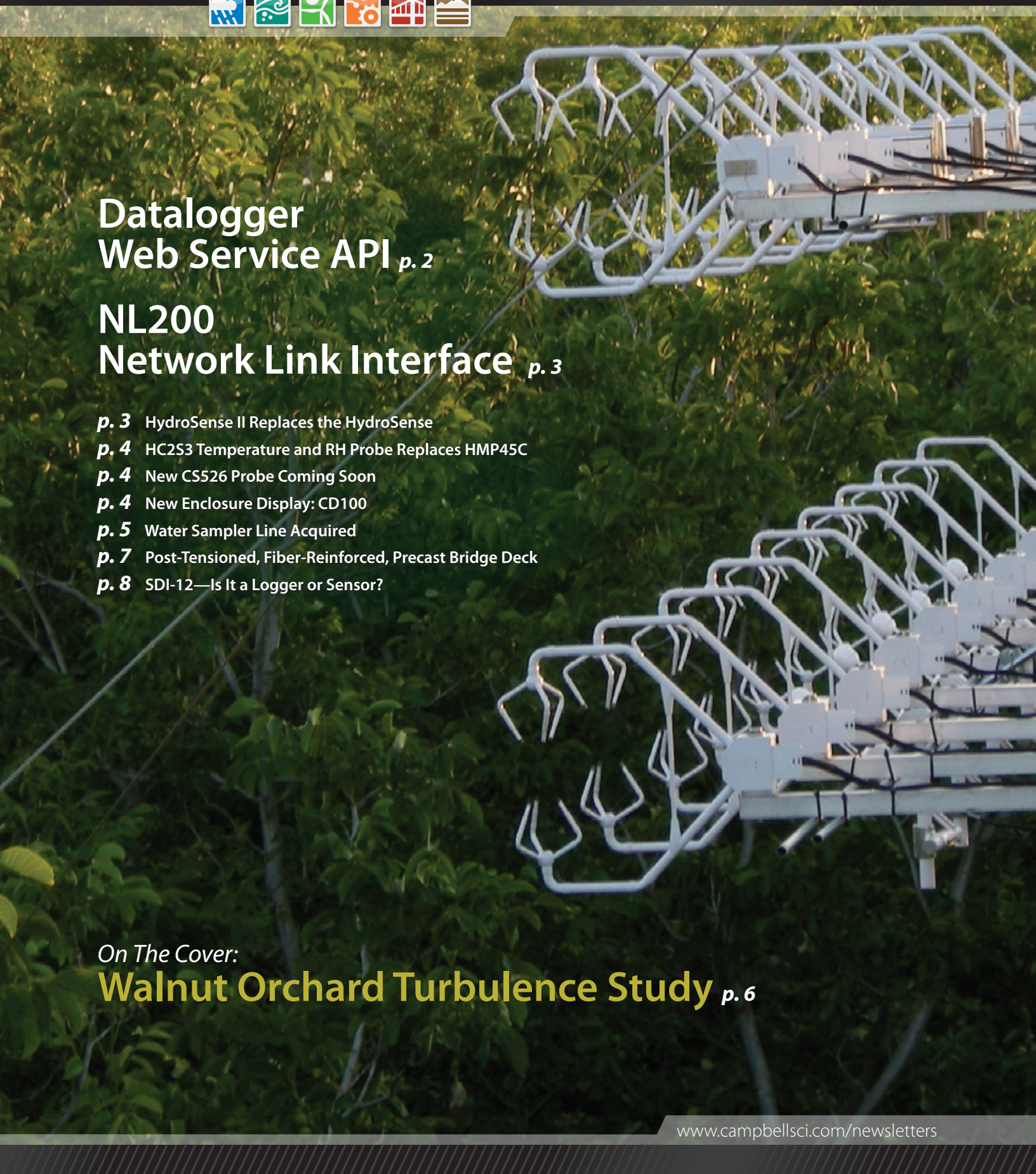
CAMPBELL® SCIENTIFIC
WHEN MEASUREMENTS MATTER

UPDATE

Fourth Quarter 2011



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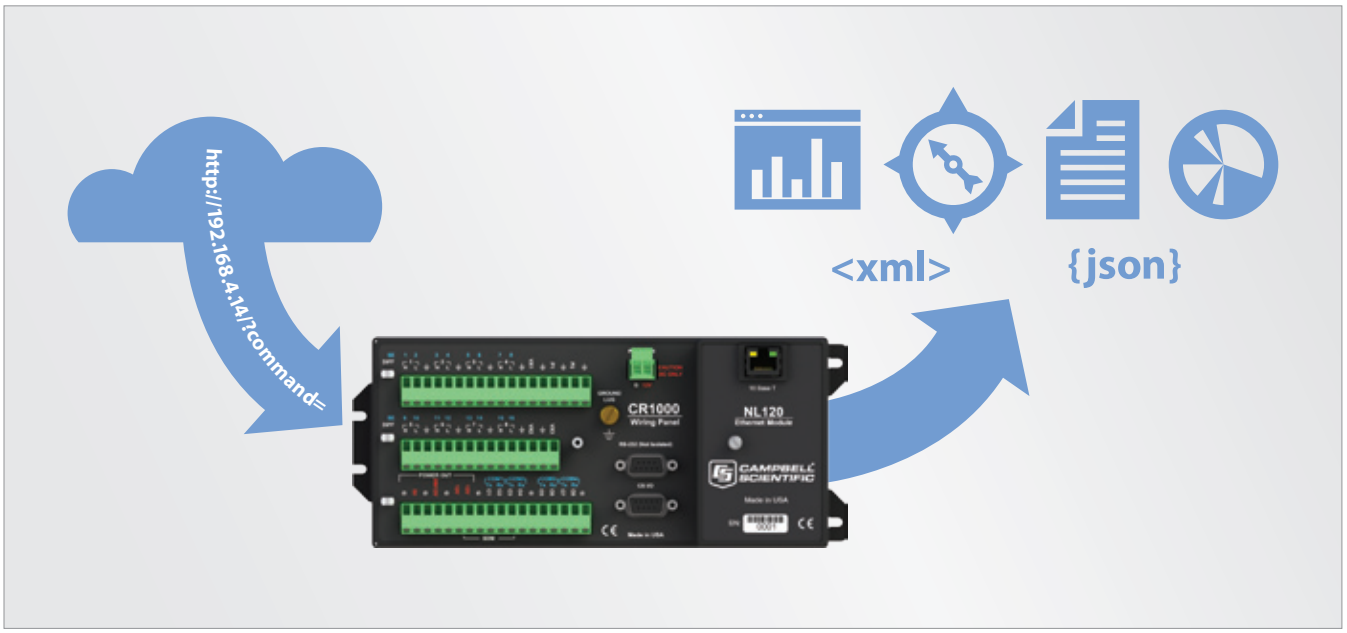
Datalogger Web Service API



New Product

An application programming interface (or API) is a set of instructions and protocols for accessing functionality in software. Since the release of their operating systems in mid-2010*, our CR1000, CR3000, and CR800 dataloggers have supported the use of a web-based API. This API enables experienced computer programmers to create custom web applications for datalogger management, control, and data display.

Secure

The datalogger web API employs basic access authentication to provide a measure of secure access to a datalogger on the web. There are