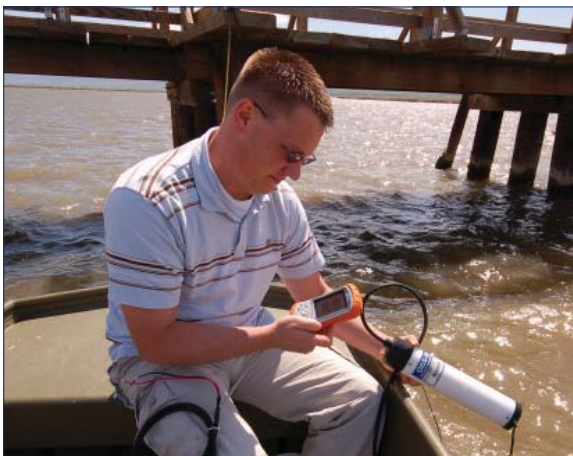
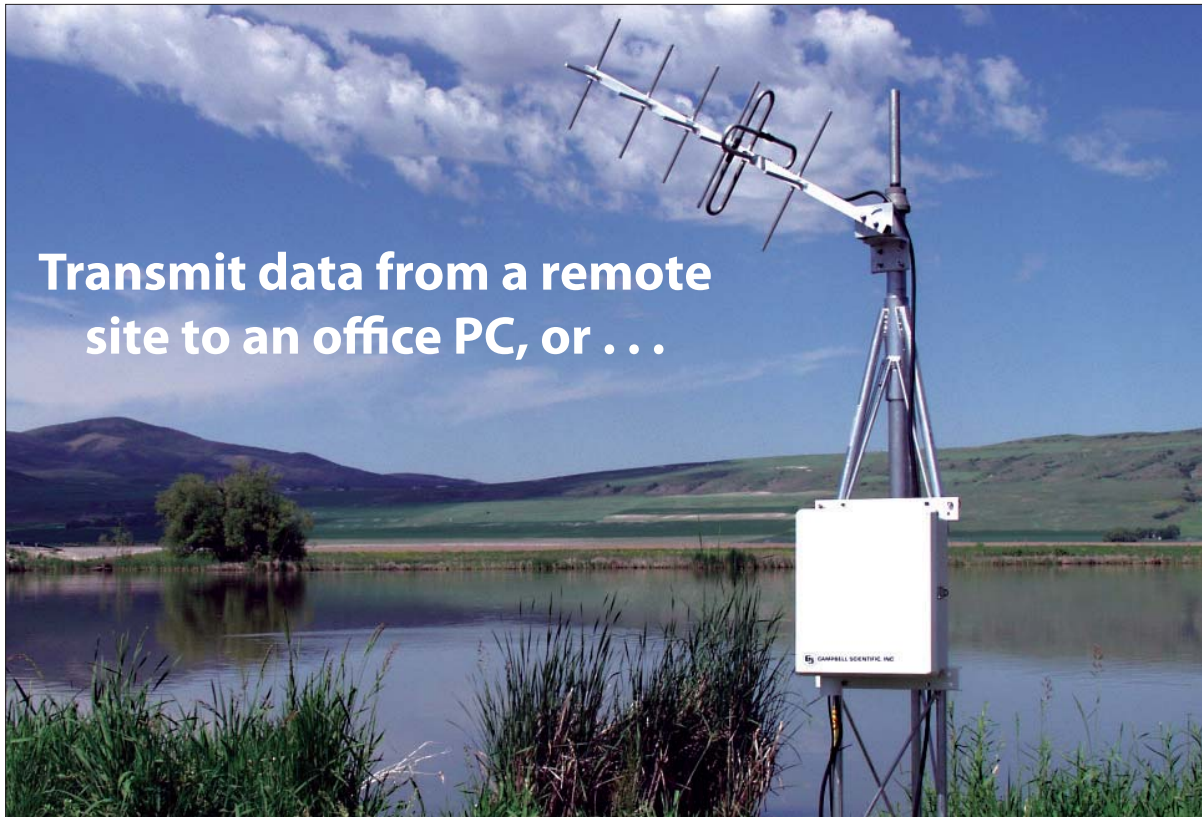




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# Data Storage & Retrieval Peripherals



# Data Storage & Retrieval Peripherals

Campbell Scientific offers a full line of data storage and retrieval peripherals. Whether you want to collect data during a site visit, contact your datalogger via telemetry, or both, our data storage and retrieval peripherals have wide operating temperature ranges allowing their use in extreme, remote environments.

