Product Manual

Sensor

A100LK

Anemometer

Revision: 02/2023

RELIABLE SINCE 1974 MONITORING

CAMPBELL SCIENTIFIC

Table of contents

1. Introduction

The A100LK anemometer is an IEC and MEASNET rated instrument recommended for wind energy applications where a Class 1 anemometer is required. It is primarily used in wind speed resource assessments and in wind turbine power performance monitoring.

> NOTE:
> This manual provides information only for CRBasic data loggers. For retired Edlog data logger support, see an older manual at www.campbellsci.com/old-manuals.

2. Precautions

- READ AND UNDERSTAND the Safety section at the back of this manual.
- The A100LK is a precision instrument. Please handle it with care.

3. Initial inspection

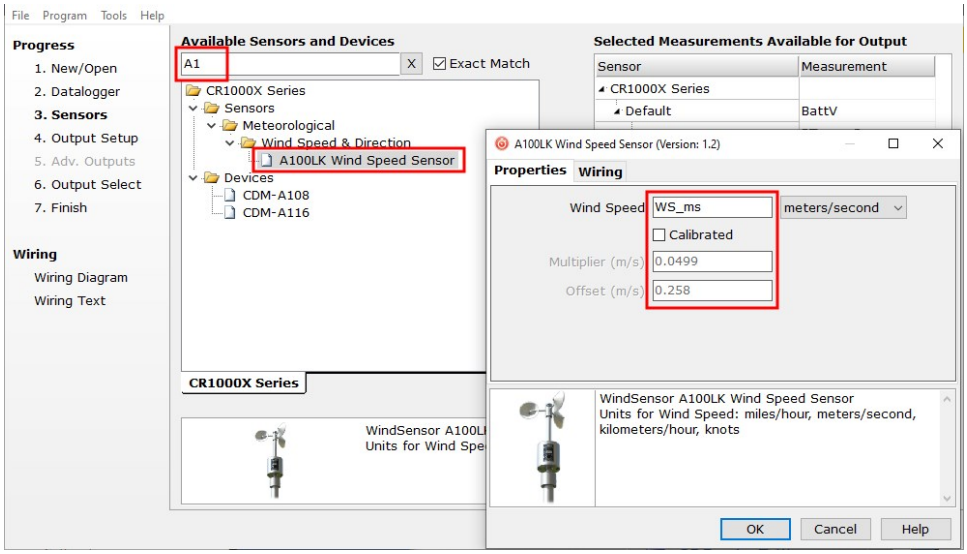
- Upon receipt of the A100LK, inspect the packaging and contents for damage. File damage claims with the shipping company. Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.
- The model number and cable length are printed on a label at the connection end of the cable. Check this information against the shipping documents to ensure the expected product and cable length are received.
- The A100LK is shipped in a box containing the sensor body, anemometer cup assembly, pipe mount, and a MEASNET calibration certificate. Information about attaching the anemometer to the sensor body is provided in Assembly and mounting (p. 7).
- The MEASNET calibration certificate contains information concerning where the anemometer was calibrated, the calibration procedure used, the calibration equation obtained, and the serial number. Cross check the serial number in the calibration certificate against the serial number on the anemometer to ensure that the given sensitivity value corresponds to your sensor.

4. QuickStart

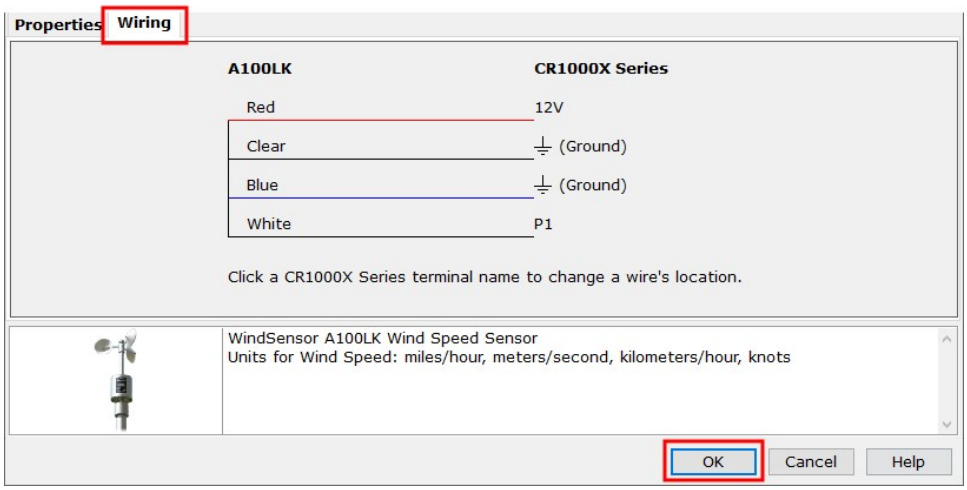
A video that describes data logger programming using ***Short Cut*** is available at: www.campbellsci.com/videos/cr1000x-datalogger-getting-started-program-part-3. ***Short Cut*** is an easy way to program your data logger to measure this sensor and assign data logger wiring terminals. ***Short Cut*** is available as a download on www.campbellsci.com. It is included in installations of ***LoggerNet***, ***RTDAQ***, or ***PC400***.

