INSTRUCTION MANUAL

020C Wind Direction Sensor

Revision: 6/16

Limited Warranty

"Products manufactured by CSI are warranted by CSI to be free from defects in materials and workmanship under normal use and service for twelve months from the date of shipment unless otherwise specified in the corresponding product manual. (Product manuals are available for review online at *www.campbellsci.com*.) Products not manufactured by CSI, but that are resold by CSI, are warranted only to the limits extended by the original manufacturer. Batteries, fine-wire thermocouples, desiccant, and other consumables have no warranty. CSI's obligation under this warranty is limited to repairing or replacing (at CSI's option) defective Products, which shall be the sole and exclusive remedy under this warranty. The Customer assumes all costs of removing, reinstalling, and shipping defective Products to CSI. CSI will return such Products by surface carrier prepaid within the continental United States of America. To all other locations, CSI will return such Products best way CIP (port of entry) per Incoterms ® 2010. This warranty shall not apply to any Products which have been subjected to modification, misuse, neglect, improper service, accidents of nature, or shipping damage. This warranty is in lieu of all other warranties, expressed or implied. The warranty for installation services performed by CSI such as programming to customer specifications, electrical connections to Products manufactured by CSI, and Product specific training, is part of CSI's product warranty. **CSI EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE**. **CSI hereby disclaims, to the fullest extent allowed by applicable law, any and all warranties and conditions with respect to the Products, whether express, implied or statutory, other than those expressly provided herein.**"

Assistance

Products may not be returned without prior authorization. The following contact information is for US and international customers residing in countries served by Campbell Scientific, Inc. directly. Affiliate companies handle repairs for customers within their territories. Please visit *www.campbellsci.com* to determine which Campbell Scientific company serves your country.

To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 227-9000. Please write the issued RMA number clearly on the outside of the shipping container. Campbell Scientific's shipping address is:

CAMPBELL SCIENTIFIC, INC.
RMA#_____
815 West 1800 North
Logan, Utah 84321-1784

For all returns, the customer must fill out a "Statement of Product Cleanliness and Decontamination" form and comply with the requirements specified in it. The form is available from our website at *www.campbellsci.com/repair*. A completed form must be either emailed to *repair@campbellsci.com* or faxed to (435) 227-9106. Campbell Scientific is unable to process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.

Safety

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.com or by telephoning (435) 227-9000 (USA). 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, 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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CRBasic Example

020C Wind Direction Sensor

1. Introduction

The 020C Wind Direction Sensor measures azimuth with research-grade accuracy and precision. Campbell Scientific recommends the 020C for wind farm power performance research, such as on eighty- and ninety-meter met towers. The 020C is especially suited to applications requiring a low starting threshold, a high damping ratio, or a short delay distance.

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*.

2. Precautions

- READ AND UNDERSTAND the *Safety* section at the front of this manual.

- The 020C is a precision instrument. Please handle it with care.

- If the 020C will be installed at heights over six feet, be familiar with tower safety and follow safe tower-climbing procedures.

- **Danger** — Use extreme care when working near overhead electrical wires. Check for overhead wires before mounting the 020C or before raising a tower.

3. Initial Inspection

- Upon receipt of the 020C, inspect packaging and contents for damage. File damage claims with the shipping company.

- The model number and cable length are printed on a label at the connection end of the cable. Check this information against the shipping documents to ensure the expected product and cable length are received.

