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) number, 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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024A Met-One Wind Direction Sensor

1. Introduction

The 024A is a wind vane manufactured by Met One. It measures wind direction only and is traditionally used in tandem with Met One’s 014A Wind Speed Sensor.

NOTE

This manual provides information only for CRBasic dataloggers. It is also compatible with most of 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 024A is a precision instrument. Please handle it with care.

- If the 024A is to be installed at heights over 6 ft, 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 024A or before raising a tower.

- 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 024A, 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.

- 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 this sensor and assign datalogger wiring terminals. *Short Cut* is available as a download on [www.campbellsci.com](http://www.campbellsci.com). It is included in installations of LoggerNet, PC200W, PC400, or RTDAQ. The following procedure shows using *Short Cut* to program the sensor.

1. Open *Short Cut* and create a new program.

2. Double-click the datalogger model.

3. Under **Available Sensors and Devices**, select the **Sensors | Meteorological | Wind Speed & Direction** folder and double-click **024A Wind Direction Sensor**.
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 out 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

Met One’s 024A is a wind vane that measures wind direction from 0 to 360 degrees with a 5-degree accuracy. It uses a 10-kΩ potentiometer to sense wind direction. A datalogger applies a precision excitation voltage to the potentiometer, resulting in an analog voltage output that is directly proportional to the wind direction’s azimuth.

The cable includes a 10k 1% resistor as shown in **FIGURE 7-5**. If the cable was purchased from Met One Instruments, the 10k resistor is not included. The cable can be used without the resistor, but this requires program changes not supported by **Short Cut** (see Section 7.4.1, **Datalogger Instruction** (p. 8)).

Cable length for the 024A is specified when the sensor is ordered. **TABLE 5-1** gives the recommended cable length for mounting the sensor at the top of a tripod/tower via a CM202 crossarm.
The 024A’s cable can terminate in:

- Pigtails that connect directly to a Campbell Scientific datalogger (option –PT).
- Connector that attaches to a prewired enclosure (option –PW). Refer to www.campbellsci.com/prewired-enclosures for more information.

### 6. Specifications

**Features:**
- Compatible with Campbell Scientific CRBasic dataloggers: CR200(X) series, CR300 series, CR6 series, CR800 series, CR1000, CR1000X, CR3000, CR5000, and CR9000(X)

**Range:** 0 to 360 degrees

**Threshold:** 0.447 m s⁻¹ (1.0 mph)

**Accuracy:** ±5 degrees

**Temperature Range:** –50 to 70 °C

**Delay Distance:** < 1.5 m (5 ft)

**Damping Ratio**
- **Standard:** 0.25
- **Optional:** 0.4

**Potentiometer Specifications**
- **Sand, Dust, and Fungus:** MIL-E-5272
- **Salt Spray:** MIL-E-12934
- **Resistance:** 0 to 10,000 Ω

**Weight:** 450 g (1 lb)

**Dimensions**
- **Overall Height:** 33.8 cm (13.3 in)
- **Overall Length:** 44.7 cm (17.6 in)
- **Tail Height:** 30.5 cm (12 in)
- **Tail Width:** 7.6 cm (3 in)

### 7. Installation

If you are programming your datalogger with Short Cut, skip Section 7.3, Wiring (p. 7), and Section 7.4, Programming (p. 8). Short Cut does this work for you. See Section 4, QuickStart (p. 2), for a Short Cut tutorial.
7.1 Siting

Locate wind sensors away from obstructions such as trees or buildings. The recommended horizontal distance is at least ten times the height of the obstruction between the windset and the obstruction. If it is necessary to mount the sensors on the roof of a building, the height of the sensors, above the roof, should be at least 1.5 times the height of the building. See Section 9, References (p. 12), for a list of references that discuss siting wind direction sensors.

