IRL estuary ecosystem. The associated pollution attenuated light penetration into the water column and limited the coverage and density of sea grass habitat.

In 2010, the St. Johns River Water Management District (SJRWMD) of northeast Florida sponsored drainage modifications for the MTWCD in efforts to reduce the runoff from their freshwater drainage system into the IRL. The SJRWMD replaced the aged gate system to divert some water that used to go east into Turkey Creek and send it west to be pumped toward the USJR.

The six new gates are fully automated, controlled by a bank of four Campbell Scientific CR1000 dataloggers. Using LoggerNet software, the dataloggers are programmed to measure twin water-level sensors upstream and a single sensor downstream of the gates. The software is installed on computers in the MTWCD and SJRWMD offices, and is also installed on a SJRWMD laptop computer, giving managers the flexibility to control the gates from any location. Two cameras are positioned to view the gates. They interface with the dataloggers and software to enable remote viewing of the site.

The Campbell Scientific equipment runs in automatic mode for most flow and flood control situations, with minimal need for staff intervention. All operations of the gates are monitored by the equipment, along with every water level, all six gate positions, rainfall, and other meteorological factors. LoggerNet software also continuously calculates and reports the discharges flowing over the gates.

Two basic operational regimes have been programmed into the controlling dataloggers: gate control and flow control. With gate control, an operator can set any of the six gates at any elevation, where they will stay until moved again. In flow control, the operator will specify any flow value, e.g., 575 cubic feet per second (cfs). Because LoggerNet constantly calculates the gate flows, this operational regime allows the dataloggers to automatically adjust the gates based upon the desired flows. The option to override and go into manual operation is available whenever managers need it.

With these flow controls, the system limits freshwater discharges from the main canal into Turkey Creek, no matter what the upstream water levels are. Emergency conditions are accounted for, and the system is programmed with modes to handle tropical storm and hurricane conditions when those modes are initiated by an operator. In these modes, the gates are incrementally opened through any countdown desired (typically 72 hours) to allow more flow through as a tropical storm or hurricane advances to the area. After the storm threat has passed, or at any point in the countdown, the system can be switched back to automatic flood-control mode.

The main advantages of all the gate and operational modifications include: the ability to raise the level of the upstream canal to divert water as needed; and the improved quality of discharging waters that pass over the gates. (This upper-level water has a higher oxygen content than the lower-level water the previous style of gates discharged, for better water quality in Turkey Creek.) These overshot gates also reduce sediment transport and turbidity in the discharge water. All of these improvements obtain the ultimate goal of reducing freshwater discharge into the IRL estuary, resulting in the reduction of nutrients and other pollution in the Indian River Lagoon.

Learn More Here
*campbellsci.com/water-diversion*

# Monitoring North Carolina 'Green' Hotel

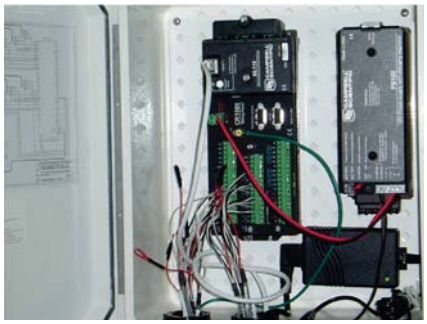
Case Study

When Dennis Quaintance decided to build the Proximity Hotel in Greensboro, North Carolina, he knew he wanted the hotel's design to exceed industry standards for environmental quality. He also knew he wanted the Proximity's daily operation to reflect a reduction in energy consumption, as compared to similar hotels.


The idea of building an environmentally responsible hotel was challenging. How could a hotel use less energy and water, continuously employ cost-saving measures, and still uphold its luxury appeal to hundreds of guests and visitors each day?

The services of Adams Environmental Systems, Inc., were employed to assist in meeting this challenge. Adams Environmental used its expertise in air quality monitoring, solar energy, and building structures to design and install an extensive monitoring system to integrate many of the hotel's sustainable practices and provide comprehensive real-time data. This monitoring system extends throughout the hotel property, including its adjoining restaurant.

- Weather station—Measures outdoor air temperature and humidity.
- BTU meter—Employed in the solar panel system on the facility's roof to monitor solar hot water production for bathing, cooking, and laundry
- Carbon dioxide, air temperature, and humidity sensors—Monitor the indoor air quality of various rooms in the facility. Using the datalogger and communication peripheral, an alarm is triggered if a room's carbon dioxide level reaches a preset level.
- Heat, smoke, and other effluent sensors—Maintain fresh airflow in the restaraunt's kitchen. The datalogger adjusts the power of the ventilation hoods' variable-speed fans to match the kitchen's needs. Typically, these fans have operated at 25 percent of full capacity.
- Energy usage monitoring—Determines air conditioning, lighting, electricity, and natural gas usage to calculate energy efficiency.



