OPERATOR'S MANUAL

CR200 Series Datalogger Overview

Revision: 3/07

CR200 Overview Table of Contents

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CR200 Overview

The CR200 datalogger provides versatile measurement capabilities in a low-cost, rugged, battery-operated package. The CR200 includes CPU and analog and digital inputs and outputs. The BASIC-like programming language includes data processing and analysis routines.

The CR206, CR211, and CR216 combine the CR200 datalogger with a spread spectrum radio for telemetering data. The different model numbers are for different spread spectrum frequency ranges:

CR206	*915 MHz*	*U.S./Canada*	*CR205 (Retired)*	*915 MHz*	*U.S./Canada*
CR211	*922 MHz*	*Australia/Israel*	*CR210 (Retired)*	*922 MHz*	*Australia/Israel*
CR216	*2.4 GHz*	*Worldwide*	*CR215 (Retired)*	*2.4 GHz*	*Worldwide*

The CR295 includes an additional 9-pin serial port and an instruction set that allows communication with our TX312 HDR GOES satellite transmitter (see Appendix B).

Throughout this manual CR200 is used to refer to the datalogger that is the same regardless of the model number.

FIGURE OV1-1. CR206 Datalogger with 900 MHz Spread Spectrum Radio

OV1. Physical Description

Figure OV1-2 shows the CR206 panel and the associated program instructions. Unless otherwise noted, they are measurement instructions (Section 7).

OV1.1 Measurement Inputs

OV1.1.1 Analog Inputs

There are five single-ended inputs for measuring voltages from 0 to +2.5 V. Resolution is 0.6 millivolts.

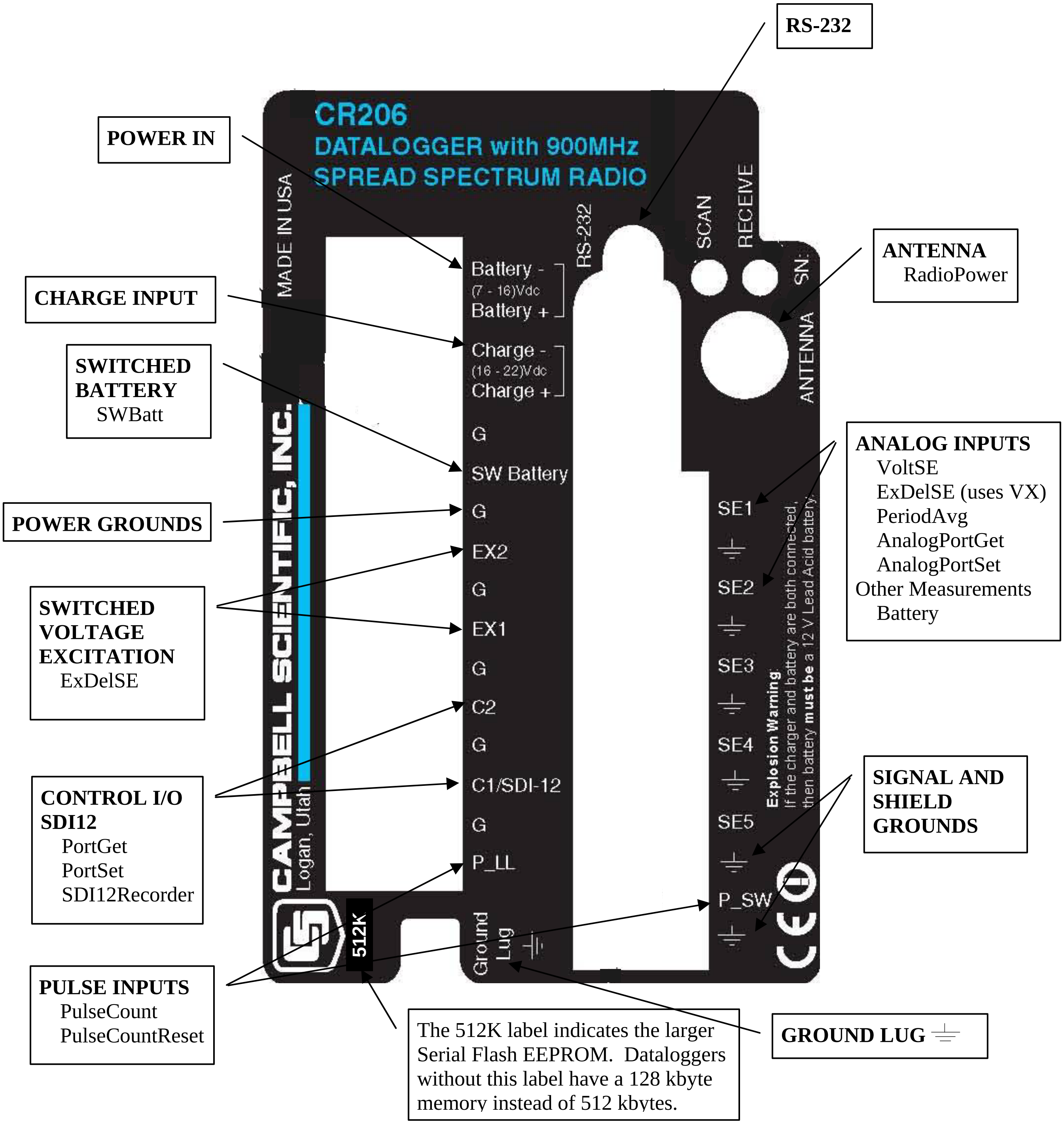


FIGURE OV1-2. CR200 Panel and Associated Instructions.

OV1.1.2 Signal/Shield Grounds ⏚

The terminals labeled ⏚ are used to connect the ground reference for measurements and shield wires.

OV1.1.3 Power Ground (G)

The G terminals (Power Grounds) are used to carry return currents from other devices powered by the SW Battery or battery and terminals.

OV1.1.4 Ground Lug

The earth ground lug is used to connect a heavy gage wire to earth ground. A good earth connection is necessary to fix the ground potential of the datalogger and to send to earth transients that come in on the terminals or are shunted to ground via the spark gaps protecting other inputs.

OV1.1.5 Switched Voltage Excitation (VX)

Two switched excitation channels provide precision programmable voltages (+2.5 V + 5 V) for bridge measurements. Each analog output will provide up to 20 mA at 2.5 V, 10 mA at 5 V.

OV1.1.6 Pulse Inputs

Two Pulse input channels can count pulses from high-level (5 V square wave), switch closure, or low-level A/C signals.

OV1.1.7 Control I/O

There are two digital Input/Output channels (0 V low, 5 V high) for frequency measurement, digital control, SDI-12 communication.

OV1.1.8 Power In

The Batt - and Batt + terminals are for connecting power from an external battery to the CR200. The CR200 will operate on 7 to 16 VDC. These are the only terminals that can be used to input battery power; the SW Battery terminal is an output only. Power to charge a 12 V lead-acid battery (16-22 VDC) must be connected to the Charge + and Charge – terminals.

OV1.1.9 Switched Battery

The SW Battery terminal provides an unregulated power from the battery that can be switched on and off under program control.

OV1.1.10 Power Supply and AC Adapter

The CR200 does not have an internal power supply but does have connections for an external battery and a built-in charging regulator for charging a 12 V lead-acid battery from an external power source. Charging power can come from a 16-22 VDC input such as a solar panel.

OV1.2 Communication and Data Storage

OV1.2.1 RS-232

A computer can connect directly to the CR200 through the RS-232 port (Figure OV1-3). The CR200 RS-232 port is a DCE device. A limited version of the RS-232 port is supported with no hardware flow control. Table OV1-1 gives a brief description of each RS-232 pin.

The CR200 RS-232 port is not electrically isolated. Connection to an AC powered computer may cause "ground loops" leading to measurement problems.