To determine the best data storage and retrieval method for your application, you should consider:

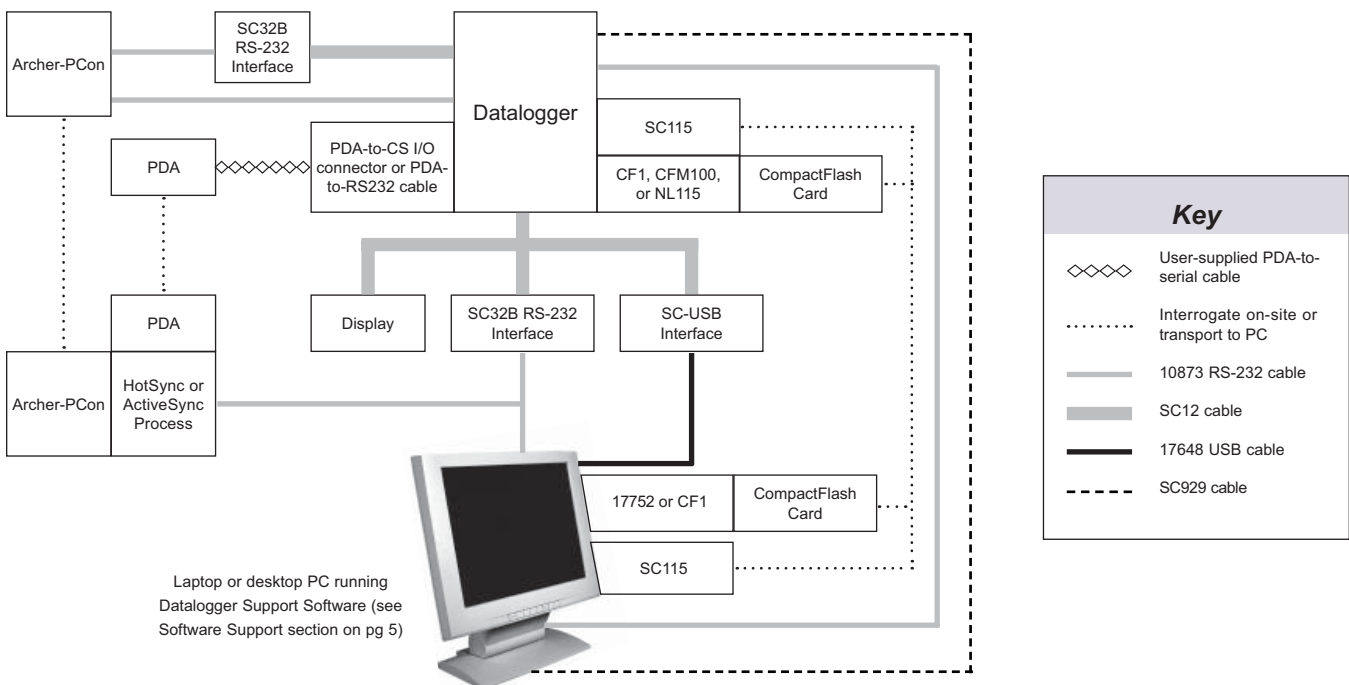
- **Accessibility of Site**—a dependable telemetry device that transmits data to a base station's computer is preferable for a site that is difficult to access. On the other hand, if your site is essentially in your backyard, you may want to collect data with a portable handheld device or laptop.
- **Availability of Service**—prior to the purchase of any equipment, you should determine if the appropriate coverage for cellular phones, RF systems, or satellite systems is available for your site. The use of telephones or the Internet requires that phone lines or an Internet connection be available within a few miles of the site.
- **Quantity of Data Collected**—this affects the transmission duration. For some telemetry devices, a long transmission length will significantly impact the current drain, and perhaps service costs.
- **Frequency of Data Collection**—if you need near real-time data, a telemetry device is indicated. If you only need to collect data every few weeks, you may prefer an on-site device.



This station for the National Estuarine Research Reserve (NERR) in Virginia transmits data via our GOES satellite transmitter.

To help you determine the best data storage and retrieval method for your application, this document describes our on-site and telemetry peripherals. For a quick comparison of devices, we recommend you review the telemetry comparison table on page 6 and the compatibility charts on pages 7 and 8.

