

CAMPBELLUPDATE

January, 2003

www.campbellsci.com

Volume 14, Issue 1

Sentek soil probes now available

Water content profiles a natural for Campbell systems

Campbell Scientific recently entered a distribution agreement with Sentek Pty, Ltd. of Stepney, South Australia. Sentek's water content profile probes are commonly used in irrigation scheduling and water movement systems. They can be easily integrated into Campbell Scientific data acquisition systems.

Continuous monitoring of soil water content profile produces data to help quantify 1) the onset of crop stress due to over- or under-watering, 2) depth of root zone, and 3) movement of water beyond the root zone. By identifying points of over- and under-watering, the range of optimal water content can be determined, and irrigation frequency can be scheduled to keep water content at optimum. Determining depth of root zone enables scheduling irrigation duration so water moves throughout, but not beyond, the root zone. Measuring water content beyond the root zone helps determine whether nutrients are being leached into ground water.

Most applications of water content profile monitoring require relative data, which is the default mode of Sentek probes. Relative data are produced by an instrument calibrated for a range of soil types. This calibration is used as a default calibration on all soil types. Data cannot be considered as absolute, but reflect soil water changes



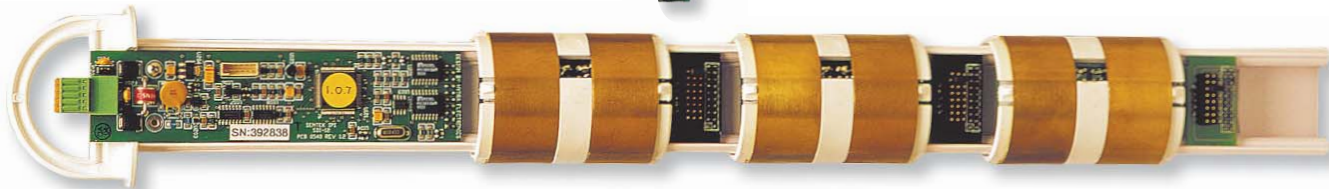
used as key decision-making criteria in irrigation scheduling. However, the probes can be calibrated to output absolute data.

Specialized tools and techniques allow installation of Sentek probes to minimize soil disturbance. Probe electronics are easily serviced and can be removed during field operations that threaten to damage the probes.

Two Sentek probes are available from Campbell Scientific's US office. EasyAG[®] is used in cultivated soils of good tilth, commonly found in vegetable production areas. It measures water content at 10 cm, 20 cm, 30 cm, and 50 cm. For installation, we offer a lightweight, inexpensive installation kit for soil textures ranging from light sand to heavy clay. EasyAG[®] is unsuitable for stony soils where the average stone size is greater than 10 mm.

Sentek's EnviroSMART[™] is recommended for higher accuracy research measurements, measurements deeper than 50 cm, and stony soils (i.e., water use in deep rooted, perennial crops). The Sentek probes can be measured by any of our dataloggers, either through the SDI-12 interface or voltage output.

Sentek's EasyAG probe, left, is ideal for measuring soil water content profiles in agricultural soils. Sentek's EnviroSMART, below, is designed for deeper measurements and stony soils.



New training course enhances LoggerNet's utility

Campbell Scientific now offers a three-day training course on the CR10X Datalogger and LoggerNet 2.1 software. The training focuses on the CR10X, but is suitable for CR23X and CR510 users. This is a comprehensive, introductory level course with an emphasis on pro-

gramming. "Hands-on" programming exercises and course handouts reinforce concepts covered by the instructors.

The training course is taught by two members of our technical support staff. Class size is limited to 10 students to ensure personalized instruction and assis-

tance. A registration form is available from: <ftp://ftp.campbellsci.com/pub/outgoing/info/train-ln.pdf>

PC208W training is no longer available. PC208W users are encouraged to consider LoggerNet training as most of the concepts are applicable to PC208W.

Message from the President

On systems: arrays, mixed arrays, and tables

By Paul Campbell

Although I have not yet reached the half century mark, I feel plenty aged thinking back on changes that have occurred in dataloggers and computers since Campbell Scientific was founded in 1974.

Our first datalogger (see www.campbellsci.com/time-line.pdf for a "walk down datalogger memory lane") printed two vertical

columns on 2.25 inch wide fan-fold paper. Each measurement scan resulted in a record of day, hour, minute, and the measurement value(s). We added the capability to record on cassette tape which could be played back directly into a computer, eliminating the requirement to hand enter



values through a keypunch.

