INSTRUCTION MANUAL

Model 014A Met One Wind Speed Sensor

Revision: 12/14

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.**"

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To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 227-9000. After an application engineer determines the nature of the problem, an RMA number will be issued. Please write this 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 web site 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.

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.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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Figures

Tables

Met One 014A Wind Speed Sensor

1. Introduction

The 014A is a three-cup anemometer that monitors horizontal wind speed for the range of 0 to 45 m s^{-1} with a threshold of 0.45 m s^{-1}. It connects directly to a Campbell Scientific datalogger, which measures the 014A's pulse signal and converts the signal to engineering units (mph, m s^{-1}, knots).

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* or contact a Campbell Scientific application engineer for assistance.

2. Cautionary Statements

- READ AND UNDERSTAND the *Precautions* section at the front of this manual.
- Caution – The black outer jacket of the cable is Santoprene® rubber. This compound is resistant to temperature extremes, moisture, and UV degradation. However, this cable 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.
- Caution – Although the 014A is rugged, it should be handled as a precision scientific instrument.

3. Initial Inspection

- Upon receipt of the 014A, inspect the packaging and contents for damage. File damage claims with the shipping company.
- Refer to Section 3.1, *Ships With*, to ensure that all parts are included.

3.1 Ships With

- (1) 5/64 inch Allen Wrench
- (1) Calibration Sheet
- (1) 014ACBL-L Sensor Cable with user-specified length
- (1) ResourceDVD or Instruction Manual

4. Quickstart

4.1 Assemble and Mount the Sensor

4.1.1 Tools Required

- 5/64 inch Allen wrench (shipped with the 014A)
- 1/2 inch open end wrench
- compass and declination angle for the site
- small screw driver provided with datalogger
- UV resistant cable ties
- small pair of diagonal-cutting pliers
- 6 inch to 10 inch torpedo level

4.1.2 Assemble the Sensor

The 014A ships with the cup assembly separate from the main housing. Assemble the sensor using the following procedure:

1. Take the cup assembly and main housing out of the shipping box (see FIGURE 4-1).

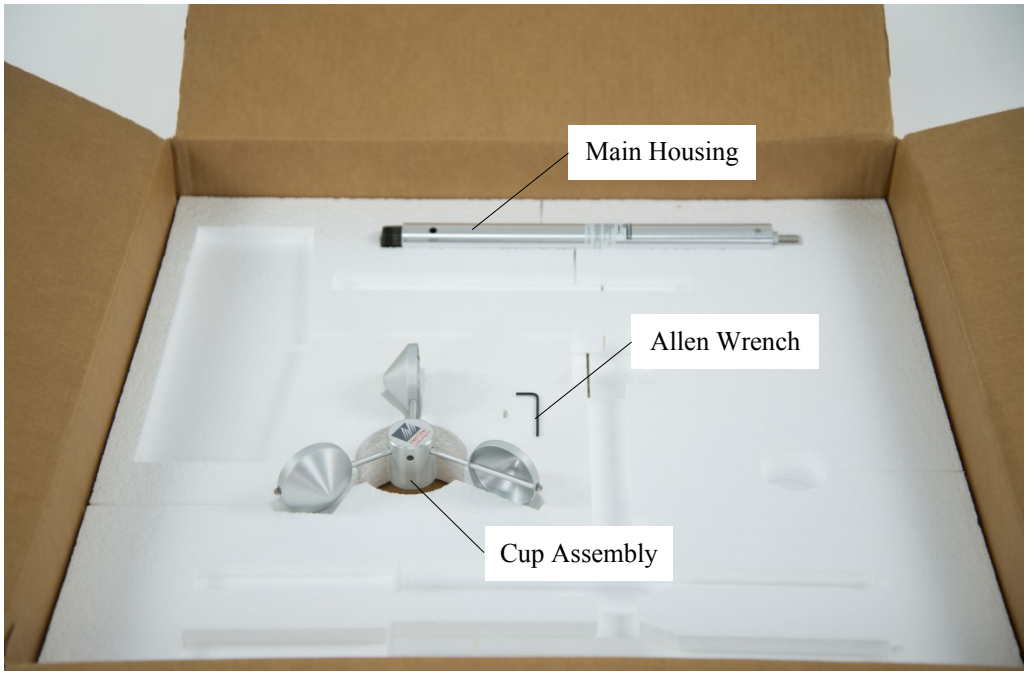


FIGURE 4-1. 014A shipping box

2. Gently slide the cup assembly down over the shaft at the top of the sensor until it meets the top bearing.

3. Use the 5/64 inch Allen wrench to tighten the screw on the side of the cup assembly; tighten until snug (see FIGURE 4-2).