## On-Site Peripherals



### *Direct Connect to Laptop or PC*

A PC or laptop can be connected directly to the datalogger's RS-232 port (no interface required). For our CR200X-series, CR3000, CR5000, and CR9000X dataloggers, this port is electrically isolated, which protects against ground loops, normal static discharge, and noise. Isolation is not provided by the RS-232 port on a CR800, CR850, or CR1000 datalogger. For these dataloggers, AC-powered PCs should be attached to the datalogger's CS I/O port instead of the RS-232 port.

When connecting to the datalogger's CS I/O port, a device that converts the CMOS logic levels of the datalogger to the RS-232 logic levels used by the PC is required. The following devices accomplish this:

- SC32B interface connects with the PC's 9-pin serial port via an SC12 CS I/O cable and an RS-232 cable. The interface also provides optical isolation.
- SC-USB interface connects with the PC's USB port using an SC12 CS I/O and a USB cable. The interface also provides optical isolation.
- SC115 interface connects with the PC's USB port either directly or via the supplied cables. The interface is not electrically isolated.
- SC929 cable attaches directly to the 9-pin serial port on a battery-powered laptop. It does not provide electrical isolation, and draws approximately 100 mA from the datalogger.

### *External Data Storage Devices*

These products are used to backup data, increase the datalogger's storage capability, or retrieve data from the datalogger's memory during a site visit.

- SC115 Memory Drive stores 2 GB of data. One end connects with the datalogger's CS I/O port for retrieving data, and the other end connects with a PC's USB port for downloading data.
- CFM100 and NL115 modules store data on one CompactFlash® (CF) card; the NL115 also supports Ethernet communications. Both the CFM100 and NL115 attach to the peripheral port on a CR1000 or CR3000 datalogger.
- One Type I, II, or III PC-card can be read by the PCMCIA card slot that is integrated into the CR5000 and CR9000X dataloggers.
- CF1 CompactFlash Adapter inserts into the PCMCIA card slot on a CR5000, CR9000X, or PC allowing the datalogger or PC to receive CF cards.
- 17752 Reader/Writer is a high-speed device that allows data stored on a CF card to be read by the USB port on a PC.

### *Portable Handheld Devices*

A portable handheld device can be used to collect and display the datalogger's data, transfer datalogger programs, graph data for up to two elements, and transfer the datalogger's data to a PC.

- Archer-PCon, Archer-OBS, and Archer-OBS-EM are three versions of Juniper Systems Archer Field PC with specialized software. The Archer-PCon is for interfacing to general Campbell Scientific data-acquisition systems, and the Archer-OBS and Archer-OBS-EM are for interfacing to our OBS-3A Turbidity and Temperature Monitoring System.
- User-Supplied Personal Digital Assistants (PDAs) require either PConnect or PConnectCE software. PConnect is for Palm OS-based devices. PConnectCE is for Windows Pocket PC/Windows Mobile OS-based devices.



With an IP67 sealed rating, the Archer Field PC is completely sealed against dust and water.