Maximum input = ±25 V
Maximum Output = ±13 V
Typical Output = ±5.4 V

TABLE OV1-1. Computer RS-232 Pin-Out

ABR = Abbreviation for the function name
PIN = Pin number
O = Signal Out of the CR200 to a RS-232 device
I = Signal Into the CR200 from a RS-232 device

PIN	ABR	I/O	Description
1			no connection
2	TX	O	asynchronous transmit
3	RX	I	asynchronous receive
4			no connection
5	GND		ground
6	DSR	O	+5 V
7			no connection
8	CTS	O	request to send +5 V
9			no connection

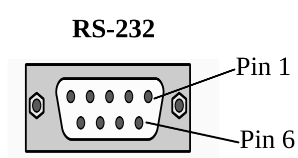


FIGURE OV1-3. Serial Communication Interfaces

OV1.2.2 Antenna

Several antennas are offered to satisfy the needs for various base station and remote station requirements. These antennas have been tested at an authorized FCC open-field test site and are certified to be in compliance with FCC emissions limits. All antennas (or antenna cables) have an SMA female connector for connection to the CR200. The use of an unauthorized antenna could cause transmitted field strengths in excess of FCC rules, interfere with licensed services, and result in FCC sanctions against user. The CR205, CR206, CR210, and CR211 use 900 MHz antennas, and the CR215 and CR216 use 2.4 GHz antennas.

NOTE An FCC authorized antenna is a REQUIRED component. You must pick one of the antennas listed below.

CSI Item Number	Description
14310	0 dBd ANTENNA, 900 MHZ, OMNI ¼ WAVE WHIP, RPSMA STRAIGHT, LINX, 3.2 inches long.
14204	0 dBd ANTENNA, 900 MHZ, OMNI ½ WAVE WHIP, RPSMA RT ANGLE, ASTRON, 6.75 inches long.
14221	3 dBd ANTENNA, 900 MHZ, OMNI COLLINEAR, ANTENEX FG9023, 24 inches tall, W/FM2 MOUNTS, fits 1 in. to 2 in. O.D. mast (requires COAX RPSMA-L or COAX NTN-L)
15970	1 dBd ANTENNA, 900 MHZ, INDOOR OMNI ½ WAVE DIPOLE, 10 ft. cable with SMA connector to fit CR200 Series, window or wall mounted by sticky back, 4 inches wide.
14205	6 dBd ANTENNA, 900 MHZ, YAGI, LARSEN YA6900 TYPE N-F, boom length 17.25 inches, longest element 7.25 inches, W/MOUNTS, fits 1 in. to 2 in. O.D. mast (requires COAX RPSMA-L or COAX NTN-L)
14201	9 dBd ANTENNA, 900 MHZ, YAGI, MAXRAD BMOY8905 TYPE N-F, boom length 21.4 inches, longest element 6.4 inches, W/MOUNTS, fits 1 in. to 2 in. O.D. mast (requires COAX RPSMA-L or COAX NTN-L)
16005	0 dBd ANTENNA, 2.4 GHz, OMNI ½ WAVE WHIP, RPSMA RT ANGLE, LINX ANT-2.4-CW-RCT-RP, 4.5 inches long.
16755	13 dBd ANTENNA, 2.4 GHz, ENCLOSED YAGI, allows vertical or horizontal polarization, MAXRAD WISP24015PTNF, boom length 17 inches, diameter 3 inches, W/ END MOUNT to fit 1 to 2 in. O.D. mast

	(requires either (1) COAX RPSMA-L for short runs or (2) COAX NTN-L with Antenna Surge Protector Kit)
COAX RPSMA-L	LMR 195 ANTENNA CABLE, REVERSE POLARITY SMA TO TYPE N MALE
COAX NTN-L	RG8 ANTENNA CABLE, TYPE N MALE TO TYPE N MALE CONNECTORS, REQUIRES 14462
14462	ANTENNA SURGE PROTECTOR KIT

FCC OET Bulletin No. 63 (October 1993)

Changing the antenna on a transmitter can significantly increase, or decrease, the strength of the signal that is ultimately transmitted. Except for cable locating equipment, the standards in Part 15 are not based solely on output power but also take into account the antenna characteristics. Thus, a low power transmitter that complies with the technical standards in Part 15 with a particular antenna attached can exceed the Part 15 standards if a different antenna is attached. Should this happen it could pose a serious interference problem to authorized radio communications such as emergency, broadcast, and air-traffic control communications.

CAUTION In order to comply with the FCC RF exposure requirements, the CR200 series may be used only with **approved antennas** that have been tested with the on-board radio and a minimum separation distance of 20 cm must be maintained from the antenna to any nearby persons.

Read Appendix C of this manual for important FCC information.

ITEM # 14310 900 MHZ OMNI ¼ WAVE WHIP 0 dBd

ITEM # 14204 900 MHZ OMNI ½ WAVE WHIP 0 dBd

ITEM # 14201   900 MHZ YAGI 9 dBd w/MOUNTS

ITEM #14205   900 MHz YAGI 6 dBd w/MOUNTS

ITEM # 14221   900 MHZ OMNI COLLINEAR 3 dBd w/MOUNTS

ITEM #15970   900 MHZ Indoor OMNI 1 dBd Window/Wall Mounted

ITEM #16005   2.4 GHz OMNI HALF WAVE WHIP 0 dBd

ITEM #16755   2.4 GHz ENCLOSED YAGI, 13 dBd w/MOUNTS

FIGURE OV1-4. Some FCC Approved Antennas

FIGURE OV1-5. Example COAX RPSMA-L Cable for Yagi or Omni Colinear

FIGURE OV1-6. Antenna Surge Protector

OV2. Memory and Programming Concepts

OV2.1 Memory

The CR200 has 2K SRAM for communication buffers, calculations, and variables, and 60K Flash EEPROM for the operating system and user program. Dataloggers originally had a 128K Serial Flash EEPROM for data storage. Campbell Scientific is increasing the data storage memory from 128 kbytes to 512 kbytes. Dataloggers with the increased memory have 512K on their label.

FIGURE OV2-1. 512K on the datalogger label indicates the larger memory.

OV2.2 Measurements, Processing, Data Storage

As a datalogger, the CR200 is programmed to measure the sensors and store data in its EEPROM memory. Data are retrieved from the CR200 using a computer and CSI software, e.g. LoggerNet.

A CR20X series datalogger with a spread spectrum radio (e.g. CR206) can also function as a wireless interface between a sensor and a “master” PakBus datalogger. In this configuration the CR200 measures the sensors and sends the data to the master datalogger. Data are retrieved from the master, rather than the CR20X.

OV2.3 Data Tables

The CR200 can store individual measurements or it may use its processing capabilities to calculate averages, maxima, minima, etc., on periodic or conditional intervals. Data are stored in tables such as listed in Table OV2-1. The values to output are selected when running the program generator or when writing a datalogger program directly.

TABLE OV2-1. Typical Data Table

TOA5	1	CR2XX		v1.0	EXPLS4.CR2	45828	AvgTemp
TMSTAMP	RECNBR	SoilT_Avg(1)	SoilT_Avg(2)	SoilT_Avg(3)	SoilT_Avg(4)		
TS	RN	DegC	DegC	DegC	DegC		
		Avg	Avg	Avg	Avg		
3/20/02 11:00	1	15.498	15.9926	18.516	19.5019		
3/20/02 12:00	2	15.4996	15.9993	18.5069	19.502		
3/20/02 13:00	3	15.4963	16.0042	18.4975	19.496		

OV2.4 PakBus Communication with the CR200

The CR200 uses Pakbus to communicate with the computer and other Pakbus devices. PakBus is a Campbell Scientific term for our packet-routing communications protocol. Packets of information transmitted between PakBus devices contain header information that is used to route the packets to their final destination.