7.2 Mounting

7.2.1 Mounting the Sensor to a Crossarm

Install the 024A using:

- CM220 Right-Angle Mounting Kit, or
- 17953 1 x 1 inch NU-RAIL Crossover Fitting

1. Remove the Allen hex screw in the lower part of the sensor housing (FIGURE 7-1).
2. Insert the 024A in the mounting bushing (FIGURE 7-1).
3. Tighten the mounting bushing screw onto the sensor housing (FIGURE 7-1).

4. Mount the crossarm to a tripod or tower.
5. Orient the crossarm north-south, with the CM220 or 17953 NU-RAIL on the north end. Appendix C, Determining True North and Sensor Orientation (p. C-1), contains detailed information on determining true north using a compass and the magnetic declination for the site.

FIGURE 7-1. Bushing installation on 024A sensor
6. Insert the sensor in the CM220 (FIGURE 7-2) or NU-RAIL fitting (see FIGURE 7-3).

**FIGURE 7-2. CM220 mount attached to a crossarm**

7. Align the sensor so that the counter weight points due south and tighten the U-bolts on the CM220 or tighten the set screws on the NU-RAIL fitting.

8. Connect the cable assembly to the sensor receptacle.

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

10. Secure the cable to the crossarm and tripod/tower using cable ties (FIGURE 7-3).

**FIGURE 7-3. The 024A mounted to a crossarm via the 17953 NU-RAIL**
7.2.2 Mounting the 024A Atop a Tripod Mast

The 024A mounts at the top of a CM106B, CM110, CM115, or CM120 tripod with the CM216 (see FIGURE 7-4). The CM216 extends 10 cm (4 in) above the mast of the tripod.

FIGURE 7-4. CM216 mount

7.3 Wiring

FIGURE 7-5. Schematic of 024A Wind Direction Sensor

FIGURE 7-5 and TABLE 7-1 shows wiring; a detailed cable diagram is provided in Section 8, Maintenance (p. 10) (FIGURE 8-1).
### 7.4 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 and you are connecting the sensor to a pulse port, 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. 2). 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 provided in the following sections. 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.campbellsic.com/old-manuals](http://www.campbellsic.com/old-manuals).

#### 7.4.1 Datalogger Instruction

The datalogger instruction that measures the 024A is datalogger dependent. The CR200(X) datalogger uses the `ExDelSE()` instruction to measure wind direction. All other CRBasic dataloggers use the `BRHalf()` instruction. Excitation voltages, range codes, delays, and multipliers are listed in TABLE 7-2. The multipliers listed in TABLE 7-2 do not account for cable length or resistor tolerances. A more accurate multiplier can be determined as described in Section 7.4.2, *Calibration* (p. 9).
### TABLE 7-2. Parameters for Wind Direction

<table>
<thead>
<tr>
<th></th>
<th>CR200(X)</th>
<th>CR300 Series</th>
<th>CR800, CR850, CR1000</th>
<th>CR6, CR1000X</th>
<th>CR5000, CR3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurement Range</td>
<td>NA</td>
<td>mV2500</td>
<td>mV2500</td>
<td>mV5000</td>
<td>mV5000</td>
</tr>
<tr>
<td>Excitation Voltage(^1)</td>
<td>2500 mV</td>
<td>2500 mV</td>
<td>2500 mV</td>
<td>2500 mV</td>
<td>5000 mV</td>
</tr>
<tr>
<td>Reverse Excitation</td>
<td>NA</td>
<td>NA</td>
<td>True</td>
<td>True</td>
<td>True</td>
</tr>
<tr>
<td>Delay or Settling Time</td>
<td>20000 µs</td>
<td>20000 µs</td>
<td>20000 µs</td>
<td>20000 µs</td>
<td>20000 µs</td>
</tr>
<tr>
<td>Multiplier</td>
<td>0.288</td>
<td>720</td>
<td>720</td>
<td>720</td>
<td>720</td>
</tr>
<tr>
<td>Offset</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

\(^1\)For cables purchased from Met One that do not include the 10k-series resistor, reduce the excitation voltages listed in this table by half.