four levels of access: all access denied, all access allowed, read-only, and control. Different commands in the web API require different levels of access. User access is assigned using a file named .csipasswd that resides on the datalogger's CPU. Depending upon the settings in the .csipasswd file, a user can be challenged with a user name and password request when accessing the datalogger or initiating control.

Full Command Set

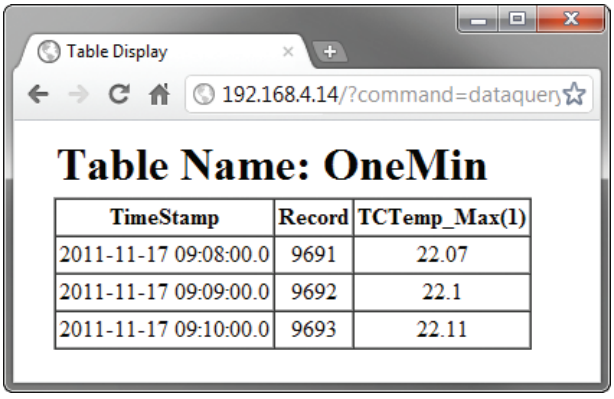
The available commands in the web API allow the programmer to create a full-featured, web-based application. The ***Browse Symbols*** and ***DataQuery*** commands allow a web client to query a datalogger for its table information and request data. ***SetValueEx*** is used to set a value in the datalogger, thus enabling control.

