

The

A newsletter for the customers of  
Campbell Scientific, Inc.

# CAMPBELLUPDATE

April, 2000

www.campbellsci.com

Volume 11, Issue 1

## The CR5000: Fast, affordable, and versatile

### CSI releases a powerful, mid-sized Measurement & Control System

The new CR5000 Measurement and Control System combines 20 differential channels with fast measurements and processing in an integrated, affordable package. In addition to the analog inputs there is a keyboard, graphics display, optically isolated RS-232 port, and PCMCIA slot. The CR5000 is available with a sealed rechargeable battery and base or with a low-profile base without batteries. Performance level and number of channels place the CR5000 nicely between our CR23X Micrologger and our CR9000 Measurement and Control System.

The second of a new generation of dataloggers started with the CR9000, the CR5000 is supported by PC9000 software. PC9000 provides tools for programming the CR5000 and collecting and viewing data. Digital and graphical real-time displays include FFT and Level crossing histograms, XY plotting, and



*The CR5000 combines ample input channels, 5 kHz throughput, and powerful measurement/control logic in a rugged, self-contained package.*

Oscilloscope. A program generator and a program editor have been added to PC9000 to support the CR5000. The CR5000 is programmed using CRBasic, a BASIC-like programming language. Data are stored in tables.

**Continued on Page 8**

### Packed with the features you want, the CR5000 offers...

- 20 differential/40 single-ended analog input channels
- 16-bit resolution
- Measurement rates up to 5000 channels/second
- Four switched voltage excitation channels
- Four switched current excitation channels
- Two continuous analog outputs
- Two 16-bit pulse counters
- Dedicated SDM communications port
- Eight digital I/O ports
- Switched 12 V output (two terminals)
- Direct measurement of thermocouples, pressure transducers, thermistors, RTDs, strain gages, frequency output, etc.
- Channel expansion with AM25T multiplexer
- Keyboard and alphanumeric/graphical display
- PCMCIA slot for additional data storage and data portability
- Nine-pin CS I/O port
- Nine-pin optically isolated RS-232 port (communication rate up to 115,200 bps)
- Battery backed, temperature compensated, real-time clock
- -25° to 50°C operating range, -40° to 85°C optional
- 9.8" x 8.3" x 4.5", 12.2 lbs

### New price lists, additional information available

Our US, International, and Systems Price Lists for the year 2000 are now available. Our new pricing became effective 1 February. Most products saw a minimal (5%) increase, representing our first across-the-board price change in nearly a decade. ☑

This symbol ☑ at the end of an article indicates that additional information is available. Please make your selections on the enclosed customer response form. The symbol ☐ indicates that specific information can be found at [www.campbellsci.com](http://www.campbellsci.com) and its subpages.

## Message from the President

# Benefits expanding with digital technology

By Paul Campbell

The fast paced advancement of digital technology is providing a variety of new options for datalogger communications, and for networking dataloggers to computers and intelligent peripherals. The benefits to those involved with data acquisition include larger data storage capacity, faster, more robust data transfer, and expanded capability through interfacing to intelligent devices.

Advances in memory density, especially non-volatile FLASH memory, has dramatically increased on-site data storage capacity. The CR10X memory options now offer more than 30 times the data storage formerly available. CR9000 memory cards are available with over 1 Gbyte of data storage. The SM16M,



referenced in this *Update*, stores up to 8 million low resolution data values (Page 7).

Campbell Scientific is working to bring the benefits of telecommunication advances to customers. Our dataloggers support data collection by GOES, Argos, INMARSAT-C, and QUALCOMM satellites. Our RF efforts include RF95-based UHF and VHF networks, spread spectrum data radios, and Meteor Communication Corp.'s (MCC) meteor burst and extended line-of-sight radios. In 1980 we built our first dc powered, 300 baud phone modem. Today cellular phones provide an additional option, and voice synthesis is available with our COM300 modem (Page 3). Data can now be retrieved over an Internet link using our new NL100 Network Link Interface (Page 3), a technology offering great future potential.

There is an increasing priority to adopt standard communication protocols for interfacing directly to digital devices from different manufacturers. For example, the Internet is built upon the "packet switched" Internet Protocol (IP). Packet

switched protocols organize data in autonomous blocks, each with its own network routing address. Common computer networks such as the Internet are based upon such protocols. Additionally, such protocols provide more robust communications across private networks such as MCC's meteor burst and extended line-of-sight radios, and QUALCOMM's satellite system.