Every PakBus device needs a Pakbus address in order to receive, send, or route packets. In a Pakbus network each device requires a unique address. The CR200 is shipped with a default address of 1. The range of allowable addresses is 1-3999.

A PakBus Networking Guide is available from the Campbell Scientific website, which describes Pakbus and gives detailed examples for several network configurations.

OV2.5 Serial ASCII Communication with the CR200

See Appendix A.

OV3. CR200 Setup using the Device Configurator Utility

The Device Configurator Utility (DevConfig) ships with the LoggerNet, PC400 and PC200W software products, and is also available no-charge from the Campbell Scientific website.

The Device Configuration Utility (DevConfig) sets up dataloggers and peripherals before those devices are deployed in the field. Some key features of DevConfig include:

- DevConfig only supports direct serial connections between the PC and devices.
- DevConfig allows you to determine operating system types and versions.
- DevConfig provides a summary of the current configuration of a device that can be shown on the screen and printed. This configuration can also be saved to a file and used to restore the settings in the same or a replacement device.

OV3.1 Power and Communication Connections to the CR200

To connect external power (7 – 16VDC) to the CR200, insert the positive lead into the “Battery +”, followed by the negative lead into the “Battery-“ terminal, as shown in Figure OV3-1.

Connect the white serial cable (PN 10873, provided) between the port labeled “RS232” on the CR200 and the serial port on the computer. For computers that have only a USB port, a USB Serial Adaptor (PN 17394 or equivalent) is required.

FIGURE OV3-1. Power and Communication Connections to the CR200

OV3.2 Using DevConfig to Set the PakBus Address

The CR200 default PakBus address is 1. Unless the CR200 is used in a network, there may be no need to change the Pakbus address, or any other default setting. To change settings, the Device Configuration Utility (DevConfig) is used, as described below.

To set the PakBus address, the CR200 must be powered up and connected to the computer as described in Section OV 3.1.

Run the DevConfig Utility. The DevConfig window is divided into two main sections: the device selection panel on the left, and tabs on the right. Select the CR2XX device, and the COM port on the computer that will be used for communications.

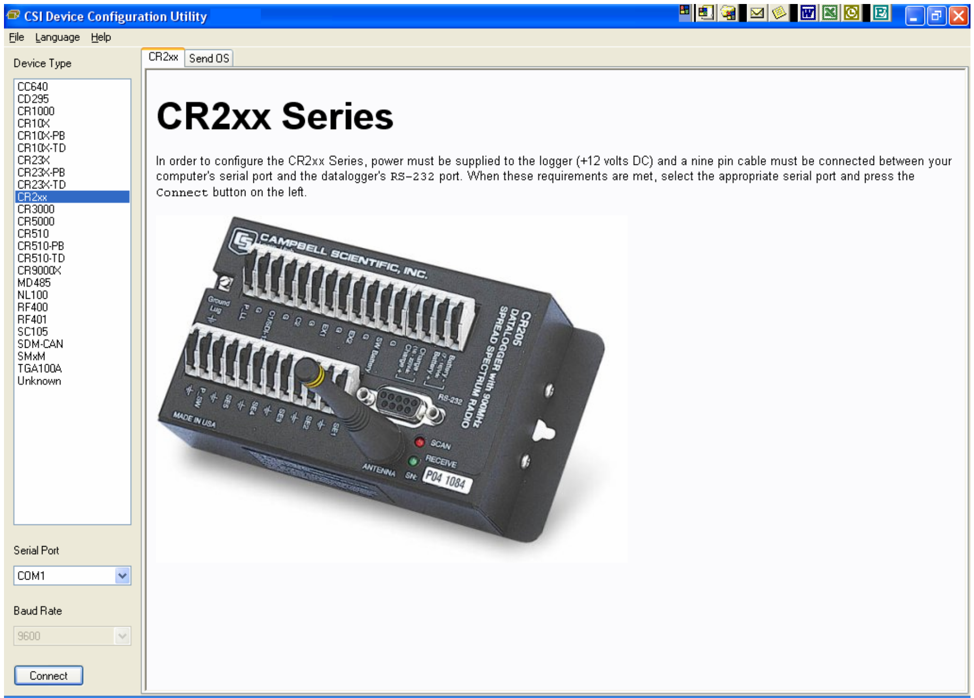


FIGURE OV3-2. DevConfig Main Screen

Click on the **Connect** button to establish communications. DevConfig establishes communications with the CR200 and displays the screen shown in Figure OV3-3.

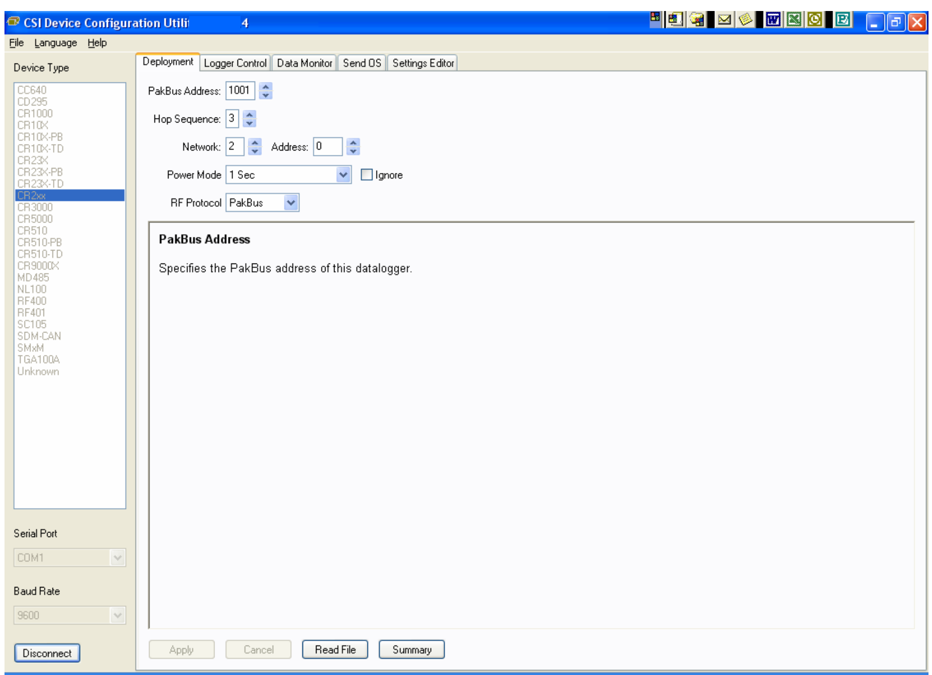


FIGURE OV3-3. Setting the PakBus Address

To set the PakBus address, use the up and down arrows next to the "Pakbus Address" box, or key in the desired number (e.g., 10) and click the **Apply** button. Leave the PakBus address at 1 for use with the Quick Start Tutorial (Section OV4). Click the **Disconnect** button to exit DevConfig.

OV3.3 CR206, CR211, and CR216 Radio Settings

The Spread Spectrum radios in the CR206, CR211, and CR216 and in the RF400 have address, frequency, and power settings. These addresses are not PakBus addresses but an address the radio encodes in its message. For two radios to talk to each other the address and frequency settings must be the same in both radios.

NOTE In a PakBus network addresses and frequency settings in ALL radios must be the same.

CR20X Radios are set up using the Deployment Tab as described in Section OV3.3. The radio settings are described below.