There are also commands to check and set the datalogger's clock and query and manage files on the datalogger's file system. Results of the commands are returned in HTML, JSON, or XML.

The Web API for the Rest of Us

So, what if you're not a programmer? You may still find the web API useful for quickly viewing a data table in a browser or setting a variable in a datalogger using a browser. A command is typed into the browser's URL field, and the result is returned in the browser window. For example, to display a table with the three most recent values from a variable named ***TCTemp_Max*** in a table called ***OneMin***, the command line would be (without line breaks):

http://192.168.4.14/?command=dataquery&uri=dl:onemin.TCTemp_Max&format=html&mode=most-recent&p1=3



The command above would return this display to the browser window.

Where Can I Learn More?

Documentation on the web API can be found in the CRBasic help files. To use the web API, the datalogger must be connected to the Internet (e.g., using an NL115, NL120, NL200, or cellular IP).

The web API opens up exciting possibilities for our dataloggers:

- Rich, custom web displays can be created by programmers.
- Datalogger data can be integrated "mashup" style with other data on the web.
- The datalogger can be used as a direct HTTP data source for other applications.

Campbell Scientific is busy leveraging the capabilities provided by the web API into its other applications. Look for new features in RTMC Pro and our PC-based web server to be announced soon!

** CR1000 OS 20, CR3000 OS 13, and CR800 OS11*

NL200 Network Link Interface

New Product

The NL200, a new, powerful, network link interface, is a wired Ethernet network connection for dataloggers and peripherals. It is the successor to the NL100, with many significant improvements, including:

- Lower current drain
- Ethernet-to-CS I/O bridging
- PakBus® routing capabilities
- DHCP support
- Wider operating-temperature range
- Faster Ethernet rates
- Smaller size
- Lower cost

With an extremely low active-current drain of 50 mA, the NL200 is one of the lowest power serial servers on the market today.

The NL200's Ethernet-to-CS I/O bridging provides direct access to the internal TCP/IP stack in our CR800, CR850, CR1000, and CR3000 dataloggers. This capability enables an NL200 used with a CR800 or CR850 to have the same functionality as an NL120 used with a CR1000 or CR3000.

Like the NL100, the NL200 allows our dataloggers, as well as other serial devices, to communicate over a local-area network or a dedicated Internet connection. Additionally, the NL200 supports sophisticated networking capabilities, especially when used in PakBus networks with PakBus devices. For example, with the NL200, multiple PakBus clients can be connected to a single datalogger at the same time. PakBus routing can also be used to maintain an Ethernet connection with up to four PakBus servers.

By providing both simple Ethernet communications and complex networking capabilities, the NL200 is a powerful device that can serve a wide range of applications to meet your networking needs.

Learn More Here
campbellsci.com/nl200

HydroSense II Replaces the HydroSense

New Product

The HydroSense II is a portable, handheld device for easily obtaining soil measurements. It is the next generation of the HydroSense soil-water measurement system. Improvements over its predecessor include a more rugged probe design, additional navigation buttons for the display, expanded memory, an internal GPS receiver, Bluetooth communications, and more powerful PC software.

The new, rugged probe design allows insertion into harder soils. Design features include rods attached to the housing using ferrule nuts, and a molded plastic grip that securely fastens the probe's cable to its housing.

The new handheld display has a button layout that enables one-hand operation. Its three-inch LCD and four navigation buttons simplify the process of changing settings and taking measurements. More than 1,000 measurements can be stored in its internal memory. The integrated GPS receiver allows each measurement to be tagged with its latitude and longitude.

The measurements can then be grouped into zones and each zone's average soil moisture calculated.

The handheld display's data are transmitted to a PC wirelessly via Bluetooth. PC software designed specifically for the HydroSense II allows the user to:

- Show data in a table or chart
- Edit zone positions and sizes
- Change device settings
- View zones and measurements in Google Earth

Learn More Here
campbellsci.com/hs2

HC2S3 Temperature and RH Probe Replaces HMP45C

New Product

For many years, Campbell Scientific has offered the HMP45C as our higher-accuracy temperature and relative-humidity probe. With the retirement of the HMP45C (due to part obsolescence), our goal was to find an appropriate replacement that would minimize the difficulties that can surface when replacing one sensor with another—a replacement in fit, form, and function.