One of the challenges faced by instrument manufacturers is supporting past products, especially ones embraced by many customers, while implementing new technology. In the case of communication peripherals, this challenge is addressed by supporting established standards. The NL100 is an example, allowing Campbell Scientific dataloggers to connect directly into an existing coaxial multidrop network or an ethernet network using IP.

Campbell Scientific is committed to providing products that respect your past investment in our dataloggers while incorporating the technological advances that are occurring more frequently now and into the future.

## Real-time weather for the public

In an effort to publicly display real-time weather measurements, we have integrated our ET-series weather station with a Trans-Lux message center.

This new system provides a wealth of displayable data. Parameters displayed on our system are maximum and minimum temperatures, wind speed, solar radiation, dew point, vapor pressure, relative humidity, evapotranspiration, and density altitude, all in appropriate units. These and other variables appear on the sign as a PC simultaneously controls the sign and routes data from the weather station to the sign every second.

In the future, this type of configuration may allow for the real-time display of time-series data from multiple dataloggers that are measuring wind speed, oil pres-



*Our weather station measures atmospheric conditions, then a Trans-lux sign displays them in near "real-time."*

sure, G forces, or essentially any variable a table-based datalogger can measure.

There has been a remarkable effort by Trans-Lux and CSI engineers to make this real-time display a reality. Now we can provide meaningful instantaneous data to the general public and scientists alike.



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## The CAMPBELLUPDATE

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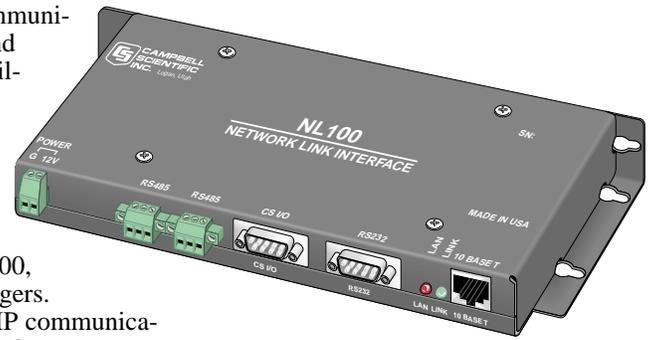
# NL100 and NL105: Dataloggers talk TCP/IP

The NL100 is a new communication peripheral that allows Campbell Scientific dataloggers to communicate via TCP/IP, making it possible to communicate via a local area network or a dedicated Internet connection. The NL100 has several ports for connecting to a datalogger, including a 9-pin CS I/O port, an RS-232 port and, on the NL105 only, a T-Link port for connecting to the CR9000(C) Measurement and Control System. The NL100, in turn, connects to the TCP/IP network via a 10baseT Ethernet port.

Campbell Scientific software is used to communicate with the NL100/105 and datalogger. The PC must have the TCP/IP protocol installed. PC208W Version 3.2 (Spring 2000) supports TCP/IP communications with our array-based dataloggers,

while PC9000 supports communications with the CR5000 and CR9000. LoggerNet is available for multi-PC networks and supports the "T" dataloggers (CR510-TD, CR10X-TD, CR23X-TD). Future versions of LoggerNet (2000) will support the CR5000, the CR9000, and the array-based dataloggers.

The advantages of TCP/IP communications are low marginal costs for connect time and faster communications rates. For example, the CR9000 can communicate at a 10 Mbit rate through an NL105; the CR5000 up to 115,200 bps through an NL100. The main disadvantage is a 130 mA current drain associated with



maintaining a continuous link. The NL100 mounts directly to our enclosure back plates. Alternatively, the NL105 occupies a slot in the CR9000(C) chassis.

Both peripherals are currently available, contact us for pricing.

## New options available for radiotelemetry

The RF310 VHF radios (148-174 MHz) and RF312 UHF radios (440-470 MHz), manufactured by Maxon, are now available. The lower cost radios support up to six channels and meet the NTIA narrowband and FCC refarming



requirements for transmission. Campbell Scientific will program the radios with the customer's FCC-assigned frequency.

The new radios require the corresponding RF310B base station and RF310M radio modem, and are not compatible with previous radiotelemetry products available from Campbell Scientific, e.g., RF300 radios, RF95(A) modems, RF232(A) base stations. If adding an existing radiotelemetry system, continue to purchase the RF300 - RF304 radios with compatible modems and base stations.