4. QuickStart

Short Cut is an easy way to program your datalogger to measure the 020C 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**.
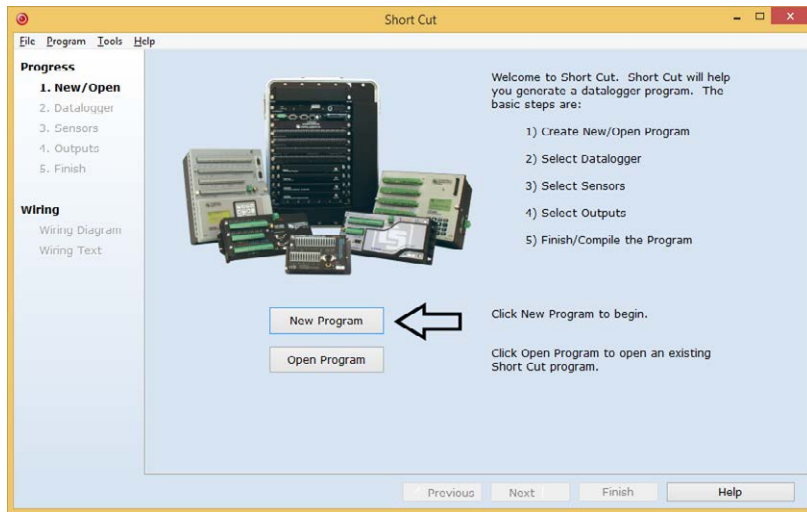
2. Select **Datalogger Model** and **Scan Interval** (default of **5** seconds is **OK** for most applications). Click **Next**.
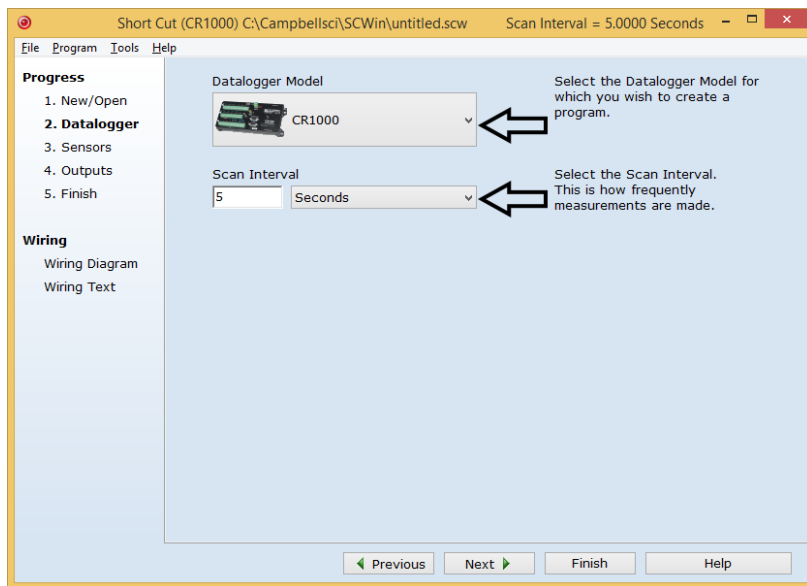
3. Under the **Available Sensors and Devices** list, select the **Sensors | Meteorological | Wind Speed & Direction** folder. Select **020C Wind Direction Sensor** and click to move the selection to the selected device window. When the sensor points south with the hub and column notches aligned, no installation-offset correction is required. Refer to the *Short Cut Help* for information about the installation offset correction.
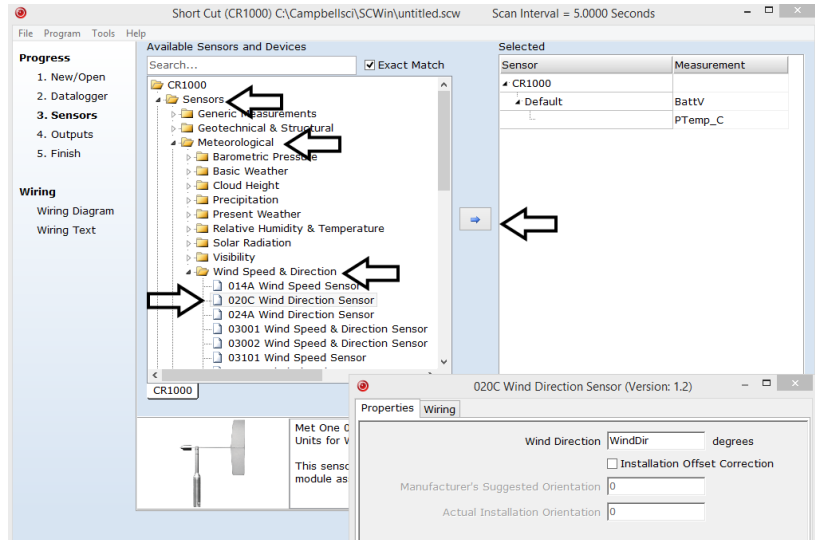
4. After selecting the sensor, click **Wiring Diagram** to see how the sensor is to be wired to the datalogger. The wiring diagram can be printed now or after more sensors are added.
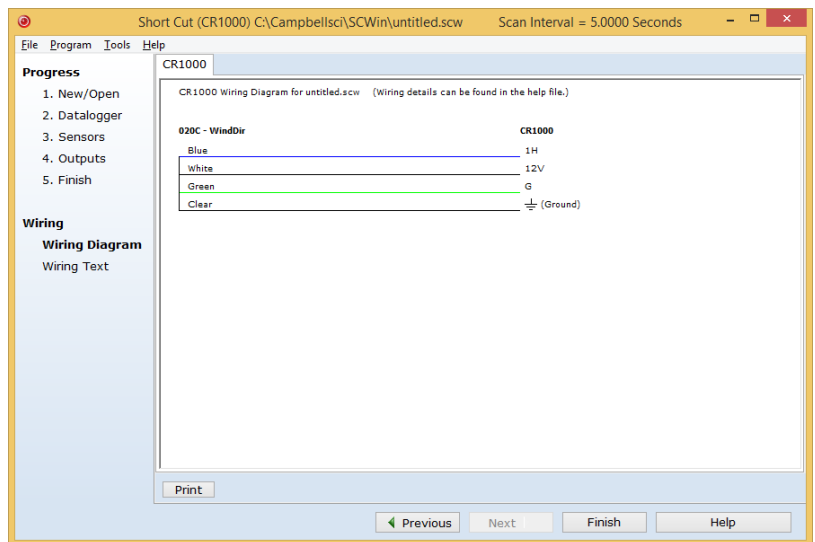
5. Select any other sensors you have, then finish the remaining *Short Cut* steps to complete the program. The remaining steps are outlined in *Short Cut Help*, which is accessed by clicking on **Help | Contents | Programming Steps**.