Our search led us to the HC2S3, manufactured by Rotronic Instrument Corp. The HC2S3 offers comparable accuracy to the HMP45C at a reduced price. The HC2S3 also has similar wiring and programming, and is housed in the same 41003-5 10-plate radiation shield (requires included hex plug) as the HMP45C.

The HC2S3 uses Rotronic's IN1 capacitive sensor to measure relative humidity and a 100 ohm PRT to measure temperature. It includes a polyethylene filter that protects the capacitive sensor from fine dust and particles and minimizes water absorption and retention. Alternatively, a Teflon filter is available for marine environments.

Although the HMP45C is no longer available, we will still recalibrate existing probes through our standard RMA procedure.

Learn More Here
campbellsci.com/hc2s3

New Enclosure Display: CD100

New Product

Now you can enter and view data without opening the enclosure. The new CD100 is an integrated keypad with display that mounts in an enclosure lid and provides the same operation and functionality as the CR1000KD. It allows you to check the datalogger's status, to view or plot sensor readings and stored values, and to enter numeric data or change ports. Security can be set in the datalogger to prevent unauthorized personnel from accessing the data.

The design of the CD100's 16-character keypad permits operation with a gloved hand. Its vacuum fluorescent display is responsive through a wide operating-temperature range, and can show 8 lines by 21 characters (64 by 128 pixels). The CD100 is both water- and dust-protected, providing an IP66 rating when installed in the enclosure lid.

Learn More Here
campbellsci.com/cd100

New CS526 Probe Coming Soon

New Product

The CS526 pH probe uses new pH-sensing technology that has significant advantages over traditional glass-bulb pH probes.

One advantage is that the CS526 provides better measurements in extreme pH conditions. For example, it can monitor pH in liquids containing high solids, aggressive chemicals, or biological materials that would clog or contaminate the junction of glass-bulb probes.

Eliminating the glass bulb in the probe's design results in other advantages. These include longer field use between maintenance, easier cleaning, dry storage, and a more rugged probe (no glass to break).

These advantages are a result of incorporating Sentron's high-tech, ion-sensitive field-effect transistor (ISFET) semiconductor as the probe's pH-sensing element.

Designed with serial RS-232 output, the CS526 improves upon its analog predecessor, the CS525, by preventing ground looping and galvanic interference.

Water Sampler Line Acquired

Company News

We are pleased to announce that Campbell Scientific has acquired the Sirco line of water samplers from Southwell Corporation in Canada. Sirco samplers have a 30-year history of successful operation in stormwater, wastewater, and other water-quality applications. As stand-alone water samplers, these products already meet a variety of sampling needs. As we integrate them with our existing data acquisition, telemetry, and sensor products, we will provide even more solutions for monitoring and control applications.

Our search for a high-quality water sampler began a couple of years ago and it didn't take long to find Sirco samplers. After distributing them for a while, we decided to make them a permanent addition to our product line as Campbell Scientific water samplers. The acquisition was finalized earlier this year, and we have successfully transferred the entire manufacturing operation to our headquarters in Logan, Utah. We have been manufacturing samplers since late summer.

CAMPBELL SCIENTIFIC UPDATE

Executive Editor	Neal Israelsen
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Assistant Editors	Linda Worlton Patrick Burt Anthony Bodily Brian Clark
Contributors	Dana Worley

The future is bright for these samplers. They are already capable of being programmed on their keypad for time-based, pulse-induced, 4 to 20 mA-input, and flow-based samples. We plan to extend their usefulness even more by integrating them with rain gages, turbidity probes, pressure transducers, and telemetry devices—on top of the power, logic, and communications protocols (e.g., Modbus, DNP3, TCP/IP) provided by our dataloggers.

One of the biggest advantages of these samplers is that they use external vacuum pumps to draw water through intake tubing, instead of the traditional peristaltic pumps that induce flow by squeezing flexible tubing. Advantages of the vacuum-pump method include faster sampling rates, better vertical lifts, longer sampling distances, more-precise volume control between samples, and less maintenance. Because the vacuum method disturbs water samples less, they better represent the original water solution, especially if the solution has high concentrations of suspended solids. To prevent cross contamination, the samplers use air pressure (up to 28 psi) to purge the tubing of excess water.