Use the following procedure to get started.

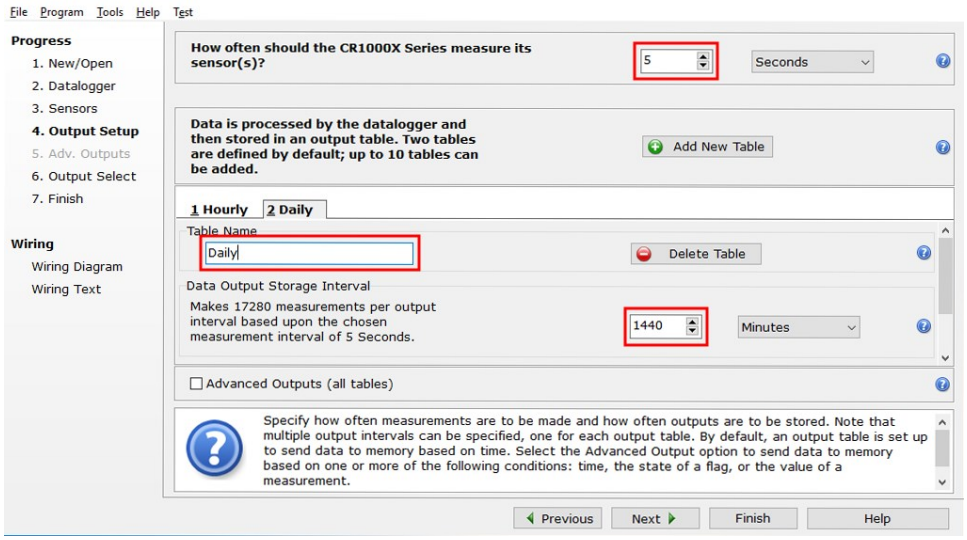
1. Open ***Short Cut*** and create a new program.
2. Double-click the data logger model.
3. In the **Available Sensors and Devices** box, type A100LK or find the A100LK in the **Sensors** > **Meteorological** > **Wind Speed & Direction** folder. Double-click **A100LK Wind Speed Sensor**. The units default to **meters/second**, which can be changed by clicking the **Wind Speed** box and selecting one of the other options. If the sensor is calibrated, click the **Calibrated** box and type the **Multiplier** and **Offset**.



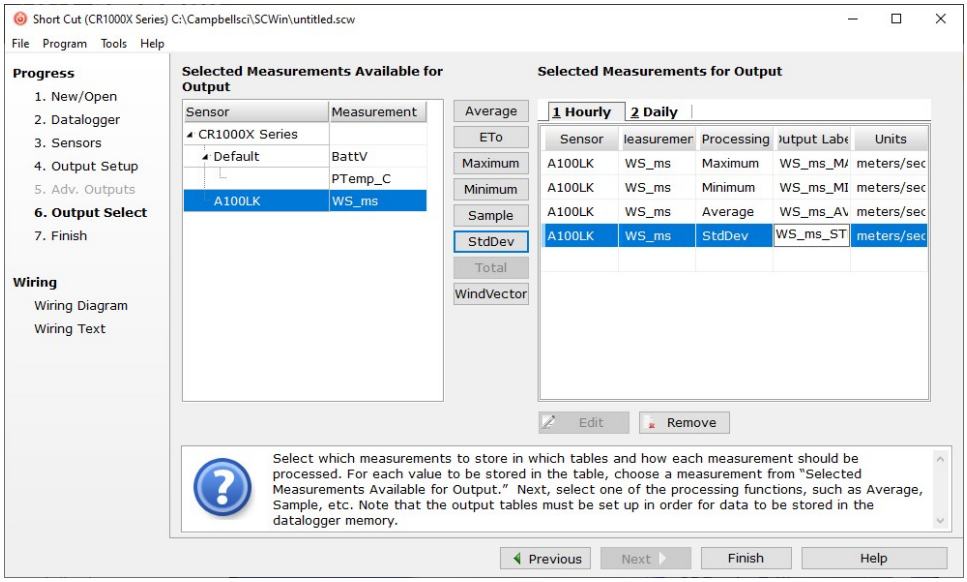
4. Click the **Wiring** tab, wire the sensor, then click **OK**.