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. Overview

The lightweight, airfoil vane is directly coupled to a single precision micro-torque potentiometer. The built-in electronics provide a voltage source for the potentiometer and amplifies the output signal for transmission over long cable lengths. The 020C includes an internal heater, which provides positive clean aspiration through the bearings, thereby greatly increasing bearing life. It also includes electrical field surge protection that reduces problems associated with static fields, near-miss lightning hits, and poor grounding systems.

The vane assembly is easily installed or replaced without requiring recalibration. All sensor components are constructed with stainless steel and anodized aluminum.

6. Specifications

Features
- Low starting threshold
- Internal heater for long bearing life
- Low profile to minimize turbulence
- High damping ratio
- Short delay distance
- Quick-disconnect connector
- Compatible with Campbell Scientific CRBasic dataloggers: CR300 series, CR6 series, CR800 series, CR1000, and CR3000

Measurement

Range:	Electrical 0° to 357°
	Mechanical 0° to 360°
Threshold:	0.5 mph
Linearity:	± 0.5% of full scale
Accuracy:	±3°
Damping Ratio:	0.4
Delay Distance:	Less than 91 cm (3 ft)

Temperature Range: –50 to 85 °C (–58 to 185 °F)

Power requirement

Sensor	
Source:	12 Vdc
Load:	10 mA
Heater	
Source:	12 Vdc
Load:	350 mA

Output:	0 to 5 Vdc for 0 to 360° or
	0 to 2.5 Vdc (Section 7.2.1.1, *Output Voltage (p. 6)*)
Output Impedance:	100 Ω maximum
Maximum Cable Length:	91.44 m (300 ft)
Weight:	0.68 kg (1.5 lb)
Material:	Anodized aluminum

7. Installation

If you are programming your datalogger with *Short Cut*, skip Section 7.1, *Wiring (p. 5)*, and Section 7.2, *Datalogger Programming (p. 6)*,. *Short Cut* does this work for you. See Section 4, *QuickStart (p. 1)*, for a *Short Cut* tutorial.

7.1 Wiring

The cable consists of five wires that connect to the datalogger and power source. Connections are given in TABLE 7-1.

TABLE 7-1. Wire Color, Wire Function, and Connections			
Wire Color	**Wire Function**	**Datalogger Connection Terminal**	**Power Source Connection Terminal**
White	12 V Power	**12V**	N/A
Green	Ground	**G**	N/A
Blue	Signal	**U** configured for single-ended analog input[1], **SE** (single-ended, analog-voltage input)	N/A
Clear	Shield	**AG** or ⏚ (analog ground)	N/A
Red[2] (optional)	Heater +	N/A	Supply 12V
Black[2] (optional)	Heater –	N/A	Supply Ground
[1]**U** channels are automatically configured by the measurement instruction.			
[2]Bearing heat only. Using the heater prolongs the bearings' life, but is practical only when the datalogger primary power is ac mains power or a high capacity solar power.			