OV3.3.1 Radio Hop Sequence

Spread Spectrum radios have a band of frequencies that they use. The radios "hop" from one frequency to another within this band, allowing multiple sets of radios to communicate at the same time without interfering with each other. The "Radio Hop Sequence" determines the sequence in which the hops are made. Radios must be set to the same "Radio Hop Sequence" in order to hear each other (i.e., for the listening radio to synchronize with the transmitting radio and hop to the same frequency at the same time). **Set the same hop sequence in all radios.**

OV3.3.2 Radio Address/Radio Net Address

The "Radio Address" and "Radio Net Address" combined are sent as part of a packet header with each message. Even if a radio is on the same hop sequence and can hear another radio, it ignores the message unless that message has its address in the header**. Set the same "Radio Address" and "Radio Net Address" in all radios.**

NOTE RF400 Spread Spectrum Radios that communicate with the CR206, CR211, or CR216 must also be set to the same Radio Address and Radio Net Address. See the RF400 manual for directions on setting these parameters in the RF400.

OV3.3.3 Radio Power Mode

The Radio Power Mode setting determines what portion of the time the radio is powered up "listening" for incoming transmissions and how much power the radio/datalogger consumes from its power supply.

RF_ON: Radio standby receive current <24 mA. The Radio Receiver is always on. This provides the fastest response when the datalogger will be interrogated but because of the current should only be used where an AC backed power supply is available or the speed is absolutely necessary.

RfpinEn: Radio standby receive current 0 mA.: For use as a wireless sensor with a TD datalogger select **RfpinEn** for the Power Mode. This has the lowest power requirement of all settings. The radio is controlled by the CR200 program. As a wireless sensor all transmissions are initiated by the CR200. The radio is only powered for the transmission and a short time after while awaiting the response from the master datalogger.

NOTE In wireless sensor applications, the RF400 on the master datalogger should be set to always on.

RF1_Sec: Radio standby receive current < 2 mA. The radio powers up once a second to listen for transmissions. The maximum response delay is 2 seconds.

RF8_Sec: Radio standby receive current < 0.4 mA. The radio powers up every 8 seconds to listen for transmissions. The maximum response delay is 16 seconds.

RF1S_LH: Radio standby receive current < 2 mA. The radio powers up once a second to listen for transmissions. When it initiates communication it sends long header (>1 second) on messages. This is used only if the datalogger will be initiating communications with SendGetData and other radios in the system are using the 1 second standby mode. The long header insures other radios in the network hear the message.

RF8S_LH: Radio standby receive current < 0.4 mA. The radio powers up every 8 seconds to listen for transmissions. When it initiates communication it sends long header (>8 seconds) on messages. This is used only if the datalogger will be initiating communications with SendGetData and other radios in the system are using the 8 second standby mode. The long header insures other radios in the network hear the message.

After selecting the desired hop, address, and power mode settings, press “Save Settings” to store the values to the radio.

OV3.3.4 RF Protocol

Identifies the radio protocol that will be used for the CR2xx. *In order to be compatible with other CR2xx and RF400 type devices, the default value of transparent must be used.* The following values are supported:

1. Transparent – This mode is compatible with older CR205, CR210, CR215, RF400, RF410, and RF415 operating systems.

2. PakBus – This mode can be used in networks involving RF401/RF411/RF416 hardware or other, newer CR206/CR211/CR216 devices and makes use of the retry capability inherent in the MaxStream radios. *This mode is not compatible with the older radios.*

OV4. Quick Start Tutorial for Programming the CR200

OV4.1 Software Products for the CR200

PC200W Starter Software supports a direct connection (RS232 cable or Spread Spectrum radio) between the PC and the CR200, and includes Short Cut for Windows (Short Cut) for creating CR200 programs. PC200W provides basic tools for setting the datalogger's clock, sending a program, monitoring sensors, and manually collecting and viewing data. CR200 support was added to PC200W in Version 3.0. PC200W is available at no charge from the Campbell Scientific website.

PC400 Datalogger Support Software (mid-level software) supports a variety of telecommunication options, manual data collection, and data display. PC400 includes Short Cut and the CRBasic Program Editor for creating CR200 programs. PC400 does not support combined communication options (e.g., phone-to-RF), PakBus® routing, or scheduled data collection.

LoggerNet Datalogger Support Software (full-featured software) supports combined telecommunication options, data display, and scheduled data collection. The software includes Short Cut and CRBasic for creating CR200 programs, and tools for configuring, trouble-shooting, and managing datalogger networks.

OV4.1.1 Options for Creating CR200 Programs

1. Short Cut is a program generator that creates a datalogger program in four easy steps, and a wiring diagram for the sensors. Short Cut supports the majority of sensors sold by Campbell Scientific, and is recommended for creating straightforward programs that measure the sensors and store data.

2. The CRBasic Editor is a program editor used to create more complex CR200 programs. Short Cut generated programs can be imported into the CRBasic Editor for adding instructions, or for functionality not supported by Short Cut.

OV4.2 Connections to the CR200

Connect the CR200 to the 12V power supply and to the computer as described in Section OV3.1.

OV4.3 PC200W Software

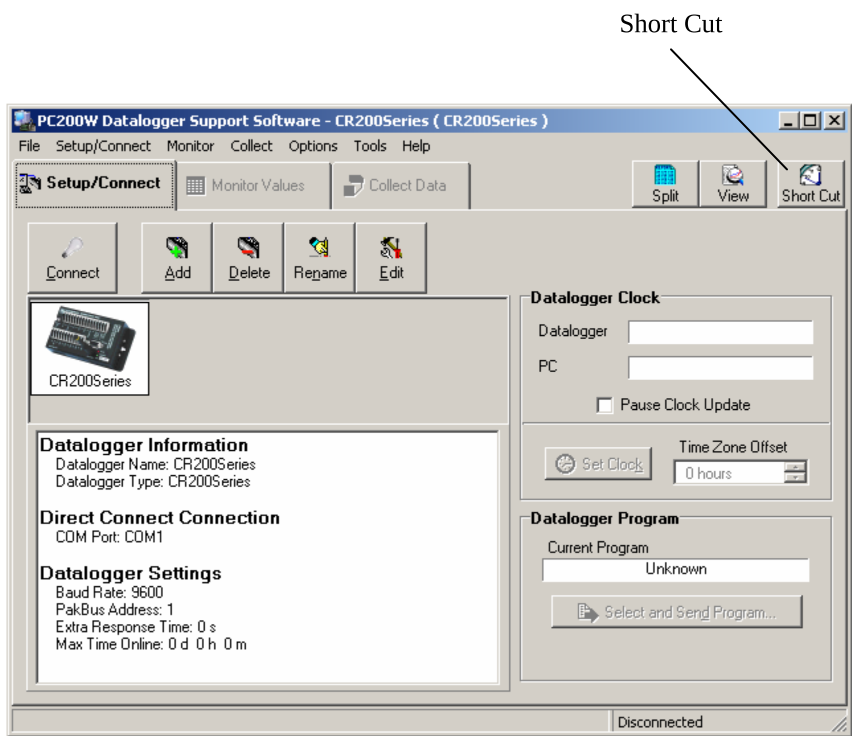
This Quick-Start tutorial prompts the user through the process of programming the CR200, monitoring sensor measurements, collecting data, and viewing data using the PC200W software. Before using PC200W, set the CR200 Pakbus address to 1 as described in Section OV3.

When PC200W is first started, the EZSetup Wizard is launched. Click the **Next** button and follow the prompts to select the **CR200**, the **COM** port on the computer that will be used for communications, **9600** baud, and **Pakbus**

Address 1. When prompted with the option to **Test Communications** click the **Finish** button.

To change a setting in the datalogger setup, select that datalogger from the main window, and click the **Edit** button. If a datalogger was not added with the Wizard, click the **Add** button to invoke the Wizard.

After exiting the EZSetup wizard, the **Setup/Connect** window appears, as shown below. The Current Datalogger Profile, Datalogger Clock, and Datalogger Program features of PC200W are integrated into this window. Tabs to the right are used to select the **Monitor Values** and **Collect Data** windows. Buttons to the right of the tabs are used to run the **Split**, **View**, and **Short Cut** applications.