As dataloggers became more sophisticated with the use of microprocessors and expanded memory, we introduced multiple output intervals so that rapidly changing phenomena like wind could be recorded more often, but something like battery voltage could be logged once a day. We also introduced on-site processing which allowed independent intervals between the scanning of sensors and the output of records. Data from different output intervals were organized contiguously in final storage as mixed arrays to use precious memory as efficiently as possible. Data retrieval was simplified through advances in telecommunications, computers, and the related software. Once mixed arrays were transferred to a computer file, they could be separated or split into their individual arrays as a first step in analysis and subsequent reporting or ingestion into a larger data base.

The mixed array final storage format continues to be a popular approach because of its simplicity and the legacy of

computer programs established for processing mixed array output. However, as the desire to readily access real-time data increased, we began to consider other data storage structures.

About 1990, we introduced the first datalogger with measured values organized in a table format. A separate output table corresponded to each output interval, and a default, Public, table corresponded to the "input locations" of the mixed array datalogger. Other tables like Status and ErrorLog allowed for easy access of other operational information. Currently, our CR9000, CR5000, and CR200-series dataloggers have memory organized in data tables, and the CR10X, CR23X, and CR510 have optional operating systems offering "table data" formatted memory.

The advantages of data storage tables are:

- Intuitive organization of datalogger memory

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Campbell Scientific Canada

Celebrating 25 years as the senior affiliate

Celebrating its 25th Anniversary this year, Campbell Scientific Canada (CSC) originally began as a one-man operation in 1978. Claude Labine, President of CSC, was doing forest meteorology research in northern Alberta where he used the third CR5 built by Campbell Scientific, Inc. (CSI). He was very impressed with the equipment considering the difficulties he had met with some of the other recorders of the time. Remember that this was at a time when DC-operated systems were few in number and fewer still worked under Canadian field conditions. He had visited CSI in the fall of 1976 just to meet the people developing this wonderful equipment. Claude approached CSI to sell the equipment in Canada.

In 1978, he started out on a cross-Canada tour to introduce the equipment to various potential users. The success of this introduction of CSI products warranted the start up of CSC, the first of five worldwide affiliates dedicated to providing and supporting reliable measurement



Located in Edmonton, Campbell Scientific Canada is a leader in environmental monitoring.

systems. Twenty-five years later, with a staff of 28, CSC is a going concern and has been working with a majority of the key players in environmental monitoring in Canada.

Brian Day, CSC's General Manager, says that "one of the key elements to success, apart from the quality of the equipment, has been the commitment to customer support." Shortly after Claude started the company, he became involved in an arctic meteorology project in the Canadian High Arctic. This provided extreme cold conditions that were perfect field conditions to challenge the

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The CAMPBELLUPDATE

A newsletter for the customers of Campbell Scientific, Inc.

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Printed January, 2003

The CR205: a low-cost, wireless sensor interface

The CR205 is a low-cost, wireless sensor interface (in addition to its datalogger functionality, see last newsletter). Wireless sensor networks are appealing because they are often more economical than trenching, laying conduit, and pulling wire. In some applications, cabled sensors are impractical due to man-made or natural causes, including construction, lightning, moving platforms, agricultural production, or bodies of water. Furthermore, problems in buried or submerged sensor leads are often difficult to diagnose and expensive to repair. In contrast, wireless sensor system components are generally accessible and easy to swap out if problems occur.

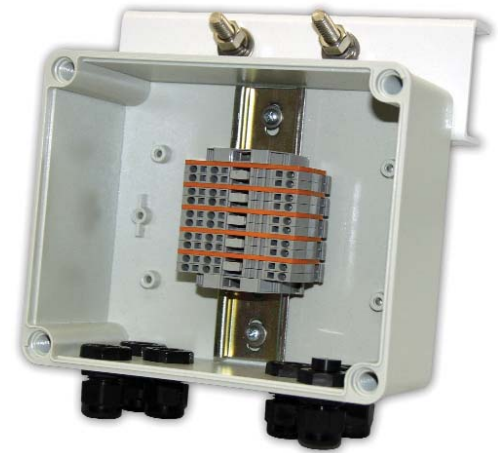
The CR200-series interfaces to a variety of sensors. Our standard precipitation, barometric pressure, air temperature and relative humidity, wind speed and direction (excluding CSAT3), 4-20 mA sensors, and SDI-12 sensors are compatible with the CR200-series. Temperature measurements require the 109 probe, and soil volumetric water

content measurements require the CS625 probe. The CR200-series provides five single-ended analog channels for sensor measurement; differential measurements cannot be made. For a list of compatible sensors and available channels, please refer to our product literature.