## Low orbit allows smaller antenna, power supply

# SAT ARGOS great for remote sites

This Service Argos certified PTT satellite transmitter is well suited for remote data collection. Service Argos data transceivers fly aboard two of NASA's polar orbiting satellites. Their relatively low orbital altitude of about 800 kilometers permits use of a smaller antenna and power supply. The orbit period is approximately 1 hour and 47 minutes for each satellite, providing hourly data transmission at extreme northern and southern latitudes. About six satellite passes per day occur at the Equator but they are not evenly spaced. Each data transmission includes up to 32 bytes (16 data points). Data must be decoded by the user, or by

Service Argos for a fee of approximately \$7.50 per day, per station.

The SAT ARGOS PTT supports up to four Argos ID numbers. Message repeat intervals, Argos ID numbers, and duty cycles are changed using a simple computer-based interface. The CS I/O port provides all the power and I/O connections to the transmitter using the standard SC12 ribbon cable. The transmitter draws less than 2 mA continuous average current drain. SAT ARGOS will be supported by the CR10X operating system (instruction 125), call for CR23X or CR510 Argos applications.

## Verbal reports made easy with COM300

The COM300 Voice Synthesized Modem is here—the long-awaited successor to our VS1. It enables users to call a CR10X, CR510, or CR23X via phone and receive a verbal report of real-time or historical conditions. Specific conditions can be reported, or a caller can listen to further information by keying an Input Location number on a touch-tone phone. The COM300 also supports call back, enabling the station to call out on a regularly scheduled basis or during an event.

The COM300 is equipped with a vocabulary of over 400 words—doubling the VS1's capability. Standard data acquisition terms are included, but a custom vocabulary can be created; contact us for details.



The COM300 also acts as a standard data modem by connecting directly to a standard switched telephone network or to our cellphone package. Data can be retrieved via computer at rates up to 9600 bps.

LoggerTalk™, a Windows-based voice editor, is shipped with the COM300 to create and edit messages spoken by either the COM300 or VS1.

# CS7500: Fast response CO<sub>2</sub>, water vapor sensor

## Add the CSAT3 and easily record surface fluxes on-line

The CS7500 is a fast-response, open-path analyzer designed for measuring CO<sub>2</sub> and H<sub>2</sub>O surface fluxes using eddy-covariance (EC) techniques. Campbell Scientific teamed with Li-Cor, Inc., to specify the features critical to quality EC flux measurements, then Li-Cor designed and now manufactures the probe as the LI-7500.

Combining the CS7500 with Campbell Scientific's CSAT3 Sonic Anemometer and CR23X Micrologger or

CR5000 provides a dc powered system capable of recording surface fluxes on-line. If time-series data are recorded, a lap-top computer or the CR5000 is required to store the large data files.

Inclusion of an SDM interface and a programmable delay in the CS7500 ensures that the CO<sub>2</sub> and H<sub>2</sub>O measurements are synchronized precisely with the CSAT3's wind measurements.

The analyzer features an aerodynamic head, low noise and low drift, and it draws 850 mA from a 12 V source. The CS7500 may be purchased from Campbell Scientific or Li-Cor for the same price. ☑



The CS7500 (front), with a CSAT3 (middle), and KH20 (rear), makes measurements in an eddy covariance application.



A547 interface (left). CS547 stainless steel sensor head provides protection for sensor components and weight for submergence.

## Conductivity probe undergoes redesign

The CS547, our new conductivity and temperature probe, is entirely encased in stainless steel. It was designed to replace both the 247 and 247W. The sensor specifications, wiring, and programming remain the same as our older probes, but the CS547 will fit in a 1" diameter pipe.

The blocking capacitors and completion resistors have been removed from the probe and placed in an auxiliary device, the A547. Multiple CS547s can be measured with one A547 connected to an AM416 multiplexer. ☑

## Self-calibrating heat flux sensor available

### HFP01SC already a proven tool for success in the field

We've added a new self-calibrating heat flux sensor to our product line. The model HFP01SC is manufactured by Hukseflux of The Netherlands and has been used successfully for the last couple of years by our UK office.

Every two hours under datalogger control, power is applied to an embedded film heater and the resulting heat flux is measured. This process corrects for error caused by differences in the thermal conductivities of the sensor and the surrounding medium, contact resistance, and sensor temperature dependence.

