INSTRUCTION MANUAL

CS210 Enclosure Relative Humidity Sensor

Revision: 4/16

Guarantee

This equipment is guaranteed against defects in materials and workmanship. We will repair or replace products which prove to be defective during the guarantee period as detailed on your invoice, provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

Campbell Scientific will return guaranteed equipment by surface carrier prepaid. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This guarantee and the Company's obligation thereunder is in lieu of all other guarantees, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request. It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment, in support of this policy a "Declaration of Hazardous Material and Decontamination" form will be issued for completion.

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Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

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PLEASE READ FIRST

About this manual

Please note that this manual was originally produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this origin.

Some useful conversion factors:

Area: 1 in^2 (square inch) = 645 mm^2

Length: 1 in. (inch) = 25.4 mm
1 ft (foot) = 304.8 mm
1 yard = 0.914 m
1 mile = 1.609 km

Mass: 1 oz. (ounce) = 28.35 g
1 lb (pound weight) = 0.454 kg

Pressure: 1 psi (lb/in^2) = 68.95 mb

Volume: 1 UK pint = 568.3 ml
1 UK gallon = 4.546 litres
1 US gallon = 3.785 litres

In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to European users.

Differences include the U.S standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for British/European use. *Please note, however, that when a power supply adapter is ordered it will be suitable for use in your country.*

Reference to some radio transmitters, digital cell phones and aerials may also not be applicable according to your locality.

Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the European market; in some cases alternatives are offered. Details of the alternatives will be covered in separate manuals.

Part numbers prefixed with a "#" symbol are special order parts for use with non-EU variants or for special installations. Please quote the full part number with the # when ordering.

Recycling information

At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the products life should be removed from the product and also be sent to an appropriate recycling facility.

Campbell Scientific Ltd can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories.

For further advice or support, please contact Campbell Scientific Ltd, or your local agent.

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Precautions

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND **TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC**. FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.eu or by telephoning +44(0) 1509 828 888 (UK). You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a **hardhat** and **eye protection**, and take **other appropriate safety precautions** while working on or around tripods and towers.
- **Do not climb** tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- **You can be killed** or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in **contact with overhead or underground utility lines**.
- Maintain a distance of at least one-and-one-half times structure height, or 20 feet, or the distance required by applicable law, **whichever is greater**, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

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CS210 Enclosure Relative Humidity Sensor

1. Introduction

NOTE The CS210 was once known as the 10162.

The CS210 enclosure humidity sensor contains an Elan HM2000 series precision bulk-polymer relative humidity sensor. It is used to monitor the relative humidity (RH) inside an equipment enclosure deployed in the field.

NOTE This manual provides information only for CRBasic dataloggers. It is also compatible with our retired Edlog dataloggers. For Edlog datalogger support, see an older manual at *www.campbellsci.com/old-manuals* or contact a Campbell Scientific application engineer for assistance.

2. Precautions

- READ AND UNDERSTAND the *Safety* section at the front of this manual.
- The CS210 is a precision instrument. Please handle it with care.
- The black outer jacket of the cable is Santoprene® rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.

3. Initial Inspection

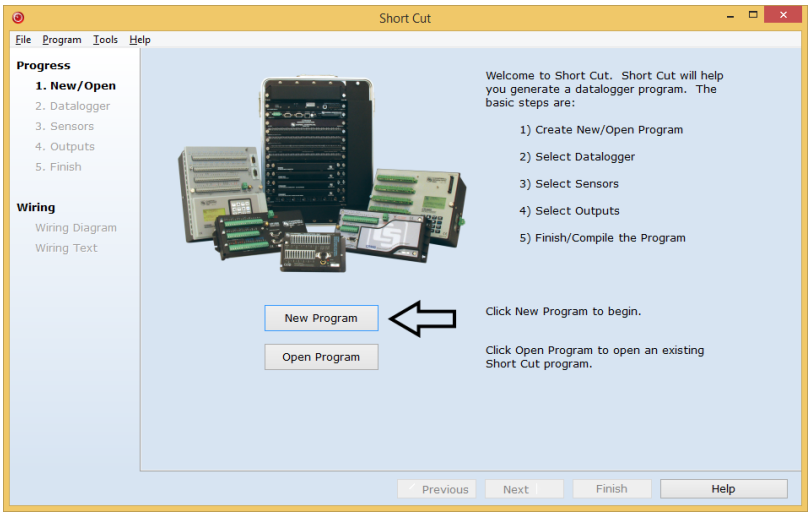
- Upon receipt of the CS210, inspect the packaging and contents for damage. File damage claims with the shipping company.
- Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.