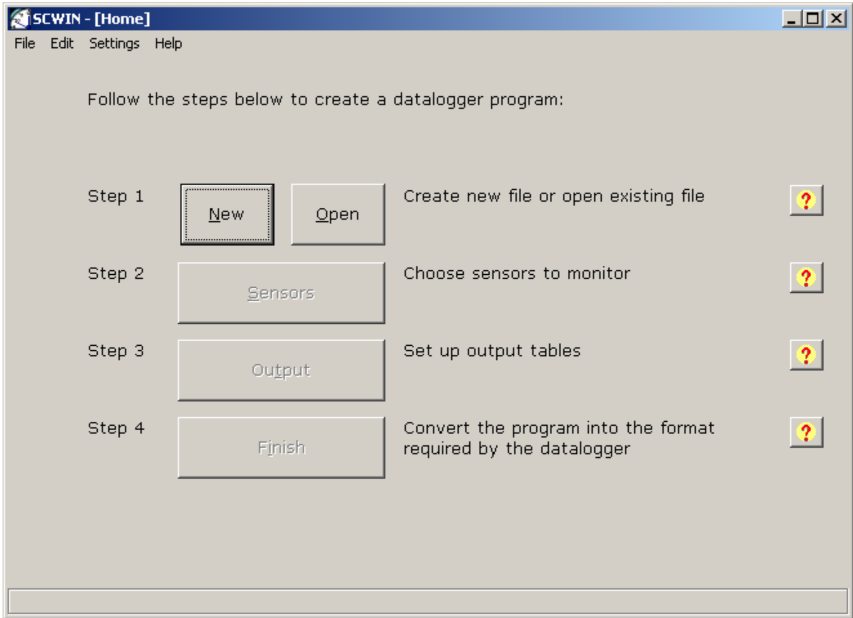


OV4.3.1 Creating a CR200 Program using Short Cut

Objective: Every 10 seconds measure air temperature (°C) with a 109 Temperature Probe, and rainfall (mm) with a TE525WS rain gage. Every 1-minute store average temperature, total rainfall, and minimum battery voltage.

Even if the 109 Temperature Probe and TE525WS Rain Gage sensors are not available, the programming example can still be followed. Without a 109 probe connected the measurement result will be NAN; without a TE525WS connected the measurement result will be 0.

Click on the **Short Cut** button to display the **Home** screen, as shown below.



Each of the four steps has a button with a **?** for accessing Help. Use the Help in conjunction with the steps outlined below:

Step 1: Create a New File

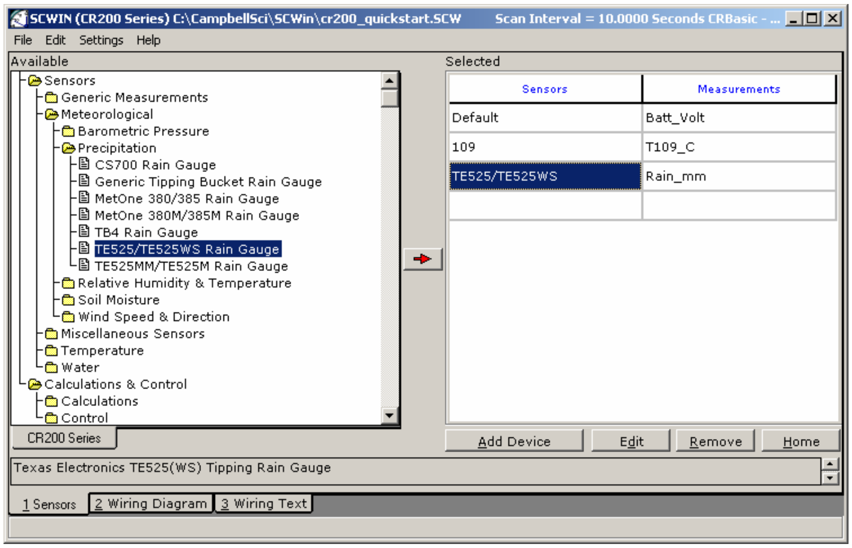
Step 1 is to open a new or existing file. From the **Home** page, click the **New** button. Use the drop-down list box to select the **CR200**. Enter a 10 second Scan Interval and click **OK** to complete Step 1.

Step 2: Select the Sensors

Step 2 is to select the sensors to be measured. From the Home page, click the **Sensors** button. The Sensors worksheet is divided into two sections: the Available sensors tree and the Selected sensors table, as shown below. The sensors you want to measure are chosen from the Available sensors tree.

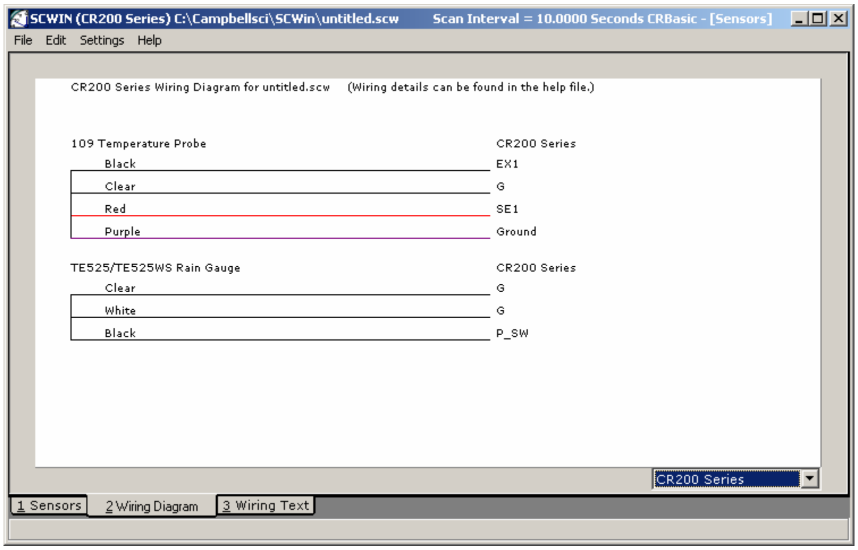
Double click on the **Temperature** application group to display the available sensors. Double click on the **109 Temperature Probe** sensor to add it the selected sensors table. Click **OK** on the next screen to accept T109_C for the measurement label, the DegC for the units.

Double click on the **Meteorological** application group. Double click on Precipitation, and double click on the **TE525 / TE525WS** sensor to add it to the selected sensors table. Click **OK** to accept Rain_mm for the measurement label, and mm for the units.



Click on the **Wiring Diagram** tab to view the sensor wiring diagram, as shown below. Wire the temperature probe and the TE525 rain gauge to the CR200 as shown on the diagram. If you don't have these sensors, a simple toggle switch can be used to simulate the TE525. Without a 109 temperature probe connected, the measurement result will be NAN (not a number).

Click the **Sensors** tab and the **Home** button to return to the Home page to continue with Step 3.



Step 3: Output Processing

Step 3 is to define the output processing for the sensor measurements. From the Home page, click the **Output** button.

The Output screen has a list of Selected Sensors on the left, and Output Tables on the right. The default is for two Tables, Table1 and Table2. Both Tables have a **Store Every** field and the drop-down list box that are used to set the interval at which data will be stored.