#### 7.4.2 Calibration

Conversion of the measurement result (X) to wind direction is done by the multiplier parameter of the measurement instruction. For a more accurate measurement, use Eq. 1 to calculate a multiplier that accounts for cable length and resistor tolerances:

\[
\text{Calculated Multiplier} = \frac{360}{\text{FSX}} \quad \text{Eq. 1}
\]

Where,

\[
\text{FSX} = \text{full scale measurement result}
\]

With a multiplier of 1, the measurement result (X) for the `BRHalf()` instruction is the ratio \(V_1/V_X\), where \(V_1\) is the voltage measured on the SE channel, and \(V_X\) is the excitation voltage. For the `EX-DEL-SE()` instruction used with the CR200(X), the measurement result is the mV value.

The full scale measurement result (FSX) is the maximum, X, output from the 024A. To determine the FSX, create a program with the parameters listed in **TABLE 7-2**, and a multiplier of 1. The value displayed in the input variable is (X). With the shoulder screw removed, slowly rotate the wind vane to get the maximum value, which is the FSX. With the 10k series resistor, the FSX is approximately half the excitation voltage for the `EX-DEL-SE()` instruction and approximately 0.5 for the `BRHalf()` instruction. The calculated multiplier is 360/(FSX) should be close to the multiplier listed in **TABLE 7-2**. Keep the offset at 0.

Enter the value calculated in Eq. 1 in the program using the CRBasic program editor.

**NOTE**

If the FSX is `NAN` or `–99999`, reduce the excitation voltage by 5 mV and determine the new FSX.
8. Maintenance

The maintenance schedules are for average to adverse environments.

8.1 6 to 12 Month Periodic Service

Inspect sensor for physical damage and verify that the vane assembly rotates freely. To verify parts and locations, refer to the parts diagram (FIGURE 8-2) and the parts list (TABLE 8-1).

8.2 24 to 36 Month Service

A complete factory overhaul of the sensor, including the replacement of the potentiometer, is recommended. To send the 024A to Campbell Scientific, the customer must receive an RMA number and fill out a “Statement of Product Cleanliness”. For more information, refer to the Assistance section that is at the beginning of this document.

FIGURE 8-1. Cable diagram
TABLE 8-1. Met One Parts List Reproduced by Campbell Scientific

<table>
<thead>
<tr>
<th>Item</th>
<th>Part No.</th>
<th>Description</th>
<th>Qty./Assy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>102105</td>
<td>Vane Assembly</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>101685-1</td>
<td>Wind Direction Support</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>101049-2</td>
<td>Label, Wind Direction</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>101789</td>
<td>Label, Caution</td>
<td>1</td>
</tr>
<tr>
<td>5</td>
<td>860015</td>
<td>Screw, Shoulder</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>601100</td>
<td>Screw, Pan Head Ph, 2-56x3/16</td>
<td>3</td>
</tr>
<tr>
<td>7</td>
<td>601680</td>
<td>Screw, Set A/H, 8-32x3/8</td>
<td>2</td>
</tr>
<tr>
<td>8</td>
<td>101687</td>
<td>Label, Met One</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>102017</td>
<td>Assembly, Potentiometer</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>980495</td>
<td>Wire, 22 Gage, Yellow</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>980450</td>
<td>Wire, 22 Gage, Blue</td>
<td>1</td>
</tr>
<tr>
<td>12</td>
<td>980475</td>
<td>Wire, 22 Gage, Orange</td>
<td>1</td>
</tr>
<tr>
<td>13</td>
<td>995425</td>
<td>Loctite 222</td>
<td>A/R</td>
</tr>
<tr>
<td>14</td>
<td>500280</td>
<td>Connector, 6 Pin</td>
<td>1</td>
</tr>
<tr>
<td>15</td>
<td>995100</td>
<td>Adhesive, Epoxy</td>
<td>A/R</td>
</tr>
<tr>
<td>16</td>
<td>995060</td>
<td>Adhesive, Silicone</td>
<td>5 ml</td>
</tr>
<tr>
<td>17</td>
<td>510020</td>
<td>Cap</td>
<td>1</td>
</tr>
<tr>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>101806</td>
<td>Assembly, Cable</td>
<td>Ref</td>
</tr>
<tr>
<td>22</td>
<td>101699</td>
<td>Assembly Instructions</td>
<td>Ref</td>
</tr>
<tr>
<td>23</td>
<td>101706</td>
<td>014 and 024 Installation</td>
<td>Ref</td>
</tr>
<tr>
<td>24</td>
<td>101697</td>
<td>Wiring Diagram</td>
<td>Ref</td>
</tr>
<tr>
<td>25</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>601850</td>
<td>Screw, Cap A/H SS 10-32x5/8</td>
<td>1</td>
</tr>
</tbody>
</table>