7.2   Datalogger 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 Program (p. B-1)*.

7.2.1 VoltSE Instruction

The **VoltSE()** measurement instruction programs the datalogger to measure the 020C.

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

Use 0.072 for the ***Mult*** and 0.0 for the ***Offset***. For ***Range***, use ***mV5000*** (CR1000, CR800, CR6, CR3000, CR5000) or ***mV2500*** (CR300). You need to move a jumper to use the ***mV2500*** range (Section 7.2.1.1, *Output Voltage (p. 6)*). If the sensor will be in electrically noisy environments, use 50 Hz or 60 Hz rejection for ***Integ/f_{notch}***.

NOTE   If the wind vane will be oriented in a direction other than south, an offset correction is required. Refer to Appendix B, *Example Program (p. B-1)*, for more information.

7.2.1.1 Output Voltage

The default output voltage range is 0 to 5 Vdc, which most Campbell Scientific dataloggers can measure. For the CR300 datalogger to measure the 020C, move the jumper block under the outer cover of the main body of the probe. The outer cover is held in place by friction against two O-rings. To change the range, carefully slide the outer cover down to expose the circuit board. A set of three jumper pins is mounted at the top of the board. Set the jumper block over pins **E1** and **2.5**. This changes the output voltage range to 0 to 2.5 Vdc, which the CR300 can measure. After changing the jumper, slide the cover into place over the top O-ring.

7.3   Siting

Locate wind sensors away from obstructions such as trees and buildings. A general rule is that a horizontal distance of at least ten times the height of the obstruction should be between the wind set and the obstruction. If mounting the sensor on the roof of a building is necessary, the height of the sensor above the roof should be at least 1.5 times the height of the building. See Section 9, *References (p. 10)*, for resources that discuss siting wind sensors.

7.4   Assembly and Mounting

Before installation:

- Check to see that the vane assembly rotates freely.
- Ensure that the vane assembly is balanced and the counterweight is tight by holding the sensor horizontal to verify balance.

Tools required:

- 1/2-inch open-end wrench (for CM220)
- 5/64-inch and 1/16-inch Allen wrenches
- 28798 020C Mounting Bushing
- compass and declination angle for the site
- small screwdriver provided with datalogger
- UV-resistant cable ties
- small pair of diagonal-cutting pliers
- 6- to 10-inch torpedo or spirit level
- CM220 Right-Angle Mounting Kit or 3/4 x 1-inch Nu-Rail® Crossover Fitting (pn 1049)

1. Mount the CM200-series crossarm to the tripod or tower. Orient the crossarm north to south with the Nu-Rail® fitting or CM220 Right Angle Mounting Kit at the north end of the crossarm. Appendix C, *Wind Direction Sensor Orientation (p. C-1)*, contains detailed information on determining true north using a compass and the magnetic declination for the site.

2. Assemble the sensor (FIGURE 7-1 and FIGURE 7-2):

    a. Remove the screw from the base of the sensor column.

    b. Place the sensor column in the bushing such that the hole in the bushing aligns with the hole just vacated by the alignment screw.

    c. Replace the screw and tighten until snug. Do not over tighten.