To accommodate the many different types of sensors used throughout the facility, Adams Environmental used Campbell Scientific's most widely used datalogger, the CR1000, with the SDM-IO16 input/output expansion module. The NL120 Ethernet interface communicates the data wirelessly to a central display kiosk in the hotel lobby. Campbell's LoggerNet software produces graphical displays of the real-time data.

Because of all the sustainability measures taken to create and maintain an environmentally responsible hotel, the Proximity Hotel and its adjoining Print Works Bistro became the first facility in the hospitality industry to obtain the U.S. Green Building Council's platinum rating for Leadership in Energy and Environmental Design (LEED).

The achievement of management's sustainability goals, the continued use of sustainability practices, and management's desire to further improve the hotel's energy efficiency are evidenced by the data supplied by the monitoring system. Using this system, the facility's actual energy use is compared to the projected use. With this type of feedback, hotel management can make informed decisions regarding improvements throughout the facility. This feedback, for example, has led to a change to the solar system that increased its BTU output by 20 percent. Overall, compared to similar hotels, this facility uses approximately 34 percent less water and 39 percent less energy.

By using less water and energy, and continuing to monitor its usage, the hotel has proven to be a cost-saving facility. As one example of these savings, the hotel was able to save $2,000 a month just by monitoring the HVAC system. It is important to note that the impact of savings like these was not negated by a significant additional cost for construction—less than $7,000 was spent for sustainability improvements during construction.

The facility's sustainability practices, while benefitting both management and the environment, have not negatively impacted the comfort level of guests and visitors. In fact, the luxury hotel has continued to be recognized for its green practices while it has received praise from its patrons. Behind the scenes, the monitoring system installed by Adams Environmental continues to promote the hotel's sustainability practices.

Learn More Here
*campbellsci.com/green-hotel*

# Enclosure Product Line Updated

New Product

In response to a growing customer need for a large enclosure to protect a datalogger and multiple peripherals, Campbell Scientific now offers the ENC24/30, with internal dimensions of 24 by 30 by 8 in., as part of our standard enclosure product line.

The ENC24/30, because of its larger size, provides additional wiring room for various components, including a datalogger, power supply, larger batteries, and communication and measurement peripherals. This enclosure, available in stainless steel or mild steel, features a backplate for mounting devices, one to four conduit openings, and 12 cable entry seals.

Because of the ENC24/30's size and weight, this enclosure is not intended to be mounted on a tripod. Rather, this enclosure is designed for mounting on a tower or a building.

In addition to our standard enclosures in a range of sizes, we also offer prewired enclosures with prewired connectors on the outside, ready for sensors to be attached.

A variety of other enclosure mounts and accessories are available to meet your diverse application needs for weather-resistant enclosures. To see our full line of enclosures, please visit our website at www.campbellsci.com/enclosures.

Learn More Here
*campbellsci.com/enclosures*

# Upcoming Trade Shows

*Visit our website for training class schedules and additional listings.*

**OCTOBER**

| | | |
|---|---|---|
| 14-19 | Oceans '12 | Virginia Beach, VA |
| 21-24 | 2012 ASA Annual Meeting | Cincinnati, OH |
| 23-25 | Automotive Testing Expo | Novi, MI |

**NOVEMBER**

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|---|---|---|
| 04-05 | Irrigation Show | Orlando, FL |
| 05-07 | CASQA | San Diego, CA |

**DECEMBER**

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| 04-07 | NGW Expo | Las Vegas, NV |
| 04-07 | AGU Fall Meeting | San Francisco, CA |

**JANUARY**

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| 06-10 | AMS 2013 | Austin, TX |
| 29-31 | Distributech | San Diego, CA |

**FEBRUARY**

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|---|---|---|
| 06-07 | Golf Industry Show | San Diego, CA |

# Training Offered

Training

Campbell Scientific offers comprehensive training courses at our state-of-the-art training facility. Our list of courses includes classes on programming our dataloggers, making the best use of our software, and professional-level expertise in research methods.

Each training course is taught by experienced Campbell Scientific application engineers. Class size is limited to ensure personalized instruction and assistance. Course fees include training manuals and the use of dataloggers, computers, and sensors. Lunch is provided on all course days, and there will be a tour of Campbell Scientific's facilities as time permits.

If you have questions about which course will best meet your needs, please contact an application engineer. We can also help you arrange a self-study course or a customized course at your location. Visit our website at www.campbellsci.com/training to see the current schedule and to register online.

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