The new product line includes many different options for both portable and stationary samplers. The PVS4150, PVS4120, and PVS4100 are portable, battery-operated water samplers. Designed for easy transport, the PVS4150 includes wheels, a telescoping handle, and a rugged case. The PVS4120 is the lightest sampler, weighing only 27 lb. The PVS4100 has a bigger pump that supports the fastest sampling rates, highest vertical lifts, and longest sampling distances. It also can use wider tubing (5/8-in. ID), which is better for handling large solids. All the portable models include space for ice to keep samples cool.

The CVS4200 and BVS4300 are stationary, ac-powered water samplers for wastewater applications. They use the same big pump as the PVS4100 and support all of its capabilities. The CVS4200 is an indoor sampler that has a corrosion-resistant steel enclosure. The BVS4300 is an outdoor sampler designed to handle extreme environments. It has a corrosion-resistant steel enclosure with a locking door and bolted-down instrument panel. All of the stationary samplers have a refrigerator option to keep the samples at the EPA-recommended temperature of 4° C. They can also be equipped with insulation, circulating fans, and heaters as needed.

Both composite and discrete options are available in both portable and stationary models. Composite samplers take samples, then deliver them into the same container each time. Discrete samplers collect samples and deliver them to different containers, from 500 ml to 1000 ml.

We are excited about the possibilities these samplers bring to water-quality applications. Don't hesitate to provide us with your input as we carry this great product line into the future.

Learn More Here
campbellsci.com/water-samplers

Walnut Orchard Turbulence Study

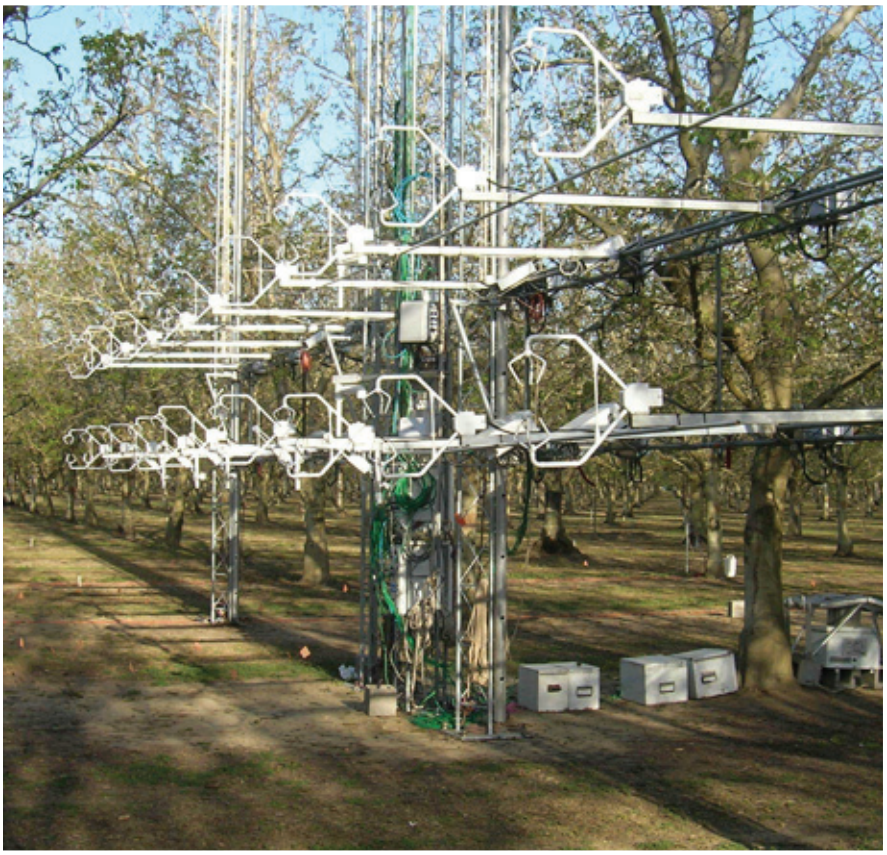
Case Study

Understanding the exchanges of energy, water, and carbon dioxide between the atmosphere, land, and plants provides a basis for understanding elements of weather, climate, and agriculture. Studying the turbulence, or eddies, in and around the canopy of trees is helpful in piecing together this understanding.