The CR205 and its on-board radio work in tandem with a base datalogger and its RF400 spread spectrum radio. The base datalogger and the CR205 communicate using PakBus protocol, which is a simplified variation of Internet protocols. The PakBus operating system for the base dataloggers (CR510, CR10X, and CR23X) can be downloaded from our web site.

The CR205s are programmed using the CRBasic editor included in LoggerNet 2.1. Base dataloggers are programmed using Edlog version 2.1 or greater, also included in LoggerNet 2.1.

For a fee, the base datalogger and CR205s can be pre-programmed at the factory to simplify installation.



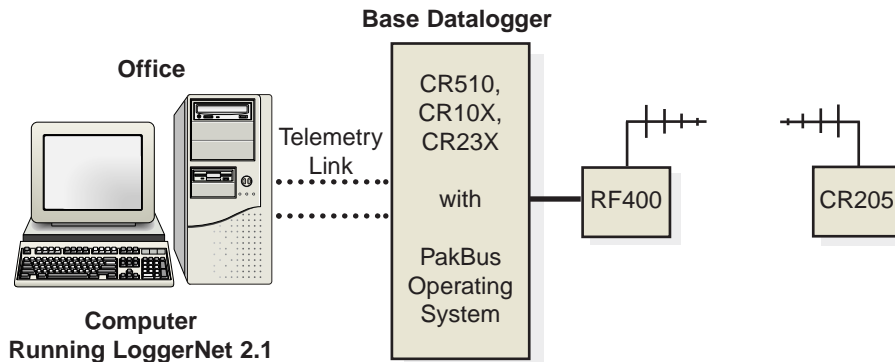
The HUB-SDM5 consists of an environmental enclosure, six compression bulkhead fittings, and five terminal strips.

Connect five SDMs to a datalogger with the HUB-SDM5

The HUB-SDM5 is used to connect up to five Synchronous Device for Measurement (SDM) sensors/peripherals to a single Campbell Scientific datalogger. The HUB-SDM5 consists of an environmental enclosure with six compression bulkhead fittings for cable entry/exit and five terminal strips, one for each SDM signal line.

The spring-loaded guillotine terminals mounted on a DIN-rail provide connection points for individual wires. The terminals are grouped in five sets of six terminals. Each terminal set allows connection of five incoming wires and one common outgoing wire. The outgoing wires may be connected to another HUB-SDM5 (a maximum of 15 SDM devices per datalogger) or directly to the datalogger.

The HUB-SDM5 is used to minimize cable runs between the datalogger and SDM sensors (CSAT3 Sonic Anemometer or CS7500 Open Path CO₂/H₂O Analyzer). It also simplifies connecting SDM sensors/devices that are separated from the datalogger.



Supported "Telemetry Links" include SC32B, RF400, COM200, COM210, COM310, SRM-5A, NL100, and some phone-to-RF combinations. Consult the factory for more details.

Canada

Continued from Page 2

equipment. It also gave CSC the opportunity to maintain an active field monitoring program. Claude continues, "Our work in the field continues to this day and the fact that we are users of the equipment certainly keeps us well aware of what our

customers are experiencing."

CSC has had a long-term working relationship with the Meteorological Services of Canada (MSC), Environment Canada's weather and climate group. MSC approached Campbell Scientific Canada to continue development of a snow depth sensor that MSC had brought to a prototype stage. Since this unit was AC-powered and housed in a common plastic

enclosure, there was much more development work required to bring it to market. Today, the SR50 is used worldwide and is distributed via the other Campbell Scientific affiliates. This start in manufacturing has led to a recent establishment of an engineering department mandated to develop other sensors and devices to meet some of the unresolved challenges in environmental monitoring.

New modules expand CR9000 capabilities

We have developed new modules to expand the capabilities of the CR9000 Measurement and Control system. The modules, which include a corresponding Easy Connector, are the CR9071E Timer/Pulse Input Module and the CR9051E Fault Protected Module.

The CR9071E Timer/Pulse Input Module replaces the CR9070. It retains the CR9070's capabilities, plus adds functionality requested by customers. The

CR9071E has 16 digital I/O channels and 12 pulse counting channels that can measure frequencies up to 1 MHz. All 28 channels can be used for interval timing.

New features include improved over-voltage protection, better channel-to-channel crosstalk isolation, interval (edge) timing with 40 nanosecond resolution, and a Wait Digital Trigger function.

The CR9051E, available first quarter of 2003, is a fault-protected version of the

CR9050E. It has 14 differential or 28 single-ended channels. Each channel is fault protected to +50 V/-40 V, ensuring that an overrange voltage on one channel will not corrupt measurements on the others.