Two differential or single-ended analog input channels are required to mea-

sure the HFP01SC. The first is used to measure the sensor output. The second measures the amount of power applied to the film heater during self-calibration. A power control circuit is built into the pig-tail end of the HFP01SC signal cable.

The self-calibration takes eight minutes. For the first three minutes, about 14 mW of power is applied to the film heater. For the remaining five minutes, the sensor is allowed to reach equilibrium with the surrounding medium.

The HFP01SC can be used to measure heat flux in many applications. A measure of soil heat flux is required for Bowen ratio determinations of sensible and latent heat flux or for examining energy balance closure in eddy covariance flux measurements. ☑

## Y2K transition reported to be uneventful

As expected, the transition to the year 2000 proved uneventful for the vast majority of our customers. As our compliance statement indicated, data integrity and capture appear unaffected.

A few customers experienced difficulty displaying data on their computer monitors following the transition. That difficulty was traced to another manufac-

turer's software; they have since provided a solution to those customers.

If you are experiencing any difficulties, please contact one of our applications engineers at (435) 753-2342 for assistance, download a copy of our Y2K application note from our Web site, or email us at the following address: info@campbellsci.com ☑

## In a pinch? New Application Notes easy to download from our Web site

We have released four new application notes:

- *Protecting Your Copy of PC208W and Its Configuration Files (3C-P)*: lists the PC208W files that should be backed-up when performing PC maintenance.
- *Collecting and Displaying Weather Data on the Web (4-V)*: provides a

procedure for creating and automatically updating a Web page that contains tabular or graphical displays of weather data.

- *Running PC9000 with Dynamic Data Exchange (3C-Q)*: describes two methods for setting up Microsoft Excel as a remote monitor for data provided by PC9000 Software.

- *Interfacing a Measurement Station with a Trans-Lux Message Center (4-U)*: describes setting up the system featured on Page 2 of this newsletter.

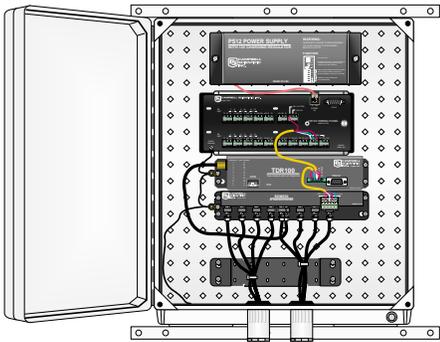
As new Application Notes become available they will be listed under the Support/Application Notes section of our Web site. ☑

# The TDR100 Time Domain Reflectometer

*Finally! A cable tester optimized for unattended use in the field*

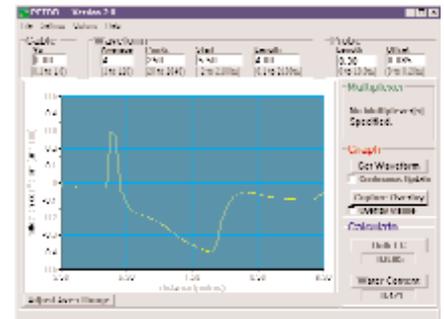
The TDR100's innovative design provides a low-cost and compact unit for time-domain reflectometry (TDR) measurements. Typical applications include measuring soil volumetric water content, electrical conductivity, and monitoring landform stability.

CR10X and CR23X dataloggers contain Instruction 119 to automate TDR100 measurements in the field or laboratory. PCTDR software, included with the TDR100, is used to display the waveform during system setup and troubleshooting. The software displays



volumetric water content and electrical conductivity, switches SDMx50 multiplexer channels, collects waveform and derivative data files, and determines probe constant values needed for electrical conductivity measurements. Acquisition time for water content, electrical conductivity, or waveforms is two seconds. The reflectometer draws a maximum 270 mA (2 mA standby) at 12 Vdc.

The ENCTDR100 is an enclosure that houses the TDR100 along with the datalogger, power supply and one SDMx50SP 8-channel coaxial multiplexer. Additional multiplexers can be added for monitoring up to 512 TDR probes.



Above: PCTDR displays "the waveform." Top: The TDR's compact design and absence of a display are part of its optimization for field use. Left: a power supply, CR10X, TDR100, and multiplexer mount neatly in a 16" x 18" enclosure.

## Campbellsci.com expands to offer you more information

Our Web site, now in its fourth incarnation, will be on-line soon, expanding the information available from our current site.