### *Keyboard Displays*

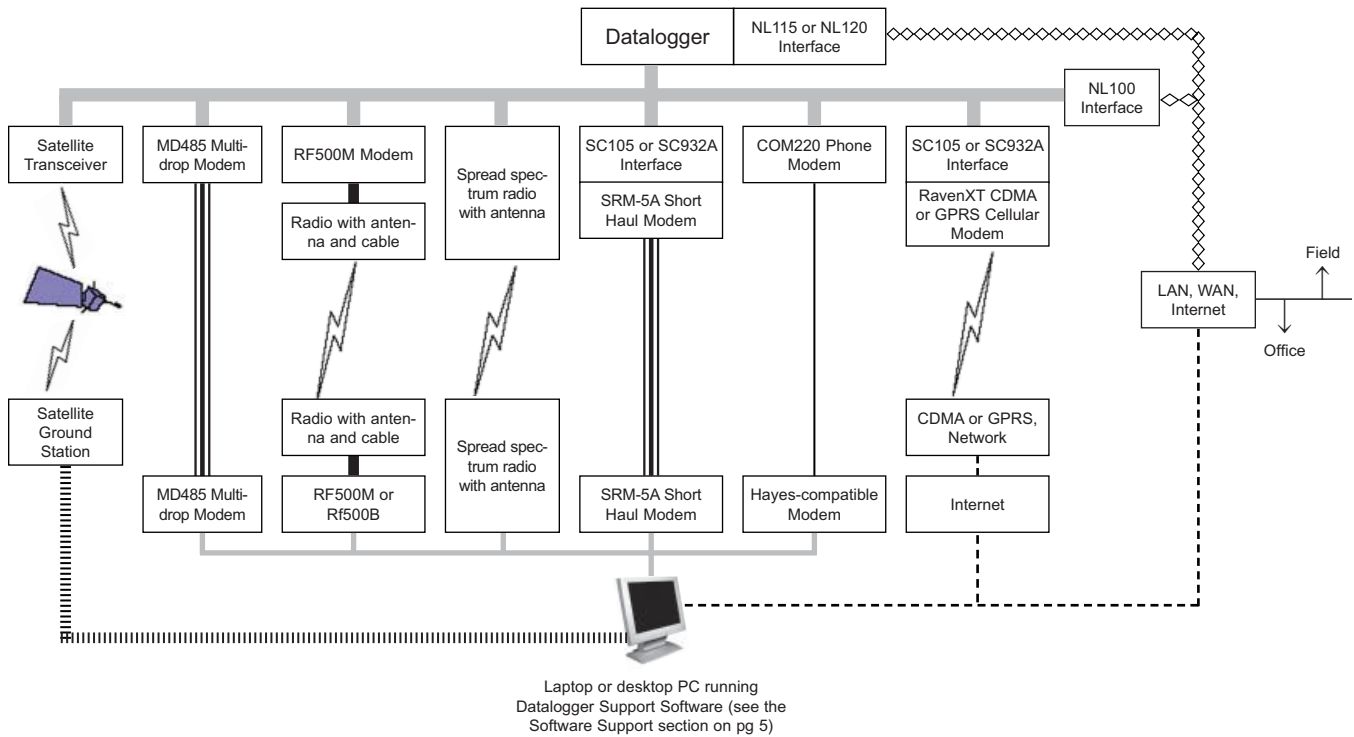
The datalogger's keyboard display provides on-site review of data values and program instructions. The keyboard display consists of a 128 x 64 pixels backlit LCD graphical or eight-line numeric display and 16-character keyboard. Keyboard displays are integrated into the CR850, CR3000, and CR5000 dataloggers.

The CR1000KD is a portable keyboard display used with our CR800 and CR1000 dataloggers. One CR1000KD can be carried from station to station in a datalogger network.

### *DataView II Display*

The DataView II consist of a two-line, 32-character LCD that can display one real-time value, a description, and units. This display mounts in an enclosure lid allowing data to be viewed on-site without opening the enclosure. The DataView II supports PakBus® dataloggers.

# Telemetry Peripherals



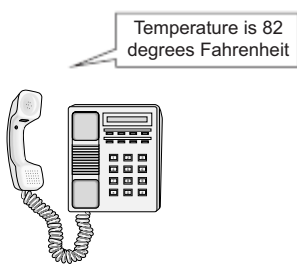
Key		
SC12 cable*	RF Connection Cable	Internet connection (e.g., phone modem w/dial up ISP)
2-twisted pair	Wireless Telemetry	10baseT Ethernet Cable
RS-232 cable	Telephone Line	Choice of Internet or phone system

\*Assumes connection to the datalogger's CS I/O port. Refer to the device's product brochure to determine the appropriate configuration for connecting to the datalogger's RS-232 port.

## Land-Line and Voice Synthesized Telephone Networks

The COM220 Phone Modem at the datalogger site transmits data over land lines. A Hayes-compatible modem at the calling end is required and surge protection at the datalogger site is strongly recommended.

The COM320 Voice-Synthesized Modem enables anyone to call a datalogger via phone and receive a verbal report of real-time site conditions.



You can use any phone to call a COM320-equipped site and receive a verbal report of site conditions. Similarly, the VSP3 Vosponder allows you to call the site with a hand-held radio.

## Digital Cellular Telephone Networks

The RavenXTV is a CDMA modem configured for Verizon cellular networks, and the RavenXTG is a GPRS modem configured for AT&T digital cellular networks. These full-duplex digital cellular modems transmit the datalogger's data to a local cellular tower. The CDMA or GPRS network then routes the data to the base station computer via the Internet.

## Ethernet

The following methods allow our dataloggers to communicate over a local network or a dedicated Internet connection using TCP/IP.