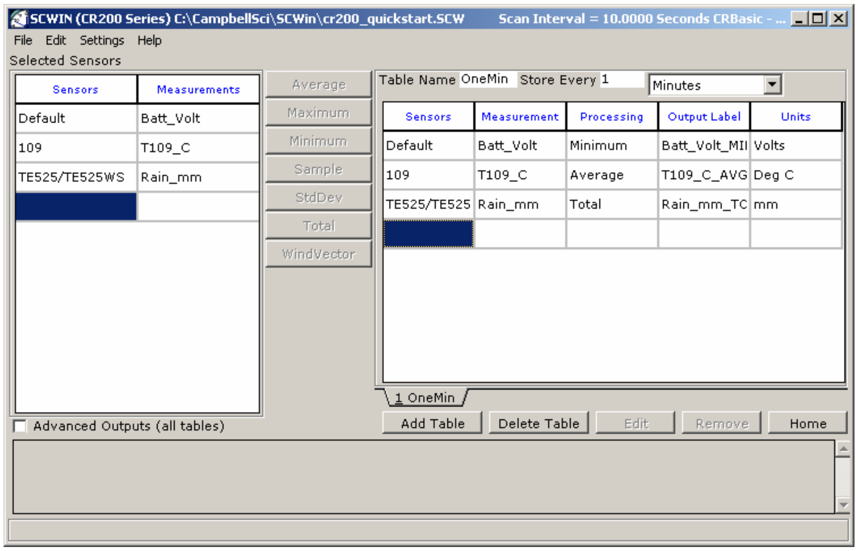
The objective for this exercise calls for a one-minute output processing. To remove Table2, Click on the **Table2** tab to activate it, and click the **Delete Table** button.

The **Table Name** field is the name that will be used for the Table in which the output will be stored. Change the default Name of Table1 to OneMin, and change the interval to 1 minute.

The Selected Sensors Table is provided on the left side of the screen. To add a sensor measurement to the Output Table, highlight a measurement and click one of the output buttons; e.g., Average.

Click the **Default** sensor (battery voltage) and double click the **Minimum** button. Click the **109** temperature sensor and double click the **Average** button. Click the **TE525** rain gauge sensor and double click the **Total** button.

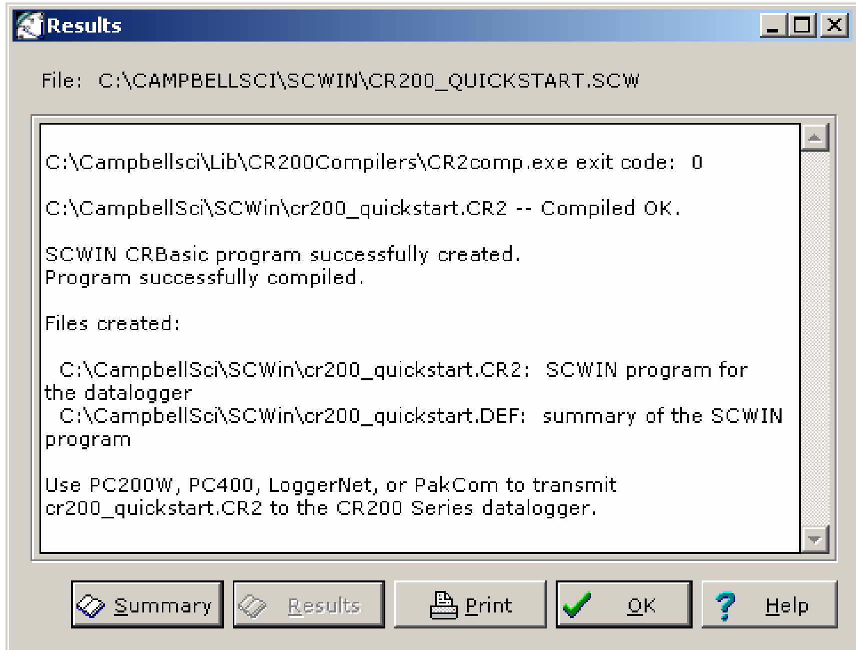
Click the **Home** button to continue with Step 4 to complete the program.



Step 4: Finish

Step 4 is to finish the program. From the Home page, click the **Finish** button. Type in CR200_QuickStart for the file name. Any errors the compiler may have detected are displayed, along with the names of the files that were created. The file C:\Campbellsci\SCWin\CR200_QuickStart.CR2 is the program file that will be sent to the CR200, CR200_QuickStart.def is a summary of the sensor wiring and measurement labels (click the **Summary** or

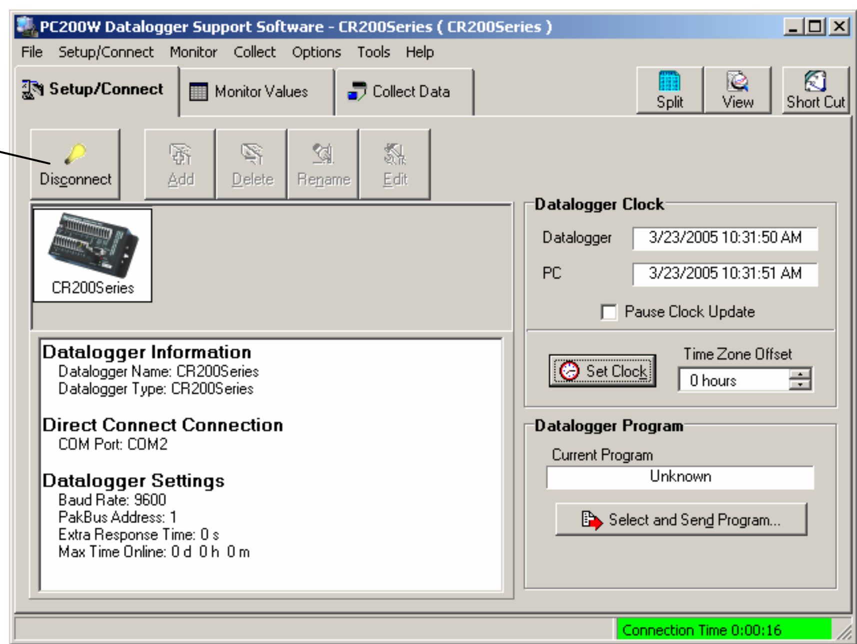
Print buttons to view or print the file). Click the **OK** button and close Short Cut.



OV4.3.2 Configuring the Setup Tab

From the **Setup/Connect** screen, click on the **Connect** button to establish communications with the CR200. When communications have been established, the text on the button will change to **Disconnect**.

Connect Button



OV4.3.3 Synchronize the Clocks

Click the **Set Clock** button to synchronize the datalogger's clock with the computer's clock.

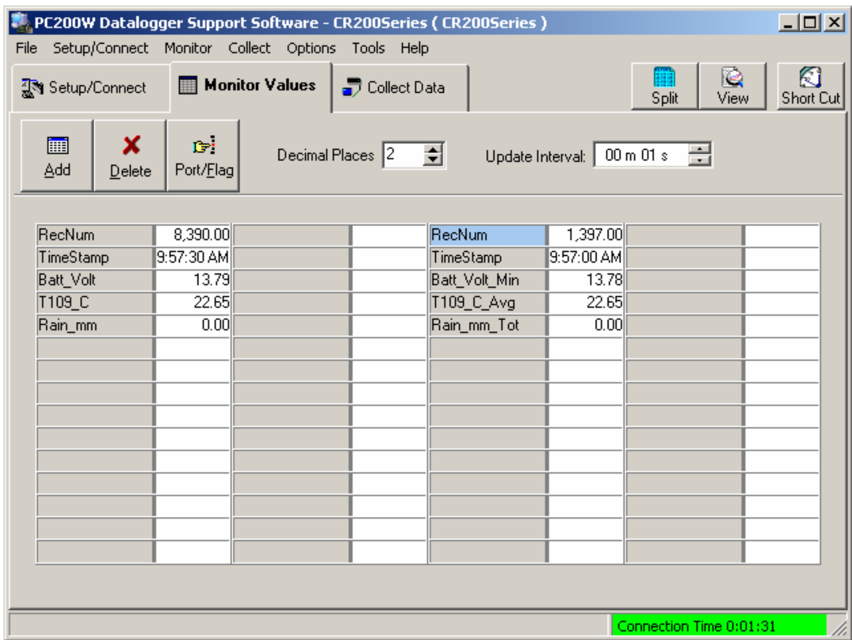
OV4.3.4 Send the Program

Click the **Select and Send Program** button. Navigate to the C:\CampbellSci\SCWin folder and select the file CR200_QuickStart.CR2 and click the **Open** button. A progress bar is displayed, followed by a message that the program was successfully sent.