All CR9051E channels become open circuits when the logger is powered down, so sensors are not loaded. The full scale voltage ranges are ± 5000 mV, ± 1000 mV, ± 200 mV, and ± 50 mV. Resolution is to $1.6 \mu\text{V}$ on the most sensitive range.

Distribute data to remote PCs with new LoggerNetData 2.1

LoggerNetData 2.1 lets you distribute the data collected by LoggerNet to one or more remote PCs. LoggerNetData includes four clients:

- **RTMC** (Real Time Monitoring and Control) graphs and displays data and sets values in remote dataloggers
- **BaleMaker** creates data files on the remote PC
- **View** displays and graphs data files
- **Split** processes data files and generates reports, including html

The clients can connect to the LoggerNet Server via any TCP/IP link (e.g., the Internet).

Customers are familiar with RTMC (which began shipping with LoggerNet 2.0), View, and Split.

BaleMaker is a new software tool that produces data files in either ASCII or binary format, with the option to produce those files in "bales" of equal time spans. BaleMaker's files can be stamped with file names that include the baling date and time, the datalogger name, and the datalogger array or table.

LoggerNetData is about half the price of LoggerNet, but does not include the LoggerNet Server. You must have LoggerNet 2.1 running on a computer to feed the RTMC and BaleMaker clients. The number of LoggerNetData clients that can attach to a single LoggerNet Server is determined by the capabilities of the machine running the host LoggerNet Server and the network over which it is accessed. LoggerNetData 2.1 is expected to ship in the first quarter of 2003.

PC-SDK: a powerful programming tool

PC-SDK Software Development Kit for LoggerNet offers a flexible and powerful programming tool to easily create innovative applications that communicate with our dataloggers. Applications developed using the SDK require a LoggerNet license for use. PC-SDK features three ActiveX® controls that dovetail into an integrated development environment such as Microsoft's Visual Basic® or Borland's Delphi®.

PC-SDK's controls encapsulate some of the fundamental tasks users want to perform with our dataloggers. The "CsiBrokerMap" control browses

the current datalogger network to display station and data table information. The "CsiDataLogger" control checks and sets the datalogger's clock, sends and receives datalogger programs, collects data from the datalogger, toggles ports and flags, and sets input location variables. You can use the "CsiDataSource" control to retrieve the logger's historical or real-time data from the LoggerNet server's cache. PC-SDK includes a Beginner's Guide, a Programmer's Reference, and examples of how to build applications with each ActiveX control using both Visual Basic and Delphi.



The Redwing has a data transmission rate of up to 19.2 Kbps via TCP/IP and a typical current drain of 50 mA.

Redwing CDPD modem replaces the Raven II

The Redwing CDPD modem/transceiver, manufactured by AirLink, has replaced the Raven II as our cellular digital modem. Like the Raven II, the Redwing is a full-duplex, 600 mW modem that supports telecommunications via a cellular digital packet data (CDPD) network.

The Redwing has a data transmission rate of up to 19.2 Kbps (datalogger dependent) via TCP/IP and a typical current drain of 50 mA while receiving and 280 mA during transmission.

All CDPD modems are IP based, requiring an Internet address assigned by your service provider. By using the Internet to access the modem, you will realize faster data throughput, eliminate long distance charges and dial-up time, and pay only for the data throughput.

Prior to purchase, contact your local cellular provider to verify that CDPD coverage is available for your datalogger site and will be available for the duration of your project.



Need more control ports or digital I/Os? Check out the SDM-IO16.

The SDM-IO16: a 16-channel input/output expansion module

Campbell Scientific Ltd, our European affiliate, has developed the SDM-IO16. The SDM-IO16 provides 16 digital I/O ports that function similarly to the control ports of our CR10X or CR23X dataloggers.

Configured as an input, the SDM-IO16 can monitor logic state, count pulses and switch closures, measure signal frequency, determine duty cycle, and send an interrupt signal to the datalogger when one or more input signals change

state. Configured as an output, the SDM-IO16 can drive normal logic level inputs and directly control low-voltage valves and relays.

Support for all SDM-IO16 functions requires Instruction 188, which is supported by LoggerNet 2.1, or PC208W 3.3, CR10X (OS 1.19), and CR23X (OS 1.16). Instruction 188 supports both input and output functions. The CR10, 21X, CR7, and CR5000 dataloggers support the output mode only.



DMM600 Duff Moisture Meter features case, sieve

The DMM600 Duff Moisture Meter now includes a rugged carrying case and a #4 sieve. The DMM600 provides real-time water content measurements of forest litter and other high-organic matter media. Typically less than one minute is required to fill the sample chamber with material, compress it, and take the reading. See www.campbellsci.com/duffmoisture.html for more information.