3. Place the sensor and bushing in the CM220 bracket (FIGURE 7-1) or Nu-Rail® fitting (FIGURE 7-2).
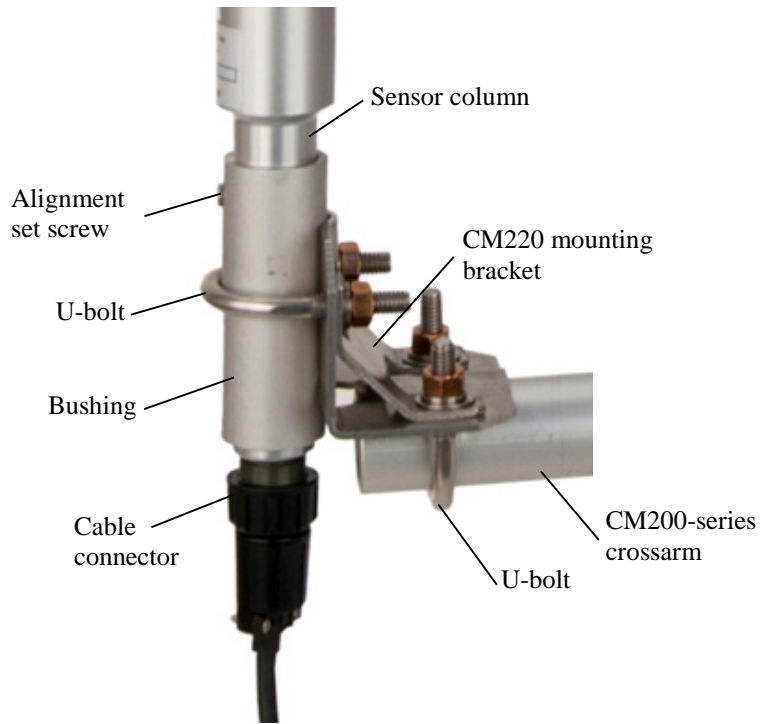
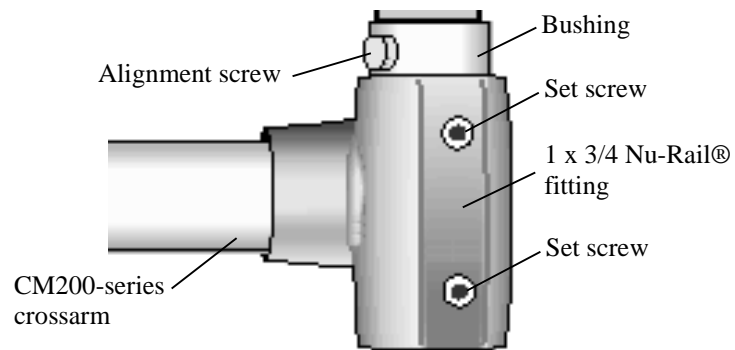*FIGURE 7-1. CM220 right-angle mounting bracket*

FIGURE 7-2. 1049 Nu-Rail® fitting

4. Rotate the sensor and bushing such that the counterweight, alignment
    notches (FIGURE 7-3), and alignment screw (FIGURE 7-1, FIGURE 7-2)
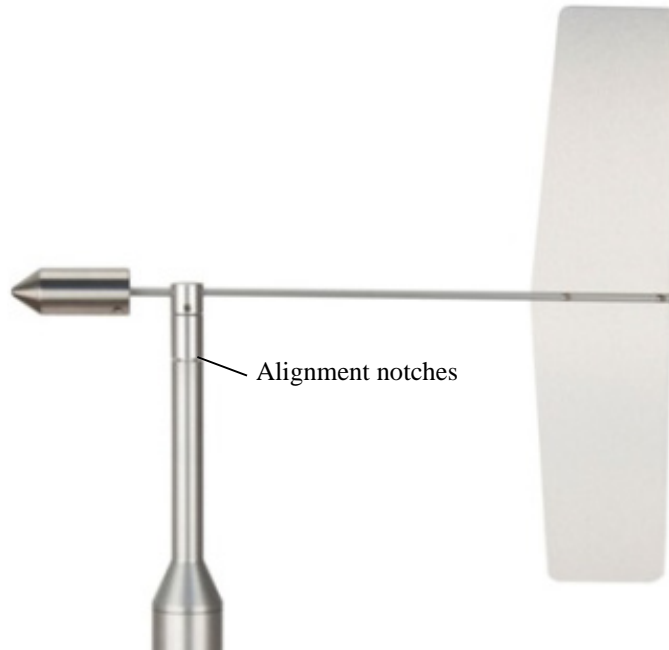   point true south.

Alignment notches

FIGURE 7-3. 020C alignment notches

5. Tighten the U-bolt if using the CM220 (FIGURE 7-1) or set screws if using the Nu-Rail® fitting (FIGURE 7-2).

6. Attach the sensor cable to the six-pin male connector on the 020C (FIGURE 7-1).

7. Route the sensor cable along the underside of the crossarm to the tripod or tower, and to the instrument enclosure.

8. Secure the cable to the crossarm and tripod or tower using cable ties.

7.5 Sensor Check-Out

With the datalogger measuring the sensor, 020C output moves up-scale as the vane rotates clockwise (as seen from above the sensor). Output will progress up-scale until the 360° (full scale) mark has been reached. Output then drops to near 0°. When the notches on the rotating hub and the column of the sensor are exactly aligned, the output will be 180°.