OV4.3.5 Monitor Data Tables

The Monitor Values window is used to display the current sensor measurement values from the Public Table, and the most recent data from the OneMin Table.

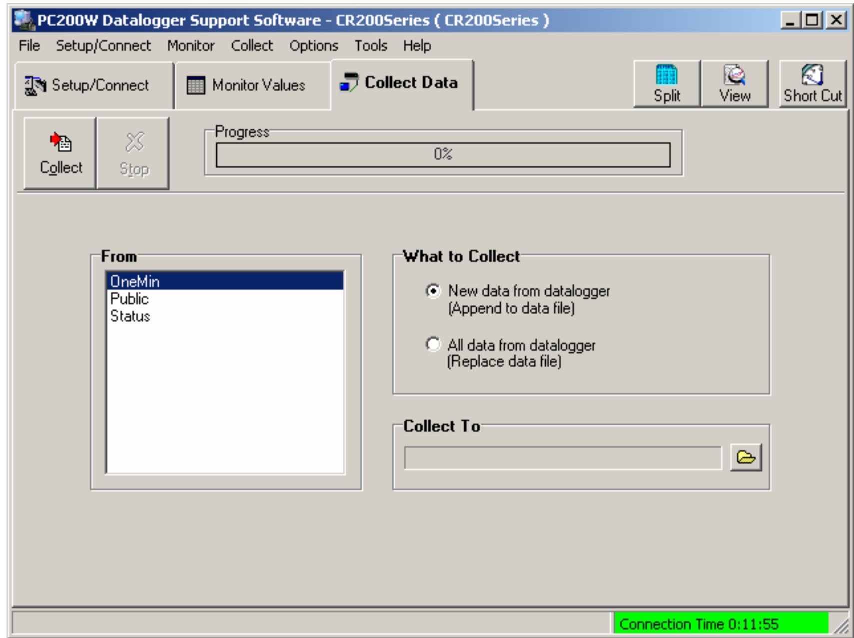
Click on the **Monitor Values** tab. The Public Table is automatically selected and displayed. To view the OneMin Table, click the **Add** button, select the **OneMin** Table, and click the **Paste** button.



OV4.3.6 Collect Data

Click on the **Collect Data** tab. From the Collect Data window you can choose what data to collect, and where to store the retrieved data.

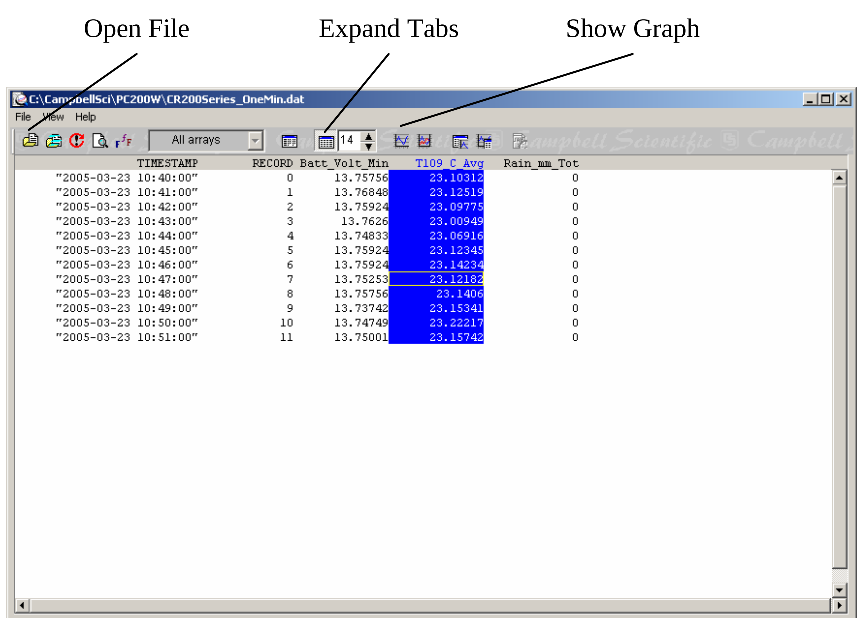
Click on the **OneMin** Table, with the Option **New data from datalogger** selected. Click the **Collect** button and a dialog box appears, prompting for a file name. Click the **Save** button to use the default file name CR200_OneMin.dat. A progress bar, followed by the message **Collection Complete** is displayed.

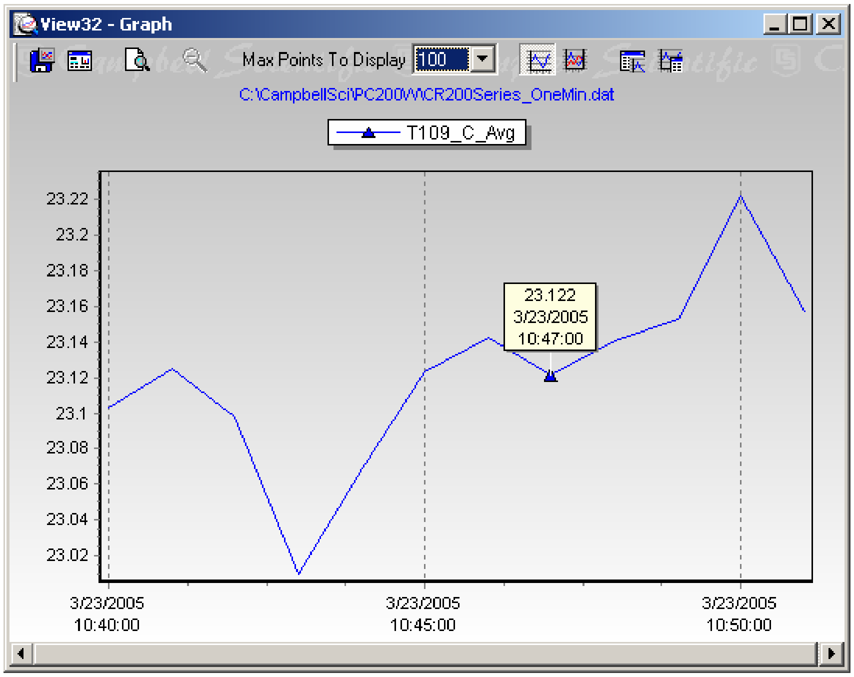


OV4.3.7 View Data

To view the collected data, click on the **View** button (located in the upper right hand corner of the main screen). Options are accessed by using the menus or by selecting the toolbar icons. If you move and hold the mouse over a toolbar icon for a few seconds, a brief description of that icon's function will appear.

To open a data file, click the **Open file** icon, and double click on the file CR200_OneMin.dat in the PC200W folder. Click the **Expand Tabs** icon to display the data in columns with column headings. To graph thermocouple temperature, click on the data column with the heading Temp_C, then click the **Show Graph, 1 Y axis** icon on the toolbar.





Close the graph and view screens, and close PC200W.

OV4.5 Programming using the CRBasic Program Editor

Users who are not familiar with the CRBasic programming language may find Short Cut to be an excellent way to learn CRBasic. First create a program using Short Cut, then open the file with CRBasic to see how Short Cut created the program. The program file listed below is the Short Cut file 200_QuickStart.CR1 from the tutorial after being imported into the CRBasic editor.