FIGURE 4-2. Allen wrench tightening bolt

4. Ensure that the cup assembly spins freely.

4.1.3 Mount to a Tripod or Tower

This quickstart installs the 014A using:

- 1049 3/4 x 1 inch NU-RAIL® Crossover Fitting (FIGURE 4-3), or
- CM220 Right-Angle Mounting Kit (FIGURE 4-4)

Please review Section 7, *Installation*, for siting and other guidelines.

1. Mount a CM200-series crossarm to the tripod or tower.

2. Orient the crossarm North-South, with the CM220 mount or 1049 NU-RAIL on the north end.

3. Insert the base of the 014A into the 1049 NU-RAIL or CM220 U-bolt (FIGURES 4-3, 4-4) and tighten the set screws on the NU-RAIL, or U-bolt on the CM220 (do not over tighten).

4. Attach the sensor cable to the connector on the 014A. Make sure the connector is properly keyed, and finger-tighten the knurled ring.

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

6. Secure the cable to the crossarm and tripod/tower using cable ties.

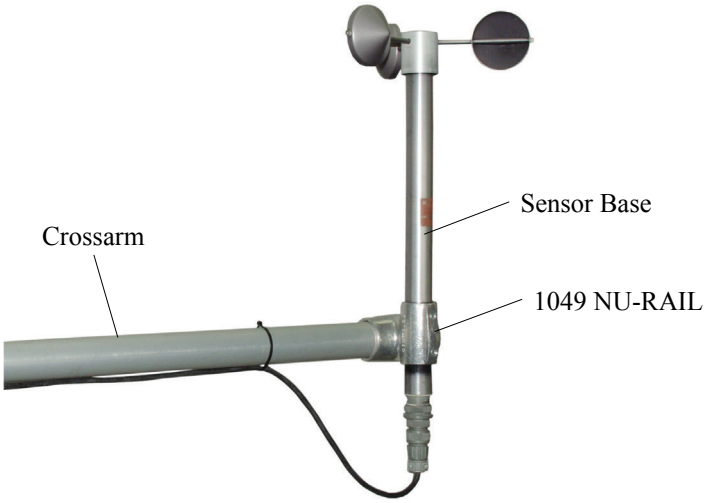


FIGURE 4-3. 014A mounted on a crossarm with pn 1049