- NL115 and NL120 modules support Ethernet communications via the peripheral port on a CR1000 or CR3000 datalogger; the NL115 also stores data on a CompactFlash card.
- CR9000X's on-board 10baseT/100baseT port allows Ethernet communications by using only a cable; an Ethernet interface is not required.
- NL100 10baseT interface is compatible with all of our dataloggers.

### Short Haul

The SRM-5A Short Haul Modem supports communications between the datalogger and a computer via a four-wire unconditioned line (two twisted pairs). Surge protectors on both ends of the transmission line are recommended.

### Multidrop

The MD485 intelligent RS-485 interface permits a PC to address and communicate with one or more dataloggers over a single CABLE2TP two-twisted pair cable.

### Satellite

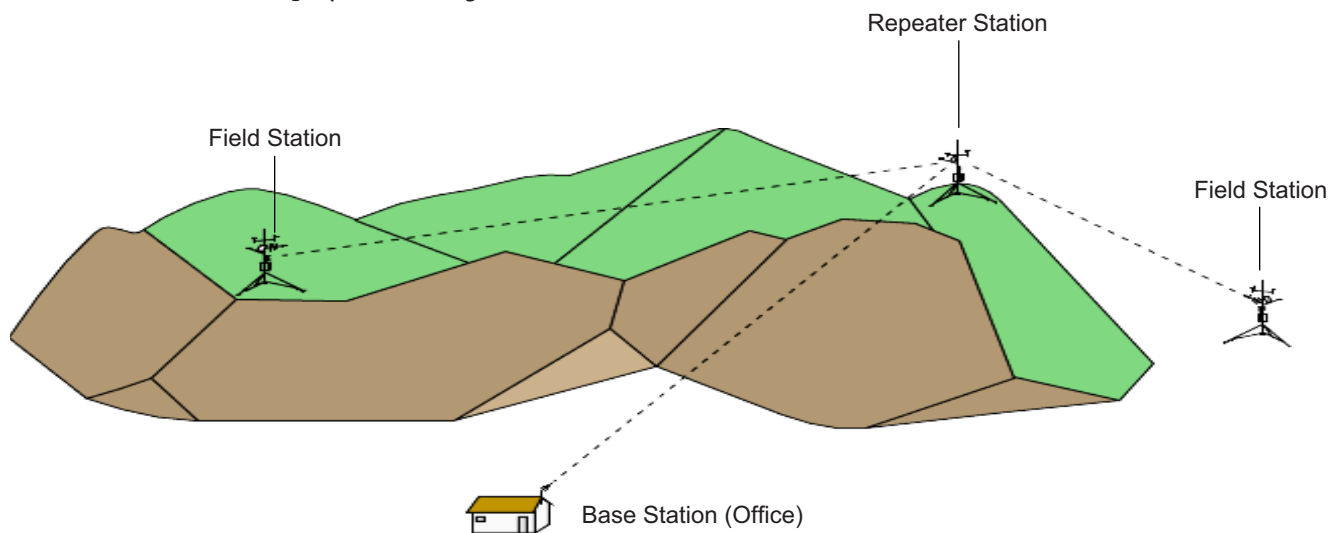
Our satellite transmitters provide one-way communications from the datalogger site to a receiving station.

- TX320 uses the GOES system. This NESDIS-certified transmitter complies with the High Data Rate version 2 (CS-2) specifications.
- ST-21 PTT uses the Argos system. Argos field sites are well suited for deployment in high latitudes.

### Radio Frequency (RF) Networks

Our RF networks transmit data over a radio frequency. Line-of-sight is required for all RF networks.

- RF310-series UHF/VHF narrowband radios can transmit data for up to 25 miles, line-of-sight. At the field station and repeater stations, the radio is attached to an RF500M modem. The computer base station should include a radio, PC, and an RF500M modem or RF500B base station. The RF310-series radios require an FCC license.
- VSP3 Vosponder allows customers to call a datalogger via a hand-held UHF or VHF radio and receive a verbal report of real-time site conditions.
- RF401-series, RF430-series, and RF450 spread spectrum radios can provide communications between a base station computer and several field stations over short distances. An individual FCC license is not required.



All of our RF networks require line-of-sight transmission. The mountain in this drawing obstructs line-of-sight with the base station. Use of the repeater station allows the base station to receive data from the field stations.