5. Repeat steps three and four for other sensors you want to measure. Click **Next**.
6. In **Output Setup**, type the scan rate, a **Table Name**, and **Data Output Storage Interval**. Click **Next**.



7. Select the output options.



8. Click **Finish** and save the program. Send the program to the data logger if the data logger is connected to the computer.
9. If the sensor is connected to the data logger, check the output of the sensor in the data display in ***LoggerNet***, ***RTDAQ***, or ***PC400*** to make sure it is making reasonable measurements.

5. Overview

The A100LK is an IEC Class 1 anemometer. It is a low-power version of the A100L2, which was developed from the proven A100 Porton™ instrument and R30 rotor design. The A100LK consumes little supply current, operating from a supply as low as 5 volts.

Rotation of the A100LK three-cup rotor is electronically converted to pulse output signals proportional to wind speed. The A100LK produces a higher rate of pulses per revolution (up to 13) compared to relay-based sensors, making it suitable for wind surveying where turbulence needs to be estimated.

The A100LK is a rugged instrument, constructed from anodized aluminum alloys, stainless steel, and weather resistant plastics. A stainless steel shaft runs in two precision, corrosion-resistant ball-races. The bearings are protected from the entry of moisture droplets and dust, resulting in an instrument suitable for permanent exposure to the weather.

The low power consumption, wide power supply range, pulse/frequency signal, and first-class performance rating make this anemometer ideal for use with our data loggers in wind-power site surveying applications.

The A100LK is manufactured by Windspeed Ltd and then cabled by Campbell Scientific.

Features:

- IEC Class 1 performance
- Low power
- High rate of pulses per revolution (up to 13) produced makes it suitable for wind surveying applications where turbulence is estimated
- Compatible with Campbell Scientific CRBasic data loggers: CR6, CR1000X, CR800 series, CR350 series, CR300 series, CR3000, and CR1000

6. Specifications

Threshold:	0.15 m/s (starting speed 0.2 m/s, stopping speed 0.1 m/s)
Maximum speed:	77.22 m/s
Accuracy:	1% ±0.1 m/s
Distance constant:	2.3 m ±10%
Calibration data:	Supplied for anemometer and rotor at one test speed to an accuracy of ±1% at +15 °C, 12 VDC supply and an analog output load of 1 MΩ
Temperature range:	–30 to 70 °C
Height:	19.5 cm (7.68 in)
Case diameter:	5.5 cm (2.2 in)
Rotor:	15.2 cm (6 in) diameter three-cup rotor
Weight:	490 g (17.3 oz) including 3 m (10 ft) cable
Supply voltage:	6.5 to 28 VDC
Current consumption:	2 mA max., 1.6 mA typical (no output load)
Power-up time:	5 s
Surge protection:	Vector PC3L2 anti-surge module fitted

7. Installation

If you are programming your data logger with ***Short Cut***, skip Wiring (p. 6) and Programming (p. 6). ***Short Cut*** does this work for you. See QuickStart (p. 2) for a ***Short Cut*** tutorial.

7.1 Wiring

Table 7-1 (p. 6) shows the connections to Campbell Scientific data loggers.

Table 7-1: Wire color, wire function, and data logger connection

Wire color	Wire function	Data logger connection terminal
White	Signal	U configured for pulse input[1], P (pulse input) or C (control terminal)
Red	Power	12V
Blue	Ground	G
Clear	Shield	⏚ (analog ground)

[1]U terminals are automatically configured by the measurement instruction.

7.2 Programming

Short Cut is the best source for up-to-date data logger programming code. If your data acquisition requirements are simple and you are connecting the sensor to a pulse terminal, you can probably create and maintain a data logger program exclusively by using ***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 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 Importing Short Cut code into CRBasic Editor (p. 13). Programming basics for CRBasic data loggers are provided in the following section.

7.2.1 CRBasic programming

A complete program is provided in Example program (p. 14).

For CRBasic data loggers, wind speed is measured using the `PulseCount()` instruction. Syntax of the the `PulseCount()` instruction is:

```
PulseCount( Dest, Reps, PChan, PConfig, POption, Mult, Offset )
```

The **PConfig** parameter should be set to **High Frequency** or **High frequency with pull up** and the **POption** parameter should be set to **Frequency**.