8. Troubleshooting and Maintenance

NOTE   All factory repairs and replacements require a returned material authorization (RMA) and completion of the "Declaration of Hazardous Material and Decontamination" form. Refer to the *Assistance* page at the beginning of this manual for more information.

8.1 Troubleshooting

Consult TABLE 8-1 for recommended actions to resolve various problems.

TABLE 8-1. 020C Wind Direction Sensor Troubleshooting			
Symptom	**Probable Cause**	**Solution**	**Refer to**
No wind direction output	Loss of supply voltage	Check datalogger 12 Vdc supply and connecting cables	TABLE 7-1, *Wire Color, Wire Function, and Connections (p. 5)*
No wind direction output	Faulty integrated circuit amplifier (output often will be steady 5.0 V)	Replace IC amplifier (plug-in)	Contact Campbell Scientific for repair authorization
No wind direction output	Faulty potentiometer	Replace potentiometer	Contact Campbell Scientific for repair authorization
No change in wind direction output below 2 to 5 mph	Bad bearings	Replace bearings	Contact Campbell Scientific for repair authorization

8.2 Maintenance Schedule

6 to 12 Month Intervals:

1. Inspect sensor for proper operation per Section 7.5, *Sensor Check-Out (p. 9)*.

2. Return to Campbell Scientific for calibration.

12 to 24 Month Intervals:

1. Return to Campbell Scientific for replacement of sensor bearings.

2. Return to Campbell Scientific for replacement of sensor potentiometer.

9. References

The following references give detailed information on siting wind-speed and wind-direction sensors.

EPA, 1989: *Quality Assurance Handbook for Air Pollution Measurements System*, Office of Research and Development, Research Triangle Park, NC, 27711.

EPA, 1987: *On-Site Meteorological Program Guidance for Regulatory Modeling Applications,* EPA-450/4-87-013, Office of Air Quality Planning and Standards, Research Triangle Park, NC 27711.

The State Climatologist, 1985: *Publication of the American Association of State Climatologists: Height and Exposure Standards*, for Sensors on Automated Weather Stations, vol. 9, No. 4.

WMO, 1983: *Guide to Meteorological Instruments and Methods of Observation,* World Meteorological Organization, No. 8, 5th edition, Geneva, Switzerland.

Appendix A. Importing Short Cut Code Into CRBasic Editor

This tutorial shows the following:

- 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)
- .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)

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 .CR300, .CR6, .CR8, .CR1, .CR3, or .CR5 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 Program

The following CR1000 program measures the sensor and includes an offset correction for the vane being installed at 270 degrees.

CRBasic Example B-1. CR1000 Example Program

```
'CR1000

'Declare Variables and Units
Public BattV
Public PTemp_C
Public WindDir

Units BattV=Volts
Units PTemp_C=Deg C
Units WindDir=degrees

'Define Data Tables
DataTable(Table1,True,-1)
  DataInterval(0,10,Min,10)
  Sample(1,WindDir,FP2)
EndTable

DataTable(Table2,True,-1)
  DataInterval(0,1440,Min,10)
  Minimum(1,BattV,FP2,False,False)
EndTable

'Main Program
BeginProg
  'Main Scan
  Scan(1,Sec,1,0)

    'Default Datalogger Battery Voltage measurement 'BattV'
    Battery(BattV)

    'Default Wiring Panel Temperature measurement 'PTemp_C'
    PanelTemp(PTemp_C,_60Hz)

    '020C Wind Direction Sensor measurement 'WindDir'
    VoltSe(WindDir,1,mV5000,1,1,0,_60Hz,0.072,0)

    'Offset correction for vane installed with 270 degree
    'installation orientation
    WindDir = (WindDir + 90 + 360)MOD 360

    'Call Data Tables and Store Data
    CallTable(Table1)
    CallTable(Table2)

  NextScan
```

Appendix C. Wind Direction Sensor Orientation

## C.1 Determining True North and Sensor Orientation

Orientation of the wind direction sensor is done after the datalogger has been programmed, and the location of true North has been determined. True North is usually found by reading a magnetic compass and applying the correction for magnetic declination; where magnetic declination is the number of degrees between true North and Magnetic North. The preferred method to obtain the magnetic declination for a specific site is to use a computer service offered by NOAA at *www.ngdc.noaa.gov/geomag*. Magnetic declination can also be obtained from a map or local airport. A general map showing magnetic declination for the contiguous United States is shown in FIGURE C-1.