A group of researchers from several universities and government agencies undertook a canopy-turbulence study that generated huge amounts of data, giving them plenty to study in their various disciplines and contributing greatly to the knowledge base in this area.

This study, carried out by the Earth Observing Laboratory (EOL) of the National Center for Atmospheric Research (NCAR), is one of a series of horizontal array turbulence studies (HATS). The array consists of 18 Campbell Scientific CSAT3 3-D Sonic Anemometers, Campbell KH2O Krypton Hygrometers, carbon-dioxide sensors, and various other environmental sensors, all mounted at precise intervals on a horizontal frame. The CSAT3 provides precision, three-dimensional turbulence measurements, with a body and frame designed for minimal flow distortion.

This array has been used for turbulence studies on the ocean (OHATS) and in cotton fields (AHATS), and for this study in a walnut orchard (CHATS). The principal goal of the HATS studies is to investigate the interaction between small-scale and large-scale eddies in order to test and improve the sub-filter-scale closure models used in large-eddy simulation of turbulent flows. In addition to the horizontal array, for the CHATS project the researchers included a vertical array on a 30 m tower, using 13



CSAT3 anemometers, 6 KH2O hygrometers, and many other sensors.

In the walnut orchard, the arrays were first used to gather turbulence data with no leaves on the trees, then during leaf-out, and finally when the canopy was fully developed. The arrays also measured water vapor, carbon dioxide, air temperature and humidity, solar radiation, leaf temperature, and turbulent pressure fluctuations. Sometimes more than one type of sensor was used to measure the same thing, providing comparative data for researchers. Also, the horizontal array could be raised and lowered to take measurements within and above the canopy.

These arrays of sensors, in such a variety of locations and with so much measurement time, have provided a very large data set that can be used to confirm and enhance numerical tools and models linking turbulence and various elements of weather, climate, and plant growth.

Learn More Here
campbellsci.com/chats-csat3

Post-Tensioned, Fiber-Reinforced, Precast Bridge Deck

Case Study

The Utah Department of Transportation is investigating the benefits of using rods made of glass-fiber-reinforced polymer (GFRP) in bridge decks. The GFRP rods resist corrosion caused by deicing salts, and as a result may extend the lifespan of the deck from 45 to 100 years. Corrosion resistance is the biggest factor in reducing the long-term cost of bridge decks.

UDOT chose the Beaver Creek Bridge as a subject of this investigation for two reasons: (1) it was constructed using precast concrete deck panels reinforced with GFRP rods, and (2) accelerated bridge construction techniques with prestressed concrete girders were used, and the DOT also wanted to test that method. The University of Utah (U of U) instrumented the bridge during construction and performed tests to determine if the new methods and GFRP construction materials provided the required performance.

Testing began in the construction phase and continued after construction was complete. Foil strain gages were installed on the GFRP rods of two of the deck panels before they were cast, and dataloggers recorded strain data each time the panels were lifted. When the panels were in place on the bridge, vibrating-wire strain gages (VWSGs) were installed to record:

- Strains induced by post-tensioning
- Strains during the truck-load test
- Change in strain caused by creep and other long-term factors

U of U researchers used accelerometers attached to the bottoms of some of the girders to:

- Record peak accelerations during truck load tests
- Record acceleration signatures during long-term monitoring
- Trigger a camera

Photo by Dr. Chris P. Pantelides, Civil & Environmental Engin, Univ of Utah

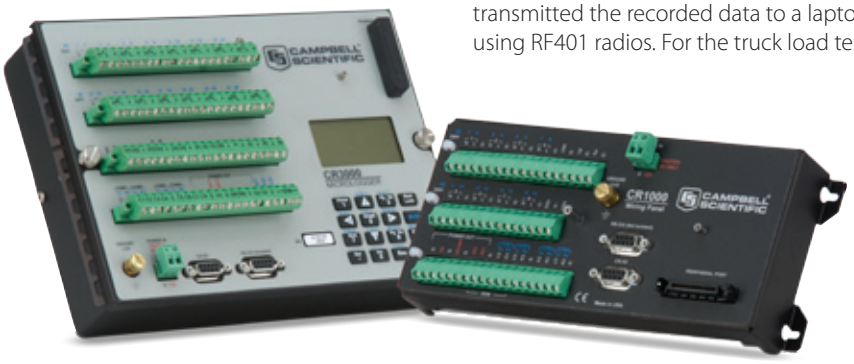
The camera recorded images of the vehicles that caused the greatest acceleration measurements.