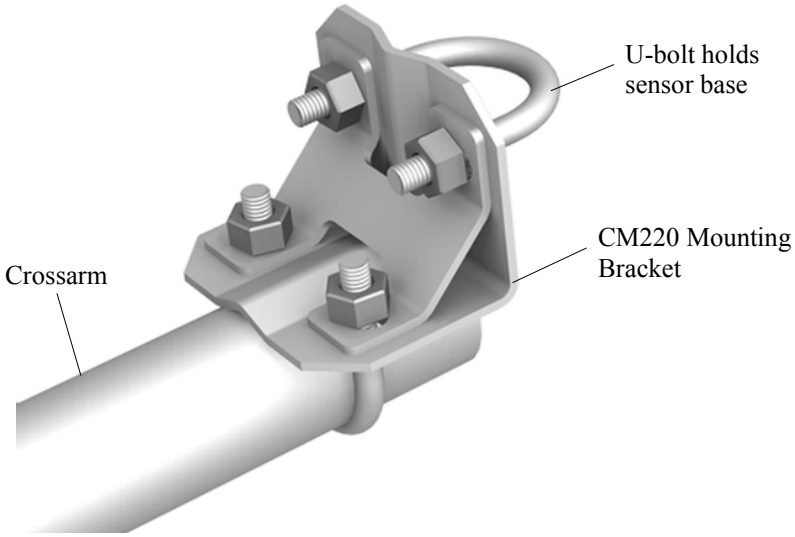


FIGURE 4-4. CM220 Right Angle Mounting Bracket

4.2 Use SCWin to Program Datalogger and Generate Wiring Diagram

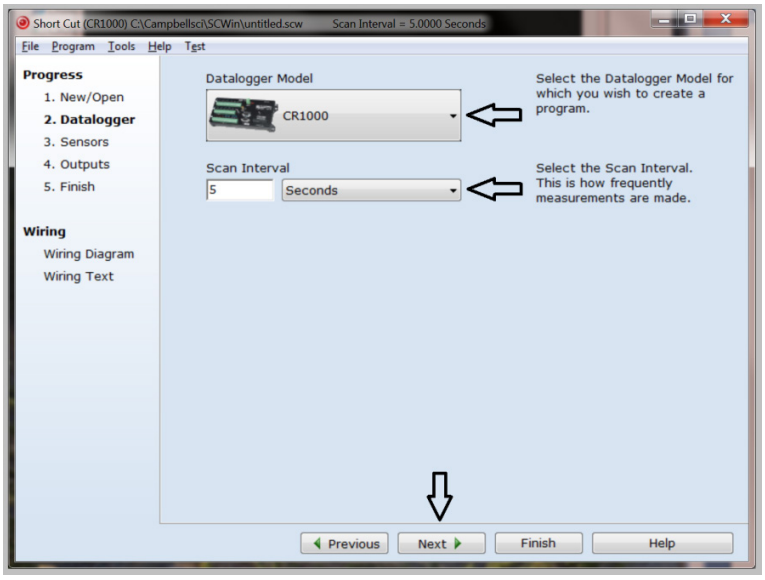
Short Cut is an easy way to program your datalogger to measure the 014A and assign datalogger wiring terminals. The following procedure shows using *Short Cut* to program the 014A.

1. Install *Short Cut* by clicking on the install file icon. Get the install file from either *www.campbellsci.com*, the ResourceDVD, or find it in installations of *LoggerNet*, *PC200W*, *PC400*, or *RTDAQ* software.

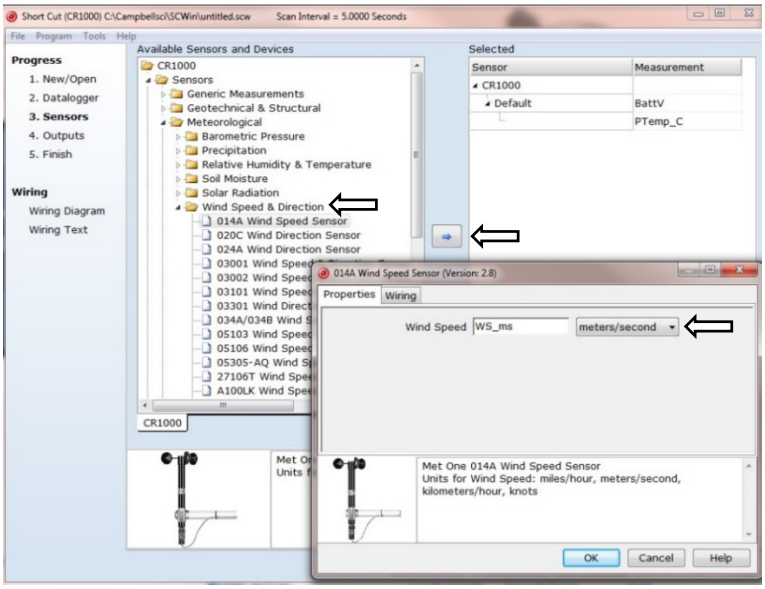
2. The *Short Cut* installation should place a Short Cut icon on the desktop of your computer. To open *Short Cut*, click on this icon.

3. When *Short Cut* opens, select **New Program**.

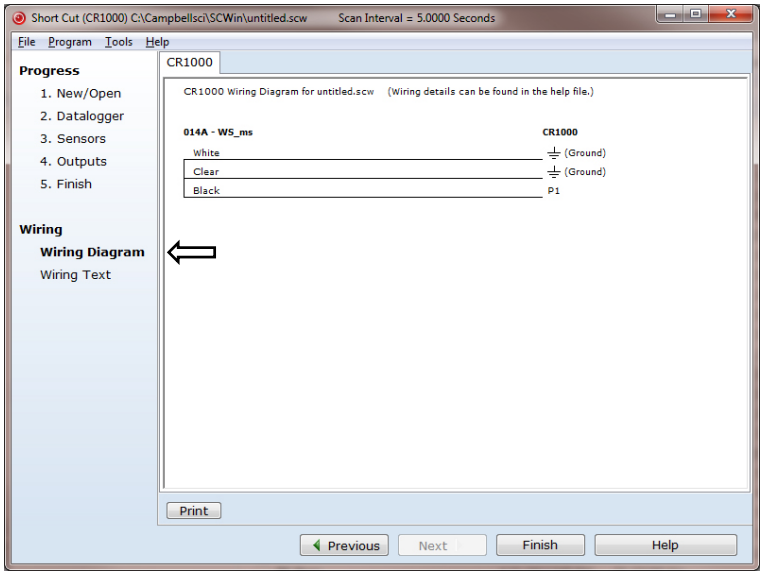
4. Select **Datalogger Model** and **Scan Interval** (default of **5** seconds is OK for most applications). Click **Next**.