4. QuickStart

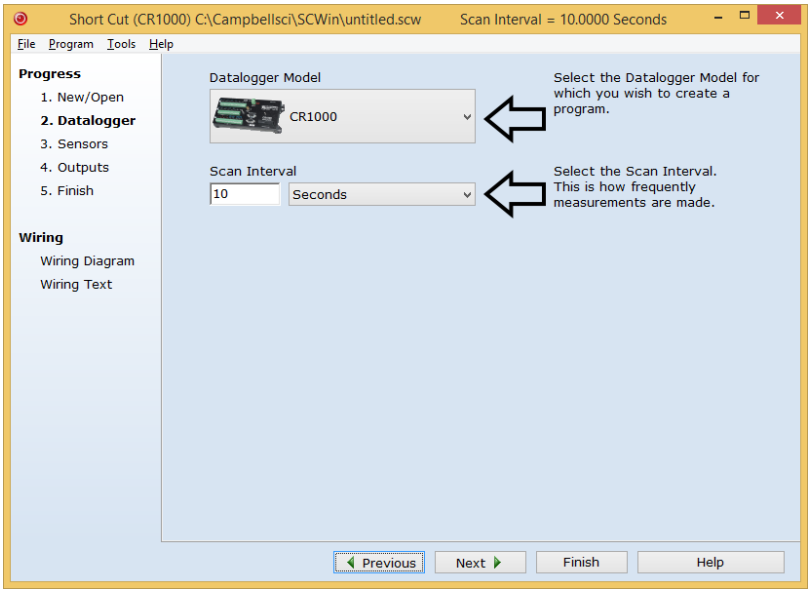
Short Cut is an easy way to program your datalogger to measure the CS210 and assign datalogger wiring terminals. *Short Cut* is available as a download on *www.campbellsci.com* and the *ResourceDVD*. It is included in installations of *LoggerNet*, *PC200W*, *PC400*, or *RTDAQ*.

Use the following procedure to get started.

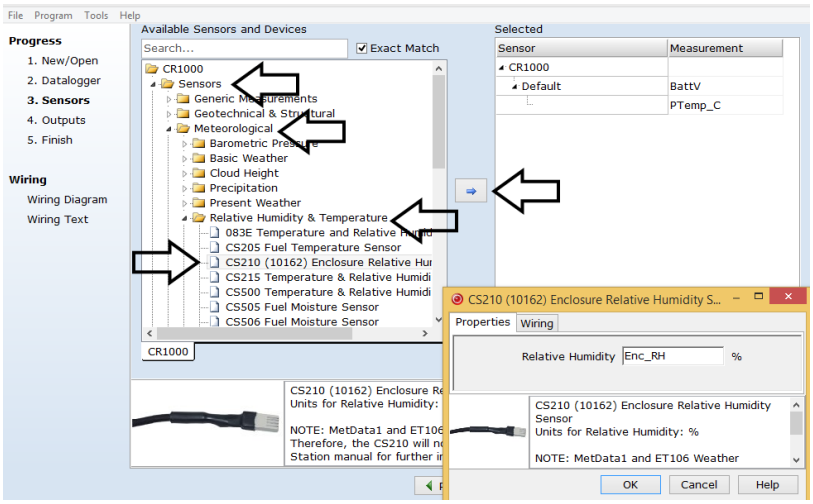
1. Open *Short Cut*. Click **New Program**.



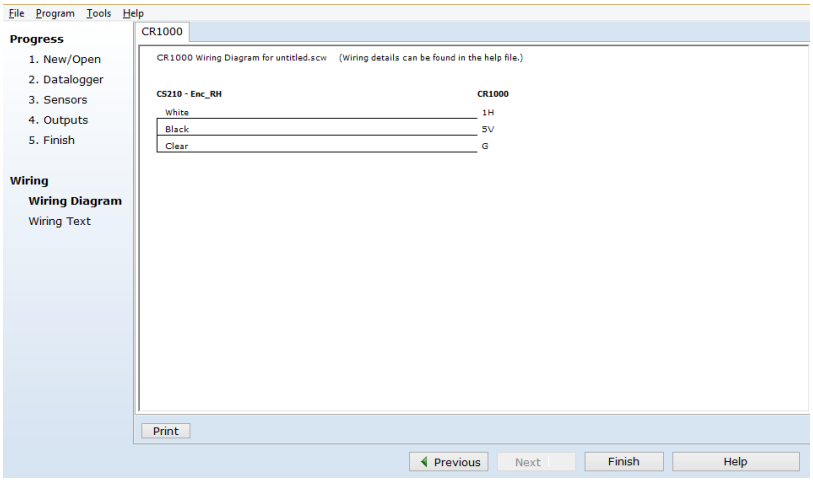
2. Select **Datalogger Model** and **Scan Interval** (must be at least **10** seconds). Click **Next**.