See Section 4 for information on the CRBasic programming.

```
'CR200 Series
'Created by SCWIN (2.2)

'Declare Variables and Units
Public Batt_Volt
Public T109_C
Public Rain_mm

Units Batt_Volt=Volts
Units T109_C=Deg C
Units Rain_mm=mm

'Define Data Tables
DataTable(OneMin,True,-1)
    DataInterval(0,1,Min)
    Minimum(1,Batt_Volt,False,False)
    Average(1,T109_C,False)
    Totalize(1,Rain_mm,False)
EndTable
```

```
'Main Program
BeginProg
    Scan(10,Sec)
        'Default Datalogger Battery Voltage measurement Batt_Volt:
        Battery(Batt_Volt)
        '109 Temperature Probe measurement T109_C:
        Therm109(T109_C,1,1,1,1.0,0.0)
        'TE525/TE525WS Rain Gauge measurement Rain_mm:
        PulseCount(Rain_mm,P_SW,2,0,0.254,0)
        'Call Data Tables and Store Data
        CallTable(OneMin)
    NextScan
EndProg
```

OV5. Specifications

ANALOG INPUTS; DIGITAL I/O

Channels SE1 to SE5 can be individually configured for single-ended measurement or digital I/O.

SINGLE-ENDED MEASUREMENT (SE1 TO SE5):
- Analog Input Range: 0 ≤ V < 2.5 Vdc
- Measurement Resolution: 0.6 mV
- Measurement Accuracy
  - Typical: ±(0.25% of reading + 1.2 mV offset) over -40° to +50°C
  - Worst-case: ±(1% of reading + 2.4 mV offset) over -40° to 50°C

DIGITAL I/O (SE1 TO SE5):
- Input/Output High State: 2.1 to 3.3 Vdc
- Input/Output Low State: <0.9 Vdc
- Output High State: 3.3 V (no load)
- Drive Current: 220 µA @ 2.7 Vdc
- Maximum Input Voltage: 4 Vdc

HALF BRIDGE MEASUREMENTS:
- Accuracy: Relative to the excitation. Using +2.5 Vdc excitation, is ±(0.06% of reading + 2.4 mV)

PERIOD AVERAGING (SE1 TO SE4):
- Maximum Input Voltage: 4 Vdc
- Frequency Range: 0 to 150 kHz
- Voltage Threshold: counts cycles on transition from <0.9 Vdc to >2.1 Vdc

EXCITATION CHANNELS (EX1 AND EX2):
- Range: Programmable 0, 2.5, 5 Vdc, or off (floating)
- Accuracy: ±25 mV on +2.5 Vdc range, ±125 mV on +5.0 Vdc range
- Maximum Current: 25 mA on +2.5 Vdc range, 10 mA on +5.0 Vdc range

CONTROL PORTS (C1 AND C2)

DIGITAL I/O:
- Voltage Level When Configured as Input: <0.9 Vdc (low state) to >2.7 Vdc (high state)
- Voltage Level When Configured as Output: 0 V (low state), 5 Vdc (high state) (no load)
- Logic Level: TTL
- Drive Current: 1.5 mA @ 4.5 V

SDI-12: SDI-12 sensors connect to C1

PULSE COUNTERS

SWITCH CLOSURE (P_SW):
- Maximum Count Rate: 100 Hz
- Minimum Switch Open Time: 5 ms
- Minimum Switch Closed Time: 5 ms
- Maximum Bounce Time: 4 ms

PULSE COUNT (P_SW, C1, AND C2):
- Voltage Threshold: count on transition from <0.9 V to >2.7 Vdc
- Maximum Input Frequency: 1 kHz
- Max Input Voltage: C1 & C2 (6.5 V), P_SW (4 Vdc)

LOW LEVEL AC (P_LL):
- Voltage Threshold: <0.5 to >2 V
- Minimum Input: 20 mV RMS
- Maximum Frequency: 1 kHz
- Maximum Input: ±20 V

Note: P_LL, C1, & C2 can be used for switch closure using the battery voltage and a 20 kOhm pull-up resistor. If the dc offset is >0.5 V, then AC coupling is required.

COMMUNICATIONS

SERIAL INTERFACE: Female RS-232 9-pin interface for logger-to-PC communications

ON-BOARD SPREAD SPECTRUM RADIO:
- Frequency: 915 MHz (CR206), 922 MHz (CR211), or 2.4 GHz (CR216)
- Transmission Range: 1 mile with 0 dBd ¼ wave antenna (line-of-sight) and 900 MHz radios; 0.6 miles (1 km) with 0 dBd ½ wave antenna (line-of-sight) and 2.4 GHz radio; up to 10 miles with higher gain antenna (line-of-sight)
- RF4XX used as a base station radio

AVAILABLE RADIO TRANSMISSION MODES:
- Always on, program controlled
- Cycle Time: 1 or 8 s cycles; on for 100 ms every period; checks for incoming communication
- Scheduled Transmission Time: off until transmission time
- PakBus® packet switching network protocol

CLOCK ACCURACY

8.2 minutes/month @ -40° to +50°C; 1 minute/month @ +25°C

CPU AND STORAGE

FINAL STORAGE: 512 kbyte Flash, data format is 4 bytes per data point (table-based)

PROGRAM STORAGE: 6.5 kbyte Flash

FASTEST SCAN RATE: once per second

SWITCHED BATTERY (SW BATTERY)

Switched under program control; 300 mA minimum current available

POWER

BATTERY VOLTAGE RANGE: 7 to 16 Vdc (can program datalogger to measure internal battery voltage)

BATTERY: 12 Vdc sealed rechargeable with on-board charging circuit. Alkaline cells, lithium, or other non-rechargeable battery types may be connected if the charging circuit is not used (i.e. nothing connected to charging terminals).

CHARGER INPUT VOLTAGE: 16 to 22 Vdc

SHELF LIFE OF CLOCK'S BACKUP BATTERY: 5 years

CURRENT DRAIN (@12 V)

QUIESCENT CURRENT DRAIN:
- No Radio or Radio Powered Off: ~0.2 mA

ACTIVE CURRENT DRAIN:
- No radio ~3 mA
- Radio receive ~20 mA (CR206, CR211), ~36 mA (CR216)
- Radio transmit ~75 mA (CR206, CR211, CR216)

AVERAGE CONTINUOUS CURRENT DRAIN:
- Radio always on ~20 mA (CR206, CR211), ~36 mA (CR216)
- Radio in 1 s duty cycle ~2.2 mA (CR206, CR211), ~4 mA (CR216)
- Radio in 8 s duty cycle ~0.45 mA (CR206, CR211), ~0.8 mA (CR216)

CE COMPLIANCE (as of 03/02)

CE COMPLIANT DATALOGGERS: CR200, CR206, CR211, CR216

STANDARD(S) TO WHICH CONFORMITY IS DECLARED: IEC61326:2002

EMI AND ESD PROTECTION

IMMUNITY: Meets or exceeds following standards:
- ESD: per IEC 1000-4-2; ±8 kV air, ±4 kV contact discharge
- RF: per IEC 1000-4-3; 3 V/m, 80-1000 MHz
- EFT: per IEC 1000-4-4; 1 kV power, 500 V I/O
- Surge: per IEC 1000-4-5; 1 kV power and I/O
- Conducted: per IEC 1000-4-6; 3 V 150 kHz-80 MHz

Emissions and immunity performance criteria available on request.

PHYSICAL

CASE DESCRIPTION: Aluminum with spring-loaded terminals

DIMENSIONS (including terminals): 5.5” x 3” x 2” (14.0 x 17.6 x 5.1 cm)

WEIGHT:
- CR200 or CR295: 8.5 oz (242 g)
- CR206, CR211, or CR216: 9.5 oz (271 g)

CUSTOM CASE: available for OEM applications; contact Campbell Scientific

WARRANTY

One year covering parts and labor.

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