The researchers installed linear-variable-differential transducers (LVDTs) above the diaphragms between the girders to measure deflection of the deck. During the load tests, they also used surveying equipment to measure deflection of the girders.

The project used two CR3000 Microloggers®, one CR1000 datalogger, one AVW200 vibrating-wire interface (to manage signals from the VWSGs), three AM16/32A multiplexers, and one CC640 digital camera. During lifting and transportation of the deck panels, the dataloggers transmitted the recorded data to a laptop using RF401 radios. For the truck load tests, the dataloggers were connected directly to the laptop. For the long-term monitoring portion of the project, a cell modem connected the dataloggers to the Internet, allowing data to be retrieved from any place with Internet access.

Collected data includes concrete strains in the deck panels, relative displacements of the panels with respect to the girders, and vertical accelerations. Using the curvature, displacement, and acceleration parameters, conclusions were made regarding the response of the deck and the girders by comparing test results to design requirements, as well as to finite element analyses from computer-generated models.

Computer-generated models of the bridge showed the flexural response of the deck panels, the dynamic response relative to the location of vehicles, and the static relative displacements at mid span. The research showed that, after two years in service, the performance of the bridge, including the precast deck, is well within the design requirements, validating GFRP rods as a viable choice for bridge construction.



Learn More Here
campbellsci.com/gfrp-bridge

SDI-12—Is It a Logger or Sensor?

Tips and Tricks

It's both! All of our customers know that Campbell Scientific dataloggers can be SDI-12 recorders, that is, they can record data from SDI-12 sensors. But did you know they can act like SDI-12 sensors, too?

This little trick makes it super easy to share data with another logger or SDI-12-enabled transmitter. Take all of your analog and digital measurements with a CR200X, CR800, CR1000, or CR3000 and share the results using SDI-12. You'll need two special instructions in your program, ***SDI12SensorSetup*** and ***SDI12SensorResponse***. We put them in a SlowSequence Do/Loop so the data are available as soon as the other SDI-12 device asks for it.

This program takes three measurements every five seconds: (1) the datalogger's battery voltage, (2) a tipping-bucket rain gage, and (3) an SDI-12 pressure transducer. When an external SDI-12 recorder queries this logger on SDI-12 address 0, it provides all three measurements.

```
PreserveVariables
Public SDI12(3)
Alias SDI12(1) = BattV
Alias SDI12(2) = Rain
Alias SDI12(3) = Level
BeginProg
  Scan (5,Sec,3,0)
    'measure battery
    Battery (BattV)
    'measure accumulated rain
    PulseCount (Rain,1,1 ,2,0,1.0,Rain)
    'measure current water level
     SDI12Recorder (Level,1,0,"M!",1.0,0)
  NextScan
  SlowSequence
  Do
    'Return 3 vals on C7 with addr 0 in 1 sec
     SDI12SensorSetup (3,7,0,1)
    'give measurements to SDI-12 recorder
     SDI12SensorResponse (SDI12())
    'reset rainfall accumulator
    Rain = 0
  Loop
  EndSequence
EndProg
```

So, not only can your Campbell Scientific datalogger read and record SDI-12 sensors, it can behave like one, too. When you need to add measurement-and-control capability to an existing DCP, your Campbell datalogger can do the job—again.

Sensing your enthusiasm at 1200 baud,

Tip

Upcoming Trade Shows

Visit our website for training class schedules and additional listings.

JANUARY

22-26	AMS Annual Meeting	New Orleans, LA
22-26	TRB 2012	Washington, DC
24-26	Distributech 2012	San Antonio, TX
25-26	Wine & Grape Symposium	Sacramento, CA

FEBRUARY

27-02	RWAU 2012	St George, UT
29-01	Golf Industry Show	Las Vegas, NV

MARCH

25-28	GEO Congress 2012	Oakland, CA

APRIL

18-22	RMATA	Mesa, AZ

MAY

15-17	ASES 2012	Denver, CO
20-24	EWRI Congress	Albuquerque, NM

JUNE

03-06	Windpower 2012	Atlanta, GA
10-13	IBC 2012	Pittsburgh, PA
19-22	Air & Waste Management	San Antonio, TX

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