3. Under the **Available Sensors and Devices** list, select the **Sensors** | **Meteorological** | **Relative Humidity & Temperature** | **CS210 (10162) Enclosure Relative Humidity Sensor**. Click  to move the selection to the selected device window. The units are percent.



4. After selecting the sensor, click **Wiring Diagram** to see how the sensor is to be wired to the datalogger. The wiring diagram can be printed now or after more sensors are added.



5. Select any other sensors you have, then finish the remaining *Short Cut* steps to complete the program. The remaining steps are outlined in *Short Cut Help*, which is accessed by clicking on **Help** | **Contents** | **Programming Steps**.

6. If *LoggerNet*, *PC400, RTDAQ*, or *PC200W* is running on your PC, and the PC to datalogger connection is active, you can click **Finish** in *Short Cut* and you will be prompted to send the program just created to the datalogger.

7. If the sensor is connected to the datalogger, as shown in the wiring diagram in step 4, check the output of the sensor in the datalogger support software data display to make sure it is making reasonable measurements.

5. Specifications

Features:

- Allows enclosure RH to be monitored remotely
- Used to schedule desiccant replacement
- Compatible with Campbell Scientific CRBasic dataloggers: CR200(X) series, CR300 series, CR6 series, CR800 series, CR1000, CR3000, CR5000, and CR9000(X)

Sensor:	Elan HM2000 series precision bulk-polymer
Relative Humidity Measurement Range:	0 to 100% non-condensing
RH Output Signal Range:	0 to 1.0 Vdc
Accuracy at 25 °C:	±3% RH (10 to 90% RH) unspecified (0 to 10% RH and 90 to 100% RH)
Typical Long Term Stability:	Better than 3% RH per year
Response Time (at 25 °C, 90% response):	10 s for a 30% to 90% RH step change
Operating Temperature:	0 to 50 °C
Storage Temperature:	–40 to 80 °C
Probe Length:	2.5 cm (1.0 in)
Probe Cross Section Area:	0.8 cm x 1.3 cm (0.3 in x 0.5 in)
Current Consumption:	<0.5 mA
Supply Voltage:	5 ± 0.25 Vdc
Settling Time:	10 s

6. Installation/Operation

If you are programming your datalogger with *Short Cut*, skip Section 6.2, *Wiring* (p. 5), and Section 6.3, *Programming* (p. 6). *Short Cut* does this work for you. See Section 4, *QuickStart* (p. 1), for a *Short Cut* tutorial.

6.1 Mounting

Mount the CS210 inside the environmental enclosure or onto a datalogger using the mounting block and the wire tie included with the sensor (FIGURE 6-1). The probe has a 28 cm (11 in) cable length, which should be adequate to place the probe near the enclosure conduits.

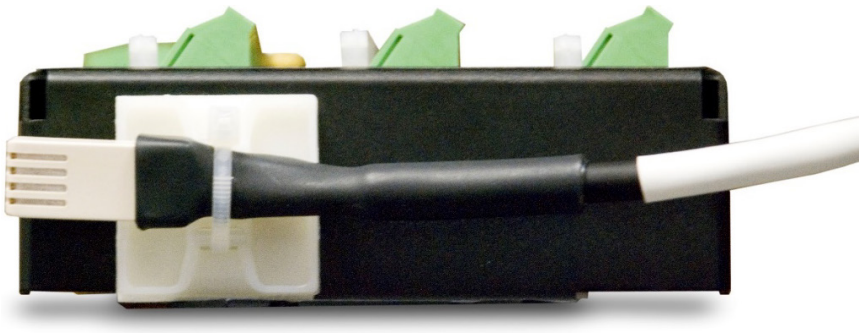


FIGURE 6-1. CS210 Installed on a CR1000

6.2 Wiring

Connections to Campbell Scientific dataloggers are given in TABLE 6-1 and FIGURE 6-2.

TABLE 6-1. Wire Color, Wire Function, and Datalogger Connection

Wire Color	Wire Function	Datalogger Connection Terminal
White	Signal	**U** configured for single-ended analog input[1], **SE** (single-ended, analog-voltage input)
Clear	Signal Reference	**AG** or ⏚ (analog ground)
Black	Power	**U** configured for 5 V source[1], **5V**, **C** (control port)
[1]**U** channels are automatically configured by the measurement instruction.		