5. Under the **Available Sensors and Devices** list, select the **Sensors** | **Meteorological** | **Wind Speed & Direction** folder. Select **014A Wind Speed Sensor**. Click  to move the selection to the **Selected** device window. The wind speed defaults to meters/second. This can be changed by clicking the **Wind Speed** box and selecting one of the other options.



6. After selecting the sensor, click at the left of the screen on **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.



7. 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**.

8. 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.

9. If the sensor is connected to the datalogger, as shown in the wiring diagram in step 6, check the output of the sensor in the datalogger support software data display to make sure it is making reasonable measurements.

5. Overview

The 014A is constructed of corrosion-resistant, stainless-steel and anodized aluminum. Its three-cup anemometer assembly contains a sealed magnetic reed switch. Rotation of the cup wheel produces a pulse that is directly proportional to wind speed.

The accompanying Met One manual contains additional information on operating principals, installation, and maintenance.

The –L portion of the model number indicates that the 014A has a user-specified cable length. TABLE 5-1 gives the recommended lead length for mounting the sensor at the top of the tripod/tower with a CM202 crossarm.

TABLE 5-1. Recommended Lead Lengths						
CM106	CM110	CM115	CM120	UT10	UT20	UT30
14 ft	14 ft	19 ft	24 ft	14 ft	24 ft	37 ft

The 014A's cables can terminate in:

- Pigtails that connect directly to a Campbell Scientific datalogger (cable termination option –PT).
- Connector that attaches to a prewired enclosure (cable termination option –PW).

6. Specifications

Features:

- Ideal for applications that do not require wind direction measurements
- Sealed magnetic reed switch
- Designed for continuous, long term, unattended operation in adverse conditions
- Compatible with Campbell Scientific CRBasic dataloggers: CR6, CR200(X) series, CR800 series, CR1000, CR3000, CR5000, and CR9000(X).

Threshold: 0.45 m s^{-1} (1 mph)

Calibrated Range: 0 to 45 m s^{-1} (0 to 100 mph)

Gust Survival: 0 to 53 m s^{-1} (0 to 120 mph)

Accuracy: 1.5% or 0.11 m s^{-1} (0.25 mph)

Temperature Range: –50 to 70 °C

Output Signal: Contact Closure, Reed Switch

Weight: 680 g (1.5 lb)

6.1 Distance Constant*

Standard: Less than 4.6 m (15 ft)
(Aluminum Cups)

Optional Fast Response: Less than 1.5 m (5 ft)
(Lexan Cups)

* The distance traveled by the air after a sharp-edged gust has occurred for the anemometer to reach 63% of the new speed.

7. Installation

If you are programming your datalogger with *Short Cut*, skip Section 7.3, *Wiring*, and Section 7.4, *Programming*. *Short Cut* does this work for you. See Section 4, *Quickstart*, for a *Short Cut* tutorial.

7.1 Siting

Locate wind sensors away from obstructions (for example, trees and buildings). As a general rule, there should be a horizontal distance of at least ten times the height of the obstruction between the sensor 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 10, *References*, for a list of references that discuss siting wind speed and direction sensors.

7.2 Mounting Options

The 014A can be attached to a CM200-series crossarm via a 1049 NU-RAIL fitting or a CM220 Right Angle Mounting Bracket. The procedure for using these mounts is provided in the quickstart (Section 4.1.3, *Mount to a Tripod or Tower*).

Alternatively, the 014A can be attached to the top of a CM106B, CM110, CM115, or CM120 tripod via the CM216 Sensor Mounting Kit. The CM216 extends 10 cm (4 in) above the mast of the tripod.

7.3 Wiring

Connections to CRBasic dataloggers are given in TABLE 7-1 and TABLE 7-2. To wire an Edlog datalogger, see an older manual at *www.campbellsci.com/old-manuals*, or contact a Campbell Scientific application engineer for assistance.

TABLE 7-1. Connections to Campbell Scientific Dataloggers Pulse Channels

Color	Wire Label	CR6 CR800 CR850 CR5000 CR3000 CR1000 CR9000X	CR200(X)
Black	Signal	Pulse	P_SW
White	Signal Reference	⏚	⏚
Clear	Shield	⏚	⏚

A control port may also be used to measure the 014A. With this option, the white wire is connected to the 5 V terminal. Please note that the control port method cannot be used with a CR200(X) datalogger.

TABLE 7-2. Connections to Campbell Scientific Dataloggers Control Ports

Color	Wire Label	CR6 CR800 CR850 CR5000 CR3000 CR1000 CR9000X
Black	Signal	Control port
White	Signal Reference	5 V
Clear	Shield	⏚

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.
- when 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 4.2, *Use SCWin to Program Datalogger and Generate Wiring Diagram*. 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.1, *Importing Short Cut Code into a Program Editor*. 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*. Programming basics and programming examples for Edlog dataloggers are provided at www.campbellsci.com/old-manuals.