Our Products section covers our peripheral products and explores our "main products" in more depth. We've added a Systems section that covers our Weather Stations as well as Evapotranspiration, Micromet, Trace Gas, Time Domain Reflectometry, SCADA, MSHA-approved, Storm Water, and Pump and Slug Test systems.

To help you *Find Us* in your area, we've hotlinked maps for locating and contacting our growing network of US and International affiliates and representatives.

Our *Support* section offers more on-line Application Notes, Manuals, Product Literature, and adds a section of Frequently Asked Questions.

As on our current site, you can select *Download* to obtain copies of Demo Software, Free Software, Training Class



*Newly added to the CSI Web site, Info Centers offer point-and-click access to valuable, application-specific information. To have your application featured, contact our webmaster.*

Schedules, and Programming Examples.

We've added Info Centers, which are application-specific areas where you, our customers, can locate information relevant to *Your Application*. We've created 27 Info Centers, including Air Quality, Aquaculture, Fire Weather, Geotechnical and Mining, Micrometeorology, Soil Water, Vehicle Test, and Water Quality. These Info Centers describe our capabilities in each area, and discuss examples of customer applications, provide links to related Web sites, and offer an Ask Our Expert button to directly contact an application engineer specializing in your area. These Info Centers will continue to expand, providing customized information relevant

to your application. Toward this end, we invite application descriptions, photos, and offers to link to your home pages. Contact [webmaster@campbellsci.com](mailto:webmaster@campbellsci.com) or your favorite application engineer for details. See ya in cyberspace!

## CR9052DC: Anti-alias filter with dc excitation

The CR9052DC, our new high-performance CR9000 module, contains six anti-alias differential channels. Each channel has its own programmable-gain instrumentation amplifier, pre-sampling analog filter, and sigma delta analog-to-digital (A/D) converter. A digital signal processor (DSP) provides anti-alias filtering and down-sampling before passing the results to the CR9000's main processor.

The maximum system throughput is a sustained 100,000 measurements per second while storing data on PC cards. A

single clock synchronizes all A/D converters on one module, and all 9052 modules within the CR9000 chassis, providing simultaneous sampling of all 9052 channels.

The DSP implements user-programmable, real-time finite impulse response filters that steeply transition from pass band to stop band. The filters maintain a constant group delay and a filter performance that does not change with time, temperature, or component tolerances. Future modules will allow users to load their

own custom coefficients into the DSP to measure the frequency response of their own needs (e.g., band pass, band reject).

The 9052 includes a user-replaceable daughter board providing six independent dc excitation channels programmable for 10 V, 5 V, or 10 mA. Future daughter boards will provide excitation and signal conditioning for integral piezo-electric accelerometers. At least one connector module, the CR9052EC, is required to attach sensors to the 9052 terminals.  

## Calibration certificates for dataloggers now available

CR510, CR10X, CR23X, and CR5000 dataloggers can now be ordered with a Calibration Certificate.

Two certificate options are available based on the standard and extended temperature ranges. The certificates comply with ISO/IEC Guide 25 requirements, which provide test data on the second page. New dataloggers will include a sticker with a recommended recalibration date.

The "Test Report" formerly sent out with new dataloggers has been discontinued.

Calibration Certificates can be ordered for dataloggers returned to CSI for recalibration; simply order this option when obtaining your RMA.

## The DCDC18R: Give yourself a boost

*Recharge your CR23X or CR5000 using standard vehicle power*

The DCDC18R Boost Regulator accepts a nominal 12 V from a vehicle's electrical system and raises it to the 18 V required for recharging the CR23X and CR5000 dataloggers' sealed rechargeable bases.

The DCDC18R operates over the same wide temperature ranges as CSI dataloggers; the 1 A output will supply plenty of power when heavy current loads are required.  



A test vehicle (above) stands instrumented with sensors, datalogger, Heads-Up Display and peripherals. The DCDC18R (left) is a compact package designed to attach to the side of a CR23X or CR5000 rechargeable base.

## Strong, lightweight UT20 a standard for fire weather

Campbell Scientific now offers a 20' tower; you'll find it in the Tripods and Towers section of our US and International Price Lists. The UT20 is a strong, lightweight aluminum tower produced by Universal Manufacturing, the same company

that manufactures our 10' and 30' towers.

Commonly used for fire weather stations, the UT20 is intended for permanent installation. It is compatible with all UT30 mounting options including bases, guy kit, and sensor mounting hardware.