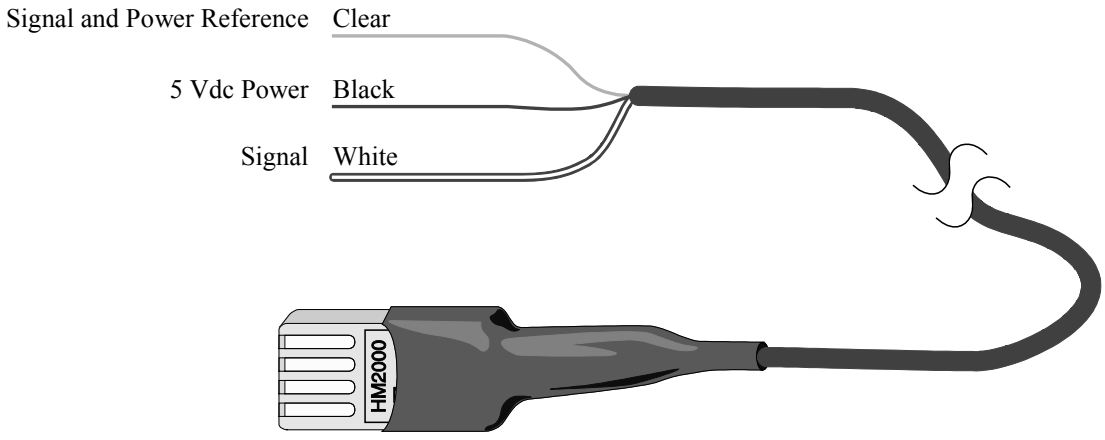


FIGURE 6-2. CS210 Wiring

6.3 Programming

Short Cut is the best source for up-to-date datalogger programming code. Programming code is needed when:

- Creating a program for a new datalogger installation
- Adding sensors to an existing datalogger program

If your data acquisition requirements are simple, you can probably create and maintain a datalogger program exclusively with *Short Cut*. If your data acquisition needs are more complex, the files that *Short Cut* creates are a great source for programming code to start a new program or add to an existing custom program.

NOTE *Short Cut* cannot edit programs after they are imported and edited in *CRBasic Editor*.

A *Short Cut* tutorial is available in Section 4, *QuickStart* *(p. 1)*. If you wish to import *Short Cut* code into *CRBasic Editor* to create or add to a customized program, follow the procedure in Appendix A, *Importing Short Cut Code Into CRBasic Editor* *(p. A-1)*. Programming basics for CRBasic dataloggers are in the following section. Complete program examples for select CRBasic dataloggers can be found in Appendix B, *Example Programs* *(p. B-1)*. Programming basics and programming examples for Edlog dataloggers are provided at *www.campbellsci.com\old-manuals*.

6.3.1 CRBasic Instructions

The relative humidity signal from the CS210 is measured using the **VoltSE()** CRBasic instruction. The CR200(X) series dataloggers use a control port to power the CS210. At the beginning of the program, use the **PortSet** instruction to turn on the control port, and the port should remain on. It takes the CS210 approximately 10 s for the reading to become stable after the port has been turned on. Depending on the scan rate, the first few measurements from the CS210 could be low.

The VoltSE instruction has the following format:

```
VoltSE( Dest, Reps, Range, SEChan, MeasOff, SettlingTime,
    Integ/fnotch, Mult, Offset )
```

For ***Range***, use ***mV2500*** (CR300, CR1000) or ***mV5000*** (CR6, CR3000, CR5000). If the sensor will be in electrically noisy environments, use 50 Hz or 60 Hz rejection for ***Integ/f_{notch}***.

The probe output scale is 0 to 1000 millivolts for the relative humidity range of 0 to 100%. TABLE 6-2 provides calibration information for relative humidity.

TABLE 6-2. Calibration for Relative Humidity

Units	Multiplier (% mV^{-1})	Offset (%)
Percent	0.1	0

6.4 Enclosure Humidity

Change the enclosure desiccant packs (model number 4905) when the enclosure relative humidity exceeds 40%.

Campbell Scientific recommends placing desiccant packs inside the enclosure and sealing all cable entry ports that do not use a sealed bulkhead connector with plumber's putty. Spikes in the enclosure humidity are a result of opening the enclosure door and allowing ambient air inside the enclosure. The enclosure relative humidity will return its nominal values (values before the enclosure door was opened) in approximately three to four hours.

7. Maintenance

The CS210 does not have any user serviceable parts nor does it require any routine maintenance.

Replace the CS210 probe every three to five years of continuous use. If the probe fails, replace it with a new one.