## Software Support

The base station computer needs to be running one of our software packages. Palm OS-based handheld devices use PConnect software, and Pocket PC devices use PConnectCE software. Our PC200W software is available, at no charge, from our website; it supports direct communications only. PC400, RTDAQ, and LoggerNet software support our direct and telemetry options. LoggerNet also supports scheduled data collection and combining data retrieval methods (e.g., phone-to-radio).

## Combining Options

You can increase the flexibility, convenience, and reliability of your application's data storage and retrieval by combining an on-site device with a telemetry device. For example, cellular phone with on-site back-up provided by a CompactFlash card combines an on-site and telemetry device. You can also combine two telemetry methods. Popular telemetry combinations are Ethernet-to-radio, multidrop-to-spread spectrum radio, phone-to-multidrop, Ethernet-to-multidrop, and phone-to-radio.

## Telemetry Comparison Table

Device	Transmission Distance or Area	Communication Rate or Throughput	Current Drain	Service Requirements
NL100 Ethernet Interface	Worldwide	up to 115.2 kbps	130 mA	Internet access
NL115 Ethernet Interface and CF Module	Worldwide	115.2 kbps	20 mA (Ethernet only); 43 mA (Ethernet and CompactFlash)	Internet access
NL120 Ethernet Interface	Worldwide	115.2 kbps	20 mA	Internet access
MD485 Multi-drop Modem	4000 ft (can increase distance by using more MD485s or combining w/ spread spectrum radios, Ethernet, or phone)	1200 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps	1.2 mA standby; 2 to 7 mA communicating	CABLE2TP two-twisted pair cable must be installed between networked dataloggers and base.
RF310-Series Narrowband VHF/UHF Radios	Up to 25 miles between stations (line-of-sight); effective distance can be increased using repeaters	1200 bps, 9600 bps, 19.2 kbps, 38.4 kbps, 57.6 kbps, 115.2 kbps	1.4 mA quiescent; <2000 mA (transmit 5 W RF power) <1000 mA (transmit 1 W RF power)	FCC-assigned frequency and license. Line-of-sight required.
RF401-Series and RF430-Series Spread Spectrum Radios	Up to 10 miles when using higher gain directional antennas at ideal conditions; up to one mile when using inexpensive omnidirectional antennas (line-of-sight obstructions and interference will affect transmission length)	up to 38.4 kbps	<1 mA stand-by; 24 mA receiving (RF401, RF411); 36 mA receiving (RF416); 26 mA receiving (RF430, RF431); 40 mA receiving (RF432); 75 mA transmitting (RF401-series) 78 mA transmitting (RF430-series)	Shares frequency with other devices such as cordless phones. Spread spectrum modems are not allowed to cause harmful interference to licensed radios. Line-of-sight is required, and signal is attenuated rapidly by foliage.
RF450 Spread Spectrum Radio	Up to 60 miles assuming ideal conditions, line-of-sight, and appropriate antenna; realistic reliable distance is ~13 miles (antenna type, line-of-sight obstructions, and interference will affect transmission length)	115.2 kbps	<7 mA sleep mode; <22 mA idle; <76 mA receiving; <500 mA transmitting	Shares frequency with other devices such as cordless phones. Spread spectrum modems are not allowed to cause harmful interference to licensed radios. Line-of-sight is required, and signal is attenuated rapidly by foliage.
SRM-5A Short Haul Modem	7.6 miles	Up to 9600 bps	2.2 mA quiescent; 10 to 15 mA active	Dedicated two-twisted pair cable connects one field station with base.
COM220 Phone Modem	Limitless as long as phone lines are installed	9600 bps, 38.4 kbps, 57.6 kbps, or 115.2 kbps (in practice, data transmission through phone lines is generally constrained to 33.6 kbps)	12 $\mu$ A quiescent; 30 mA active	If not available at the site, phone lines must be installed.
RavenXTV CDMA Cellular Modem	Dependent on antenna used and CDMA coverage	Up to 80 kbps	50 mA dormant; 120 mA receive/transmit	CDMA coverage at the datalogger site and account at Verizon.
RavenXTG GPRS Cellular Modem	Dependent on antenna used and GPRS coverage	Up to 80 kbps	104 mA dormant 350 mA transmit/receive	GPRS coverage at the datalogger site and account at AT&T.
TX320 High Data Rate (HDR) version 2 GOES Satellite Transceiver	Western Hemisphere	100 bps, 300 bps, 1200 bps	0.5 mA idle; 15 mA during GPS fix, 2.6 A transmitting	Formal permission to use the GOES system must be acquired from NESDIS. Non-U. S. government agencies and research organizations must have a sponsor from a U.S. government agency.
ST-21 Argos Satellite Transceiver	Worldwide	Latitude dependent. From 448 average bytes per day at the equator to 1792 average bytes per day at the poles.	1.12 mA 375 mA transmitting	To use the Argos system, you must receive formal permission from Service Argos and pay a fee. The data must be used for environmental purposes.