7.4.1 Wind Speed

Wind speed is typically measured with a pulse count instruction, using the switch closure configuration.

If using a control port, see Appendix B.2, *Control Port Example Program*.

The expression for wind speed (U) is:

$$U = MX + B$$

where

M = multiplier
X = number of pulses per second (hertz)
B = offset

TABLE 7-3 lists the multipliers (M) and offsets (Off) to obtain meters/second or miles/hour when the pulse count instruction is configured to output the result in Hz.

TABLE 7-3. Wind Speed Multiplier*

Model	Meters/Second	Miles/Hour
014A	M = 0.8000 Off = 0.447	M = 1.789 Off = 1.0
*When configured to output counts, the above multiplier is divided by the execution interval in seconds		

8. Maintenance

8.1 Suggested Maintenance Schedules

8.1.1 6 to 12 Month Periodic Service

Visually inspect the anemometer cups for cracks and breaks, and make sure that each arm is securely attached to the cup assembly hub. Also check to see that the vent hole, located at the base of the sensor, is unobstructed.

Special caution is advised under adverse conditions of high winds, heat, and/or sandy areas. Look for abrupt stopping of the cup assembly with slow cup rotation. If this occurs, the bearings may need to be replaced.

8.1.2 12 to 24 Month Service

Replace sensor bearings.

8.1.3 24 to 36 Month Service

A complete factory overhaul of the sensor is recommended. Contact Met One directly for wind speed sensor repair and recalibration service. This repair and calibration service includes disassembly and detailed inspection of all moving mechanical parts and all electronic components. Service includes replacement of bearings, shaft, and set screws as well as a functional test of the sensor. Charges above the basic service charge may be added for replacement of additional materials.

Met One Instruments, Inc.
1600 Washington Blvd.
Grants Pass, OR 97526
(541) 471-7111
FAX (541) 471-7116

9. Troubleshooting

Symptom: No wind speed

1. Check that the sensor is wired to the pulse channel specified by the pulse count instruction.

2. Disconnect the sensor from the datalogger and use an ohm meter to check the reed switch. The resistance between the white and black wires should vary from infinite (switch open) to less than 1 ohm (switch closed) as the cup wheel is slowly turned.

3. Verify that the Configuration Code (switch closure, hertz), and multiplier and offset parameters for the pulse count instruction are correct for the datalogger type.

10. 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

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.

A.1 Importing Short Cut Code into a Program Editor

Short Cut creates files that can be imported into *CRBasic Editor* program editor. These files normally reside in the C:\campbellsci\SCWin folder and have the following extensions:

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

Use the following procedure to import *Short Cut* code into *CRBasic Editor* (CR6, CR200(X), CR1000, CR800, CR3000, CR5000 CR9000(X) dataloggers).

1. Create the *Short Cut* program following the procedure in Section 4, *Quickstart*. 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 a ".CR6", ".CR2", ".CR1", ".CR8", ".CR3", ".CR9", or ".CR5" extension, for CR6, CR200(X), CR1000, CR800, CR3000, CR9000(X), or CR5000 dataloggers, respectively. Select the file and click **Open**.

4. Immediately save the file in a folder different from \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 a **'** character (single quotation mark) begins each line. This character instructs the datalogger compiler to ignore the line when compiling the datalogger code.

Appendix B. Example Programs

B.1 Pulse Port Examples

The following CR1000 program uses a pulse port to measure the 014A every 5 seconds. The programs store mean wind speed (in m s^{-1}) every 60 minutes. Wiring for the examples is given in TABLE B-1.

TABLE B-1. Wiring for Pulse Port Example Programs

Color	Description	CR1000
Black	Signal	P1
White	Signal Reference	⏚
Clear	Shield	⏚

B.1.1 CR1000 Example Program

```
'CR1000

'Declare Variables and Units
Public Batt_Volt
Public WS_ms

Units Batt_Volt=Volts
Units WS_ms=meters/second

'Define Data Tables
DataTable(Table1,True,-1)
  DataInterval(0,60,Min,10)
  Average(1,WS_ms,FP2,False)
EndTable

'Main Program
BeginProg
  Scan(5,Sec,1,0)
    'Default Datalogger Battery Voltage measurement Batt_Volt:
    Battery(Batt_Volt)
    '014A Wind Speed Sensor measurement WS_ms:
    PulseCount(WS_ms,1,1,2,1,0.8,0.447)
    If WS_ms<0.448 Then WS_ms=0
    'Call Data Tables and Store Data
    CallTable(Table1)
  NextScan
EndProg
```