Appendix A. Importing Short Cut Code Into CRBasic Editor

This tutorial shows:

- How to import a *Short Cut* program into a program editor for additional refinement
- How to import a wiring diagram from *Short Cut* into the comments of a custom program

Short Cut creates files, which can be imported into *CRBasic Editor*. Assuming defaults were used when *Short Cut* was installed, these files reside in the C:\campbellsci\SCWin folder:

- .DEF (wiring and memory usage information)
- .CR2 (CR200(X)-series datalogger code)
- .CR300 (CR300-series datalogger code)
- .CR6 (CR6-series datalogger code)
- .CR8 (CR800-series datalogger code)
- .CR1 (CR1000 datalogger code)
- .CR3 (CR3000 datalogger code)
- .CR5 (CR5000 datalogger code)
- .CR9 (CR9000(X) datalogger code)

Use the following procedure to import *Short Cut* code and wiring diagram into *CRBasic Editor*.

1. Create the *Short Cut* program following the procedure in Section 4, *QuickStart (p. 1)*. Finish the program and exit *Short Cut*. Make note of the file name used when saving the *Short Cut* program.
2. Open *CRBasic Editor*.
3. Click **File** | **Open**. Assuming the default paths were used when *Short Cut* was installed, navigate to C:\CampbellSci\SCWin folder. The file of interest has the .CR2, .CR300, .CR6, .CR8, .CR1, .CR3, .CR5, or .CR9 extension. Select the file and click **Open**.
4. Immediately save the file in a folder different from C:\Campbellsci\SCWin, or save the file with a different file name.

NOTE Once the file is edited with *CRBasic Editor*, *Short Cut* can no longer be used to edit the datalogger program. Change the name of the program file or move it, or *Short Cut* may overwrite it next time it is used.

5. The program can now be edited, saved, and sent to the datalogger.
6. Import wiring information to the program by opening the associated .DEF file. Copy and paste the section beginning with heading "-Wiring for CRXXX–" into the CRBasic program, usually at the head of the file. After pasting, edit the information such that an apostrophe (**'**) begins each line. This character instructs the datalogger compiler to ignore the line when compiling.

Appendix B. Example Programs

Our CR6-series, CR300-series, CR800-series, CR3000, CR5000, and CR9000(X) dataloggers are programmed similarly to the CR1000 example.

The CR200(X) program turns on control port 2 to power the CS210. Notice that the scan rate is set at 10 seconds. The sensor won't give a good reading until the second scan.

CRBasic Example B-1. Sample CR1000 Program

```
'CR1000 Series Datalogger

'SENSOR WIRING
'CS210
'Black: 5V
'White: SE1
'Clear: G

'Declare Public Variables
Public PanelTempC
Public Batt_Volt
Public Enc_RH

'Define Data Tables
DataTable (Daily,1,-1)
  DataInterval (0,1,Day,10)
  Minimum (1,Batt_Volt,FP2,0,False)
  Minimum (1,PanelTempC,FP2,False,False)
  Maximum (1,PanelTempC,FP2,False,False)
  Maximum (1,Enc_RH,FP2,False,False)
EndTable

'Main Program
BeginProg
  Scan (10,Sec,0,0)
    PanelTemp (PanelTempC,250)
    Battery (Batt_volt)
    'Measure CS210. Sensor is on all the time. Don't need a delay.
    VoltSe (Enc_RH,1,mV2500,1,1,0,250,0.1,0)
    'Set the sensor to 100% if it exceeds 100%.
    If Enc_RH > 100 Then Enc_RH = 100

    CallTable Daily
  NextScan
EndProg
```

CRBasic Example B-2. Sample CR200(X) Program

```
'CR200(X)-Series Datalogger
'To create a different opening program template, type in new
'instructions and select Template | Save as Default Template
'date:
'program author:

'SENSOR WIRING
'CS210
'Black: C2
'White: SE1
'Clear: G

'Declare Public Variables
'Example:
Public batt_volt
Public Enc_RH

'Define Data Tables
DataTable (Daily,1,-1)
  DataInterval (0,24,hr)
  Minimum (1,batt_volt,0,0)
  Maximum (1,Enc_RH,False,0)
EndTable

'Main Program
BeginProg
  Scan (10,Sec)
    Battery (Batt_volt)

    'Power the CS210 using C2 and leave it on.
    PortSet (C2,1 )
    VoltSe (Enc_RH,1,1,0.1,0)
    'Set the sensor to 100% if it exceeds 100%.
    If Enc_RH > 100 Then Enc_RH = 100

    CallTable Daily
  NextScan
EndProg
```

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