Declination angles east of true North are considered negative, and are subtracted from 360 degrees to get true North as shown in FIGURE C-2 (0° and 360° are the same point on a compass). For example, the declination for Logan, Utah is 13.5° East, so true North is 360° – 13.5°, or 346.5° as read on a compass. Declination angles west of true North are considered positive, and are added to 0 degrees to get true North as shown in FIGURE C-3.

Orientation is most easily done with two people, one to aim and adjust the sensor, while the other observes the wind direction displayed by the datalogger.

1. Establish a reference point on the horizon for true North.

2. Sighting down the instrument center line, aim the nose cone or counterweight at true North. Display the input location or variable for wind direction using a hand-held keyboard display, PC, or palm.

3. Loosen the U-bolt on the CM220 (or the set screws on pn 1049) that secure the base of the sensor to the crossarm. While holding the vane position, slowly rotate the sensor base until the datalogger indicates 0°. Tighten the set screws.
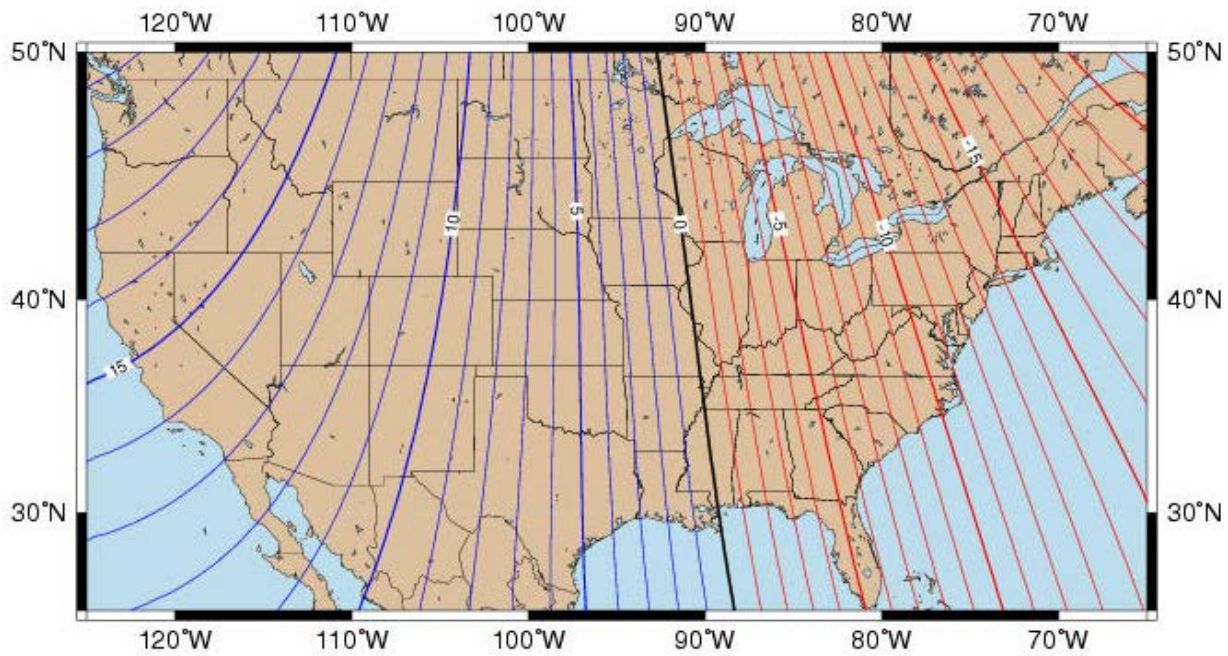
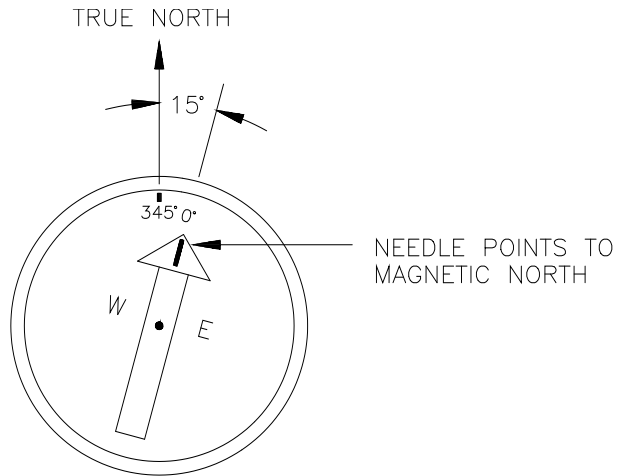FIGURE C-1. Magnetic declination for the contiguous United States (2004)