## Training: Make sure your gear is being used to its fullest potential

CSI conducts three-day training courses on our dataloggers and PC software. Classes are held monthly at our facilities for the CR10X and PC208W, and quarterly for the CR9000 and PC9000.

Download a course itinerary, registration form, scheduling, and local travel information from our Web site, or call 435-753-2342.  

Call now to secure your company's session

## CSI application engineers hit the road for customized training at your facilities

CSI's training class is on the road! If you're interested in having our application engineers travel to your facility and provide training for up to 12 people, please call Craig at 435-750-9518.

You'll need to provide a room conducive to training, but we will provide

everything else—the computers, dataloggers, sensors, software, etc.

We'll conduct our standard three-day course, and our application engineers can answer specific questions about your measurement needs. Cost depends on class size.



Small and portable, the new storage modules fit easily into a shirt pocket.

## Compact and rugged, new storage modules becoming favorites

The SM4M and SM16M replace the SM192 and SM716 as our next generation, compact (5" x 3" x 1") storage modules. Non-volatile memory stores 2 and 8 million low-resolution data values for the SM4M and SM16M, respectively. Both devices store up to eight datalogger programs, simplifying field exchange of programs.

The new modules are compatible with our array-based dataloggers and our DSP4 Heads Up Display. The operating temperature range is identical to their predecessors: -35° to 65°C standard, -55° to 85°C, extended.

Up to four storage modules can be connected to one datalogger using SC12 or SC12R cable(s). Data are transferred from the datalogger at rates of 9.6 to 76.8 kbps. A green LED on the module lights up during data storage; a red LED indicates the module's operational status at power-up.

Data and programs are transferred between the storage modules and a computer using an SC532 interface at rates from 300 to 115,200 bps. SMS software, included in Version 3.1a of PC208W and available at no charge in PC200W 1.2, provides software support for the new modules. ☑

## Change necessary for some model numbers and invoices

We have changed business software to become Y2K compatible. As a result, we've made some minor changes to some model numbers and to the appearance of our quotes and invoices.

## Just five easy steps

# SCWin: A simple way to generate datalogger programs

Want a really simple way to generate a datalogger program? Check out Short Cut for Windows! SCWin's five easy steps walk you smoothly through the process:

1. Create a program file
2. Choose your sensors and units of measure from a list
3. Select special calculation or enter custom equation
4. Set intervals for data output
5. Build the download file



SCWin's main screen guides you through programming your datalogger.

SCWin supports over 120 sensors, special calculations (e.g., windchill, heat index), and generic measurements (half bridge pulse) for the CR10X, CR510, CR23X, and their predecessors. The MetData1 and ET106 Weather Station sensors are also supported. SCWin automatically allocates terminals and creates a wiring diagram for you to follow.

If you need to crunch your data, just type in the equation and let SCWin create the datalogger code. Choose from a variety of statistics to process your data, then select up to 10 intervals to store

the results. When you're finished, SCWin saves your settings and builds a file to send to the datalogger using PC200W or PC208W.

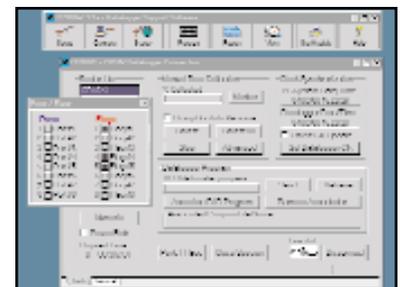
Short Cut for Windows was released March 22. Updates with new features or sensors will be available from our web site: [www.campbellsci.com/resource.html](http://www.campbellsci.com/resource.html) or follow the links from our home page.

If you find problems, have ideas for improvements or sensors to support, or want to be notified of new Short Cut releases, please email us: [scwin@campbellsci.com](mailto:scwin@campbellsci.com)

## PC208W: Support for new products and difficult telecommunications links

A new version of PC208W Datalogger Support Software (3.1a) has been released. We've added new features, such as:

- Support in SMS for the new SM4M and SM16M Storage Modules
- Support in Edlog for new peripherals such as the TDR100 Soil Moisture Interface, SDM-CANbus interface, and LI-7500 Gas Analyzer
- Improved Scheduling for data collection to keep retries within narrow calling windows for cellphone users
- More reliable protocols for setting flags, ports and input



PC208W supports programming, telecommunications, and data display.

locations over marginal telecommunications links (may require updated datalogger operating systems)

Version 3.1a will use settings from any of the previous PC208W installations, so upgrading is easy.