B.2 Control Port Example Program

The following CR5000 program uses control ports to measure three 014A wind speed sensor. The program measures them every second and stores the mean wind speed (in m s^{-1}) every 15 seconds.

```
‘CR5000 Series Datalogger
‘Wind Speed using TimerIO Instruction

‘Declare Variables and Units
Public J, WindSpeed(3)

‘Define Data Tables
DataTable(Test,1,-1)
  DataInterval(0,15,Sec,10)
  Average(3,WindSpeed(),IEEE4,False)
EndTable

‘Define Subroutines
‘Sub
  ‘Enter Sub instructions here
‘EndSub

‘Main Program
BeginProg
  Scan (1,Sec,0,0)
    ‘Measure the WindSpeed Profile 014A, 3 anemometers connected to C4, C5, C6 ports

    TimerIO (WindSpeed(1),11000111,00222000,100,0)  ‘Frequency on falling edge
    ‘Convert measurement to m/s
    For j = 1 to 3
      WindSpeed(j) = 0.447 + WindSpeed(j)/1.25
    Next j
    CallTable Test
  Next Scan
End Prog
```

Appendix C. Sensor Maintenance

C.1 Reed Switch Replacement Procedure

To verify parts and locations, refer to the cable and parts diagrams (FIGURE C-2 and FIGURE C-3) and the parts list (TABLE C-1).

A. Remove sensor from mounting arm and disconnect cable.

B. Remove the cup assembly.

C. Remove the three Philips screws at the top of the sensor and lift out the bearing mount assembly.

D. Unsolder the leads of the reed switch and remove the switch from the two mounting terminals, see the parts diagram.

E. Solder the new switch onto the sides of the switch mount terminals (form a loop in the relay leads to obtain proper lead length -- **DO NOT CUT THE RELAY LEADS.**) Measure the distance between the bottom of the rotating magnet and the top of the switch envelope, as shown in FIGURE C-1. The spacing should measure between 0.01 and 0.02 inches.

F. Spin the shaft to verify switch operation by listening for a faint sound of the switch closure. If the switch cannot be heard, move the switch slightly closer to the magnet assembly.

G. Reassemble sensor.

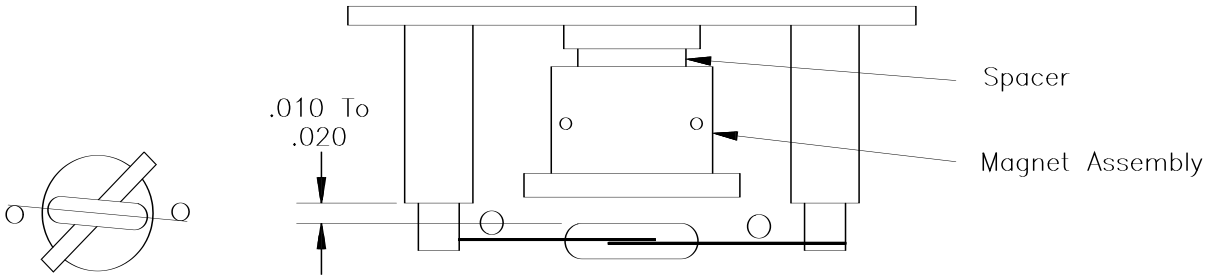


FIGURE C-1. Reed Switch Assembly

C.2 Bearing Replacement Procedure

The bearings used in the 014A sensor are special stainless steel ball bearings with a protective shield. Bearings are lubricated and sealed. **DO NOT LUBRICATE BEARINGS AS THE LUBRICATION WILL ATTRACT DUST AND INHIBIT BEARING OPERATION.**

A. Follow steps A, B, and C in reed switch replacement procedures.

B. Loosen set screws in magnet assembly, lift shaft and collar up and out of bearing mount. Be sure to retain lower spacer.

C. Insert a right-angle type of tool, such as an Allen wrench, into bearing. Cock it slightly to one side and remove both bearings.

D. Install new bearings. Be careful not to introduce dirt particles into bearings. **CLEAN HANDS ONLY! DO NOT ADD LUBRICATION OF ANY KIND**.

E. Reassemble the sensor in reverse order. Be sure to include spacers over the bearings when replacing the shaft in the bearing mount. After the magnet assembly has been tightened, a barely perceptible amount of endplay should be felt when the shaft is moved up and down.