9. References

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


024A Met One Wind Direction Sensor
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 the following 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)
- .CR1X (CR1000X 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. 2). 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, .CR1X, .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.

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.

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.
Appendix B. Example Programs

The following program examples measure the 014A wind speed sensor and the 024A wind direction sensor. Wind speed and direction measurements are processed by the WindVector() instruction, which outputs mean wind speed, mean wind vector direction, and standard deviation of wind direction for the output interval.

B.1 CR1000 Program

```crbasic
'CR1000
'Declare Variables and Units
Public BattV
Public PTemp_C
Public WS_ms
Public WindDir
Units BattV=Volts
Units PTemp_C=Deg C
Units WS_ms=meters/second
Units WindDir=degrees
'Define Data Tables
DataTable(Table1,True,-1)
DataInterval(0,60,Min,10)
WindVector(1,WS_ms,WindDir,FP2,False,0,0,0)
FieldNames("WS_ms_S_WVT,WindDir_D1_WVT,WindDir_SD1_WVT")
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)
'014A Wind Speed Sensor measurement 'WS_ms'
PulseCount(WS_ms,1,1,2,1,0.8,0.447)
If WS_ms<0.457 Then WS_ms=0
'024A Wind Direction Sensor measurement 'WindDir'
BrHalf(WindDir,1,mV2500,1,1,1,2500,True,20000,250,720,0)
If WindDir>=360 Or WindDir<0 Then WindDir=0
'Call Data Tables and Store Data
CallTable Table1
NextScan
EndTable
EndProg
```
## B.2 CR200(X) Program

<table>
<thead>
<tr>
<th>CRBasic Example B-2. CR200(X) Program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CR200/CR200X</strong></td>
</tr>
<tr>
<td>'Declare Variables and Units</td>
</tr>
<tr>
<td>Public BattV</td>
</tr>
<tr>
<td>Public WS_ms</td>
</tr>
<tr>
<td>Public WindDir</td>
</tr>
<tr>
<td>Units BattV=Volts</td>
</tr>
<tr>
<td>Units WS_ms=meters/second</td>
</tr>
<tr>
<td>Units WindDir=degrees</td>
</tr>
<tr>
<td><strong>Define Data Tables</strong></td>
</tr>
<tr>
<td>DataTable(Table1, True, -1)</td>
</tr>
<tr>
<td>DataInterval(0, 60, Min)</td>
</tr>
<tr>
<td>WindVector(WS_ms, WindDir, False, 0, 0)</td>
</tr>
<tr>
<td>FieldNames(&quot;WS_ms_S_WVT, WindDir_D1_WVT, WindDir_SD1_WVT&quot;)</td>
</tr>
<tr>
<td>EndTable</td>
</tr>
<tr>
<td><strong>Main Program</strong></td>
</tr>
<tr>
<td>BeginProg</td>
</tr>
<tr>
<td>'Main Scan</td>
</tr>
<tr>
<td>Scan(1, Sec)</td>
</tr>
<tr>
<td>'Default Datalogger Battery Voltage measurement 'BattV'</td>
</tr>
<tr>
<td>Battery(BattV)</td>
</tr>
<tr>
<td>'014A Wind Speed Sensor measurement 'WS_ms'</td>
</tr>
<tr>
<td>PulseCount(WS_ms, P_SW, 2, 1, 0.8, 0.447)</td>
</tr>
<tr>
<td>If WS_ms&lt;0.457 Then WS_ms=0</td>
</tr>
<tr>
<td>'024A Wind Direction Sensor measurement 'WindDir'</td>
</tr>
<tr>
<td>ExDelSE(WindDir, 1, 1, 2500, 20000, 0.288, 0)</td>
</tr>
<tr>
<td>If WindDir&gt;=360 Or WindDir&lt;0 Then WindDir=0</td>
</tr>
<tr>
<td>'Call Data Tables and Store Data</td>
</tr>
<tr>
<td>CallTable Table1</td>
</tr>
<tr>
<td>NextScan</td>
</tr>
<tr>
<td>EndScan</td>
</tr>
<tr>
<td>EndProg</td>
</tr>
</tbody>
</table>
## B.3 CR3000 Program