# CR5000

Continued from Page 1

The built-in keyboard and graphics display allows the user to check measurements, view and plot stored data, set program flags, change or format the PC card, and run or edit a stored program.

Two megabytes of internal, battery-backed SRAM are available for operating system use and data storage. Data storage is expanded via the built-in PCMCIA slot. The slot accepts one type I, type II or type III card (SRAM or ATA, DOS formatted). ATA FLASH cards greater than 200 Mbytes and type III hard disks exceeding 1 Gbyte are available. The hard disks have a reduced temperature and shock range. Data stored on the PC card can be collected from the CR5000 via a computer/telecommunications link or the card can be removed and read directly in a PC. Data buffered in the CR5000 while the card is removed are written to a card when it is inserted.

The CR5000 can measure and store up to 5000 measurements per second without a burst mode; for example, 20 channels

measured and stored every 4 milliseconds. The overhead required to set up a scan reduces the throughput to 2000 Hz when measuring a single channel (0.5 milliseconds per scan).

For automotive testing applications, all analog channels and both pulse channels can be measured at a 100 Hz scan rate while using analog integration to reduce measurement noise. Considerable processing is possible at this rate.

In addition to the statistical output routines for collecting averages, maxima, minima, standard deviations, etc., routines are available that store only critical data or summaries. These include:

- Fast Fourier Transform
- Data Event starts and stops storing data based on trigger conditions. Data before the start trigger and following the stop trigger can also be stored
- Worst Case allows ranking the data events and keeping only the most significant ones
- Histograms include multidimensional frequency distribution, level crossing, and rainflow (stress/strain cycle counting for fatigue analysis)

The CR5000 can measure four separate eddy covariance H<sub>2</sub>O/CO<sub>2</sub> surface flux systems at 20 Hz (Page 4) plus standard meteorological sensors, while calculating fluxes on line as well as storing the time series data.

If speed isn't necessary, the CR5000 is as miserly with power as our other data-loggers. While measuring at 5 kHz it consumes 200 mA, but when the scan interval is longer, it drops considerably. At a 1 Hz scan rate the current averages 4.5 mA. At scans longer than 10 seconds, a sleep mode reduces the average current to 1.5 mA. The CR5000 can also power off under program control (0.4 mA) and wake up either at a preset time or in response to a digital input.

A new measurement feature is current excitation for resistance measurements. The current excitation, programmable in the range of  $\pm 2.5$  mA, allows measuring sensors such as RTDs directly without bridge completion resistors.

We are currently accepting orders for the CR5000 with a 60 day ARO delivery. Please check with a CSI applications engineer as to the suitability of the CR5000 for your application. ☑ ☐



Aerial photo shows new building (top right) and cars of "early riser" employees.

## Manufacturing now in new facilities

Our new 40,000 ft<sup>2</sup> addition (black and white building) houses much of our Manufacturing Department. Most of the space vacated by manufacturing in the two yellow buildings will be consumed by our Engineering, Administration, and Marketing Departments.

## Meet Campbell Scientific at:

Date	Exhibit	Location
<b>May</b>		
9-11	Sensors/Motion Control Expo	Anaheim, CA
<b>June</b>		
11-15	AWWA Annual Conference & Exhibit	Denver, CO
18-21	Resource Conservation & Development	Ogden, UT
19-21	A&WMA Conference & Exhibit	Salt Lake City, UT
<b>July</b>		
2-7	Int'l Soil Tillage Research Organization	Ft. Worth, TX
8-12	ASAE Annual International Meeting	Milwaukee, WI
16-19	Joint Propulsion 2000 Conference	Huntsville, AL
20-23	Recirculating Aquaculture Systems	Roanoke, VA
30-8/2	ASCE Water Resources Eng. Conference	Minneapolis, MN
<b>August</b>		
6-10	Ecological Society of America	Snowbird, UT
7-9	American Assoc. of State Climatologists	Logan, UT
8-11	HydroVision 2000	Charlotte, NC
12-16	American Phytopathological Society	New Orleans, LA
14-18	Agriculture & Forestry Meteorology	Davis, CA
<b>September</b>		
19-21	Sensors Expo	Detroit, MI
26-29	Dam Safety (ASDSO) Conference	Providence, RI



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