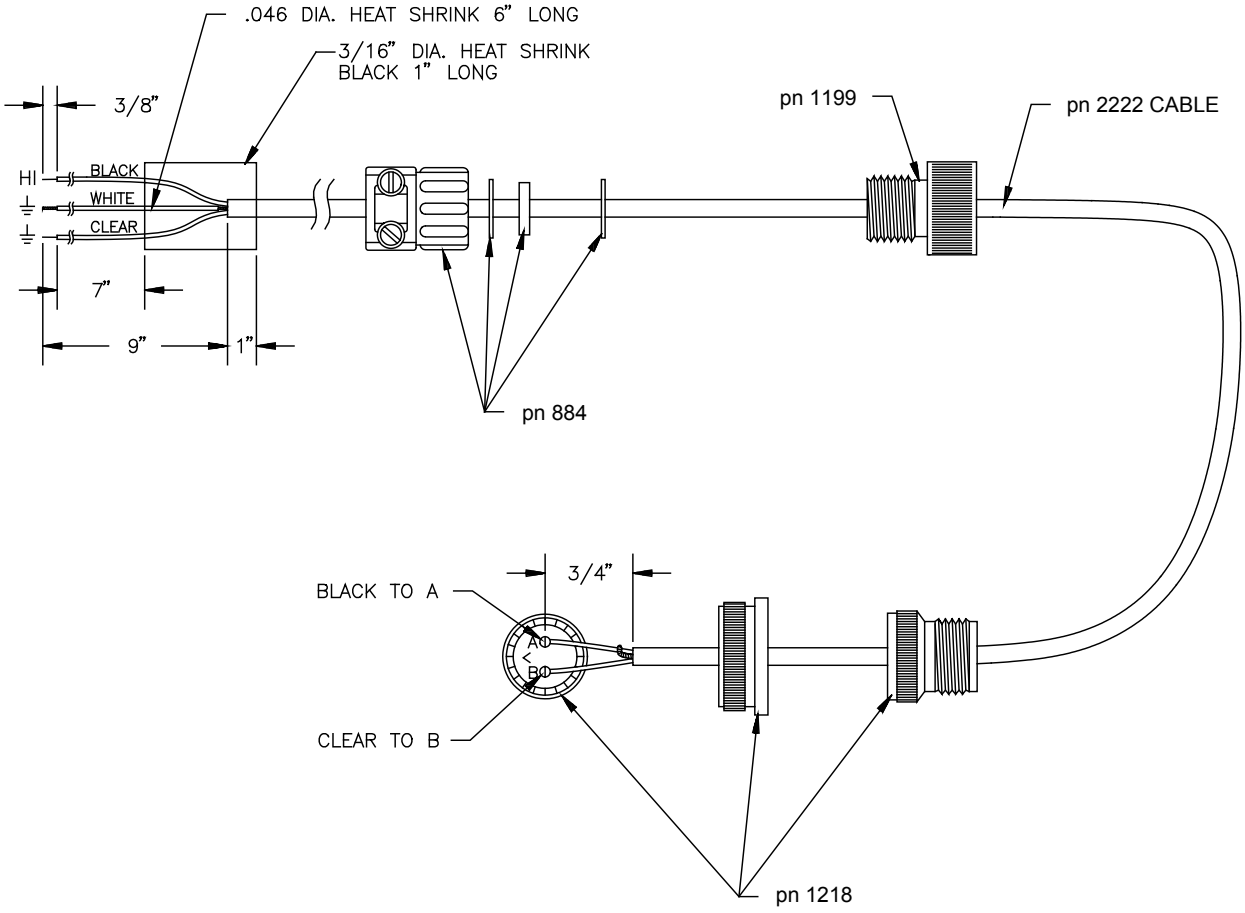


FIGURE C-2. Cable Diagram

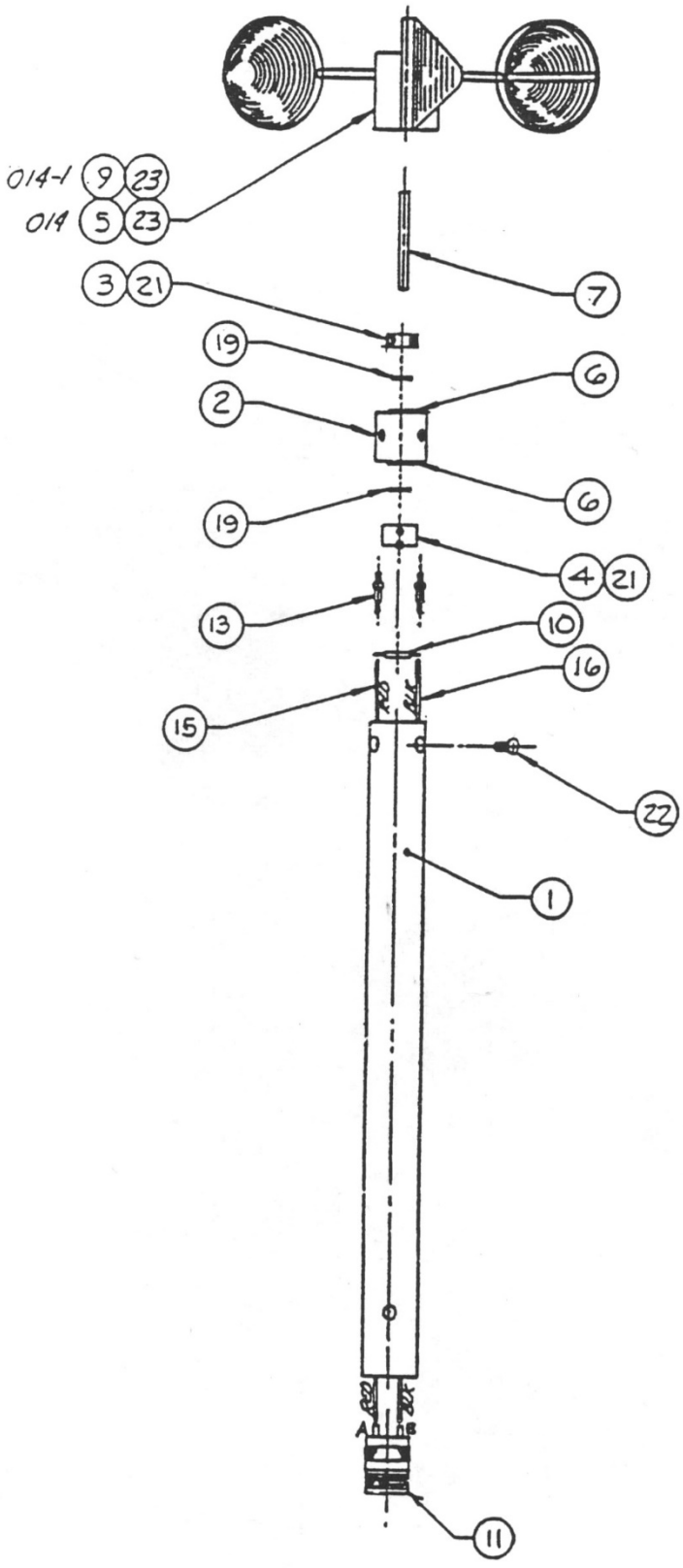


FIGURE C-3. Parts Diagram

TABLE C-1. Met One Parts List

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Item	Part No.	Description	Qty./Assy
1	1011685-2	Housing	1
2	101685-4	Bearing Mount	1
3	101685-7	Collar	1
4	101715	Magnet Assembly	1
5	101812	Assy, Cup (Alum)	1
6	101898	Bearing	2
7	86001	Shaft	1
8	101048-2	Label	1
9	1812-1	Assy, Cup (Lexan)	1
10	880160	Switch, Reed	1
11	500295	Conn, 2 Pin Male	1
12	510020	Cap	1
13	970062	Terminal	2
14			
15	9980480	Wire, 22G Red	18"
16	980445	Wire, 22GA Black	18"
17			
18			
19	860250	Spacer	2
20			
21	601250	SCR, SET A/H C/P 4-40x1/8	4
22	601230	SCR,FLT HD PHIL 4-40x1/4	3
23	601680	SCR,SET A/H C/P 8-23x3/8	2
24			
25	995120	Adhesive, (RTV 108)	A/R
26	995100	Adhesive, Epoxy (907)	A/R
27	995425	Locite 222-21	A/R
28	995060	Adhesive, Silicone	5 ml
29	995430	Locite 290-21	A/R
30	400010	Cable, 2 Cond.	REF
31	500372	Conn, 2 Pin Socket	REF
32	480500	Clamp	REF

Appendix D. Theory of Operation

D.1 Mechanical

The sensor's cup assembly consists of three aluminum cups mounted on a cup assembly hub. A stainless steel shaft, which rotates on precision-sealed ball bearings, connects the cup assembly to a magnet assembly. When the shaft is rotated, the turning magnet assembly causes a reed switch to close. There are two contacts (reed switch closures) per revolution. The frequency of closures is linear from threshold to 45 m s^{-1}.

D.2 Calibration

The 014A sensor has a threshold speed of 0.447 m $s^{-1}$and follows the equation:

V = 0.447 + f/1.250 where
V = wind speed (m s^{-1}), and
f = output frequency (hz,)

or, V = 1.0 + f/0.5589
where V = wind speed (mph), and
f = output frequency (hz.)

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