FIGURE C-2. Declination angles east of true North are subtracted from 360° to get true North
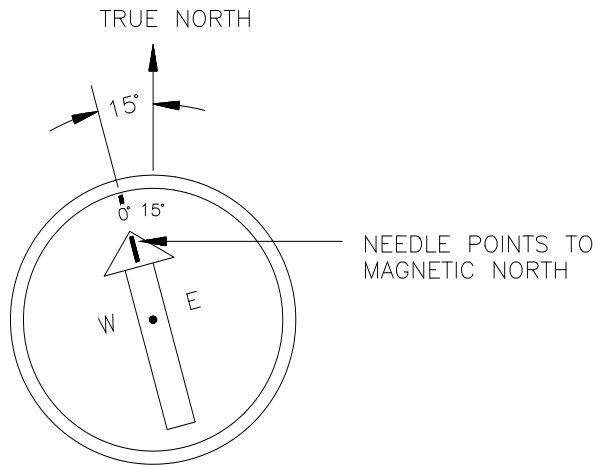

FIGURE C-3. Declination angles west of true North are added to 0° to get true North

Campbell Scientific Companies

Campbell Scientific, Inc.
815 West 1800 North
Logan, Utah 84321
UNITED STATES
www.campbellsci.com • info@campbellsci.com

Campbell Scientific Africa Pty. Ltd.
PO Box 2450
Somerset West 7129
SOUTH AFRICA
www.campbellsci.co.za • cleroux@csafrica.co.za

Campbell Scientific Southeast Asia Co., Ltd.
877/22 Nirvana@Work, Rama 9 Road
Suan Luang Subdistrict, Suan Luang District
Bangkok 10250
THAILAND
www.campbellsci.asia • info@campbellsci.asia

Campbell Scientific Australia Pty. Ltd.
PO Box 8108
Garbutt Post Shop QLD 4814
AUSTRALIA
www.campbellsci.com.au • info@campbellsci.com.au

Campbell Scientific (Beijing) Co., Ltd.
8B16, Floor 8 Tower B, Hanwei Plaza
7 Guanghua Road
Chaoyang, Beijing 100004
P.R. CHINA
www.campbellsci.com • info@campbellsci.com.cn

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www.campbellsci.com.br • vendas@campbellsci.com.br

Campbell Scientific Canada Corp.
14532 – 131 Avenue NW
Edmonton AB T5L 4X4
CANADA
www.campbellsci.ca • dataloggers@campbellsci.ca

Campbell Scientific Centro Caribe S.A.
300 N Cementerio, Edificio Breller
Santo Domingo, Heredia 40305
COSTA RICA
www.campbellsci.cc • info@campbellsci.cc

Campbell Scientific Ltd.
Campbell Park
80 Hathern Road
Shepshed, Loughborough LE12 9GX
UNITED KINGDOM
www.campbellsci.co.uk • sales@campbellsci.co.uk

Campbell Scientific Ltd.
3 Avenue de la Division Leclerc
92160 ANTONY
FRANCE
www.campbellsci.fr • info@campbellsci.fr

Campbell Scientific Ltd.
Fahrenheitstraße 13
28359 Bremen
GERMANY
www.campbellsci.de • info@campbellsci.de

Campbell Scientific Spain, S. L.
Avda. Pompeu Fabra 7-9, local 1
08024 Barcelona
SPAIN
www.campbellsci.es • info@campbellsci.es

Please visit www.campbellsci.com to obtain contact information for your local US or international representative.