## On-Site Compatibility Table

Device	CR200X-series	CR800/CR850	CR1000	CR3000	CR5000	CR9000X
<i>Direct Connect</i>						
RS-232 Cable (w/o an interface)	X	X	X	X	X	X
SC32B Interface		X	X	X	X	X
SC-USB Interface		X	X	X	X	X
SC115 USB Interface		X	X	X		
SC929 CSI/O Cable		X	X	X	X	X
<i>Displays</i>						
CR1000KD Keyboard Display		X	X			
CD295 DataView II (see note 2)	X	X	X	X		
<i>Portable Handheld Devices and Infrared Interfaces</i>						
User-Supplied PDAs (see note 3)	X	X	X	X		
Archer-PCon	X	X	X	X		
SC-IRDA Infrared Interface		X	X	X		
<i>External Data Storage Devices</i>						
SC115 Memory Drive		X	X	X		
Type I, II, or III PC-Cards					X	X
CF1 Adapter with CF Card					X	X
CFM100 Module with CF Card			X	X		
NL115 Module with CF Card			X	X		
<b>Notes:</b>						
1. To determine compatibility with devices not offered by Campbell Scientific or devices not listed on this chart, refer to the device's product literature or manual, or contact a Campbell Scientific applications engineer.						
2. To be compatible with our CR800, CR850, CR1000, and CR3000, the CD295 OS and PC295 must be version 2 or higher. Customers can go to <a href="http://www.campbellsci.com/downloads">www.campbellsci.com/downloads</a> and acquire the CD295 OS upgrade and PC295 upgrade. Our Device Configuration Utility (DevConfig) is required to upgrade the CD295 OS. DevConfig is included in PC400, LoggerNet, and RTDAQ software, as well as available from our web site.						
3. PDAs with a Palm OS require PConnect software; PDAs with a Windows Pocket PC/Windows Mobile OS require PConnectCE software.						

## Telemetry Compatibility Table

Device	CR200X-Series	CR800/CR850	CR1000	CR3000	CR5000	CR9000X
<i>Ethernet</i>						
NL100 Interface	X	X	X	X	X	see note 2
NL115 Ethernet/CF Interface			X	X		
NL120 Interface			X	X		
<i>Multidrop</i>						
MD485 Modem	X	X	X	X	X	
<i>RF Networks</i>						
RF310-Series Narrowband UHF/VHF Radios		X	X	X		
RF500M/RF500B Narrowband Modem/Base Station		X	X	X		
VSP4 Vosponder		X	X	X		
RF401-Series and RF430-Series Spread Spectrum Radios (see note 3)	X	X	X	X	X	see note 4
RF450 Spread Spectrum Radio (see note 3)	X	X	X	X	X	see note 4
<i>Satellite</i>						
TX320 HDR version 2 (CS-2) GOES Transmitter	CR295X only	X	X	X	X	
ST-21 Argos Transceiver		X	X	X		
<i>Short Haul</i>						
SRM-5A Rad Modem		X	X	X	X	see note 4
<i>Telephone Networks</i>						
COM220 Phone Modem		X	X	X	X	see note 4
COM320 Voice Synthesizer Phone Modem		X	X	X		
RavenXT-Series Digital Cellular Modems	X	X	X	X	X	see note 4
<b>Notes:</b>						
1. To determine compatibility with devices not offered by Campbell Scientific or devices not listed on this chart, refer to the device's product brochure or manual, or contact a Campbell Scientific applications engineer.						
2. Although compatible, the CR9000X has an on-board Ethernet connector and therefore the NL100 is not required.						
3. Campbell Scientific does not recommend using RF401-series radios or RF430-series radios in the same network as the RF450.						
4. Although compatible, these devices do not support the CR9000X's maximum communication rate, and therefore may not be practical for many CR9000X applications.						