<table>
<thead>
<tr>
<th>CRBasic Example B-3. CR3000 Program</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>'CR3000</strong></td>
</tr>
<tr>
<td><strong>'Declare Variables and Units</strong></td>
</tr>
<tr>
<td>Public Batt_Volt</td>
</tr>
<tr>
<td>Public WindDir</td>
</tr>
<tr>
<td>Public NewMult</td>
</tr>
<tr>
<td><strong>Units Batt_Volt=Volts</strong></td>
</tr>
<tr>
<td><strong>Units WindDir=degrees</strong></td>
</tr>
<tr>
<td><strong>'Define Data Tables</strong></td>
</tr>
<tr>
<td>DataTable(Table1,True,-1)</td>
</tr>
<tr>
<td>DataInterval(0,60,Min,10)</td>
</tr>
<tr>
<td>Sample(1,WindDir,FP2)</td>
</tr>
<tr>
<td>EndTable</td>
</tr>
<tr>
<td>DataTable(Table2,True,-1)</td>
</tr>
<tr>
<td>DataInterval(0,1440,Min,10)</td>
</tr>
<tr>
<td>Minimum(1,Batt_Volt,FP2,False,False)</td>
</tr>
<tr>
<td>EndTable</td>
</tr>
<tr>
<td><strong>'Main Program</strong></td>
</tr>
<tr>
<td>BeginProg</td>
</tr>
<tr>
<td>Scan(5,Sec,1,0)</td>
</tr>
<tr>
<td><strong>'Default Datalogger Battery Voltage measurement Batt_Volt:</strong></td>
</tr>
<tr>
<td>Battery(Batt_Volt)</td>
</tr>
<tr>
<td><strong>'024A Wind Direction Sensor measurement WindDir:</strong></td>
</tr>
<tr>
<td>BrHalf(WindDir,1,mV5000,1,1,1,5000,1,2000,250,1.0,0)</td>
</tr>
<tr>
<td>NewMult=360/WindDir</td>
</tr>
<tr>
<td><strong>'Call Data Tables and Store Data</strong></td>
</tr>
<tr>
<td>CallTable(Table1)</td>
</tr>
<tr>
<td>CallTable(Table2)</td>
</tr>
<tr>
<td>NextScan</td>
</tr>
<tr>
<td>EndProg</td>
</tr>
</tbody>
</table>
Appendix C. 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](http://www.ngdc.noaa.gov/geomag). The 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 FIGURE C-2 (0° and 360° are the same point on a compass). For example, the declination for Logan, Utah is 11.78° East (11 August 2015). True North is 360° – 11.78°, or 348.22° 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 South. Display the input location or variable for wind direction and verify the value is close to 180 degrees.

FIGURE C-1. Magnetic declination for the contiguous United States (2015)
FIGURE C-2. Declination angles east of True North are subtracted from 0 to get True North

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