With more features, COM310 phone modem replaces the COM300

The COM310 is the newest member of the voice modem family, replacing the COM300 for use with array-based or table-based dataloggers. It has the same modulations, temperature, and current drain specifications as the COM300. The COM310 features an on-board speaker to aid troubleshooting in the field.

The COM310 can be installed in a table-based datalogger network, using the new Concurrent Synchronous Device Communication (CSDC) protocol. The ability to use histograms in the voice string allows the customer to be more specific in the voice string, and an on-board speaker assists in the data mode communication.

The COM310 can answer the telephone, recite predefined messages that include the latest measurements, initiate voice warning call-outs, and answer and initiate data calls. The COM310 uses LoggerTalk™ software to generate the voice strings. LoggerNet, PC208W, or PC200W is used to download the voice program to the datalogger.

PConnectCE ideal for Pocket PCs, dataloggers

PConnectCE software is now available to support Pocket PC personal digital assistants (PDAs). Using PConnectCE, you can set up multiple stations (array-based dataloggers) with unique names. You can then connect to a datalogger with the connector that ships with the PConnectCE software. You will need to supply a serial autosync cable or serial desktop cradle for your PDA.

Each PDA requires its own licensed copy of PConnectCE.

Once connected, you can check and set the clock, send and retrieve datalogger programs, monitor measurements, and collect and view data.

When you synchronize your Pocket PC device with your computer, the data from the remote stations is transferred to the computer, and datalogger programs are exchanged automatically.



2003 price lists now available

Our US and International price lists for 2003 are available, effective 1 January 2003. You can receive our price lists via email, fax, or by contacting one of our applications engineers.



While most US prices did not change, many products experienced price decreases due to improvements in the manufacturing process. A few prices increased, primarily due to our costs for parts. International prices experienced a 5% increase.

CS115: Where high-accuracy barometric pressure measurements meet affordability

The CS115 Barometric Pressure Sensor uses the resonant silicon technology developed by Druck to measure barometric pressure. It measures over a 600 to 1100 millibar range and outputs a variable frequency of 600 to 1100 Hz. The CS115's accuracy is ± 0.3 mb at $+20^{\circ}\text{C}$, and ± 0.5 mb between -10° to $+50^{\circ}\text{C}$. Its operating temperature range is -40° to $+60^{\circ}\text{C}$.

The frequency output from the CS115 is measured by Campbell Scientific's CR500, CR510, CR10(X), CR23X, and CR5000 dataloggers using the period averaging instruction, or by our CR7, 21X and CR9000 dataloggers using the pulse count instruction. The CS115 has an integral circuit that switches power from the datalogger to the barometer only during measurement, reducing power requirements.



The CS115 measures barometric pressure over a 600 to 1100 millibar range.

Systems

Continued from Page 2

- Automatic recording of a time stamp for corresponding data records
- Elimination of post-processing to split mixed arrays
- Improved efficiency of time stamps associated with stored values in interval based tables
- Greater flexibility to allocate the maximum number of records for each kind of data
- Selective collection of a subset of stored values from memory
- Compatibility with future networking packet switched protocol (PakBus)

With the release of LoggerNet 2.0 in 2002, we are able to support either mixed array or table loggers. Customers are now able to update datalogger operating systems from our web site and enjoy the advantages of table-structured final storage. Initial releases of PConnect for Palm and Pocket PC PDAs (personal digital assistant) support mixed arrays. Future releases of these products will be available to support table dataloggers.

Campbell Scientific continues to improve and extend datalogger capabilities with innovative software to serve you better.

CAMPBELL SCIENTIFIC CALENDAR

Date	Event	Location
February		
5-7	Fish Farming Trade Show	Greenville, MS
9-13	American Meteorological Society	Long Beach, CA
13-15	Golf Course Superintendents Assoc.	Atlanta, GA
18-21	Aquaculture America 2003	Louisville, KY
25-28	Utah Rural Water Assoc. Conf. & Expo	St. George, UT
March		
3-6	SAE International Expo	Detroit, MI
April		
21-25	Western Snow Conference	Scottsdale, AZ
27-30	Info Management & Tech Conference	Santa Clara, CA
May		
5-9	SAE Noise & Vibration Conf. & Exhibit	Traverse City, MI
June		
2-5	Sensors Expo	Chicago, IL
23-25	Air & Waste Management Association	San Diego, CA
July		
25-29	Intern'l Union for Quaternary Research	Reno, NV
27-30	American Society of Ag Engineers	Las Vegas, NV

visit our web site for additional listings and training class schedules



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