The slope value is entered as the multiplier in the pulse count instruction. For the best accuracy you should always obtain an individual multi-point wind speed calibration in a reputable wind tunnel (such as MEASNET) wherever the highest accuracy results are required.

Calculations for a nominal A100LK suggest that the nominal figures for the data logger would be: slope = 0.0499, offset = 0.258 (for results in m/s, best fit over 4 to 16 m/s) (ref 2).

However, slope/offset figures from Garrad Hassan quotes consensus figures for the A100LK as: slope = 0.0499, offset = .2400.

The example program contained in this manual uses the calculated offset value.

7.3 Siting

Locate wind sensors away from obstructions such as trees or buildings. Generally, there should be a horizontal distance of at least ten times the height of the obstruction between the A100LK and the obstruction. If the sensors need to be mounted on a roof, the height of the sensors above the roof, should be at least 1.5 times the height of the building. See References (p. 11) for a list of references that discuss siting wind speed and direction sensors. For power performance applications refer to IEC 61400-12-1 which specifies the mounting and location of anemometers.

7.4 Assembly and mounting

Materials required:

- 5/32-inch hex key wrench
- Small screwdriver provided with data logger
- UV resistant cable ties
- 6-inch to 10-inch torpedo level
- 76 cm (30 in) mounting pipe
- 3/4-inch-by-1-inch Nu-Rail crossover fitting
- Anemometer cup assembly (see Figure 7-1 [p. 8])

- Sensor body (see Figure 7-1 [p. 8])
- Pipe mount (see Figure 7-1 [p. 8])

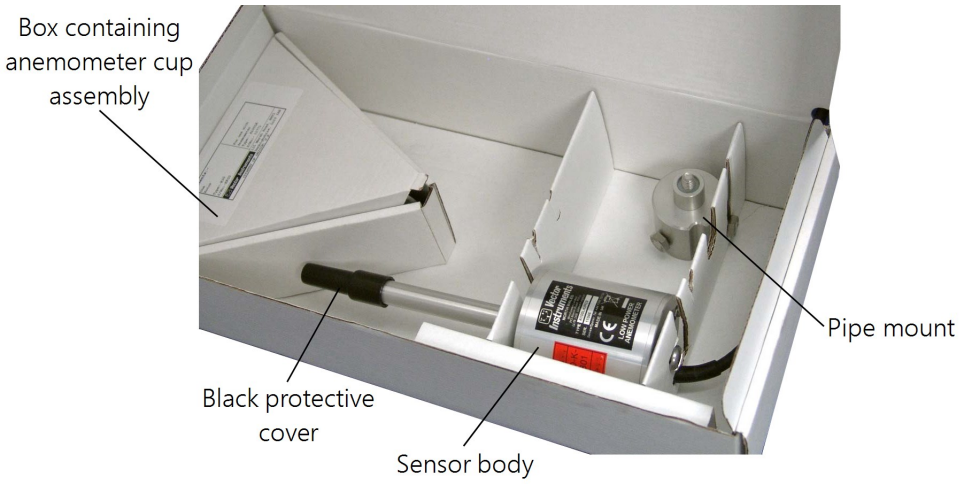


Figure 7-1. Shipping box

To assemble and mount the sensor to a crossarm, do the following.

1. Remove black protective cover from sensor shaft.

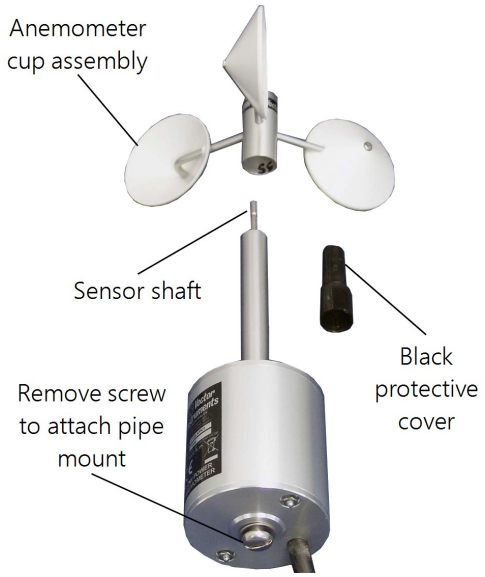


Figure 7-2. Anemometer cup assembly, sensor body, and shaft cover

2. Hold sensor in a vertical position and press anemometer cup assembly onto shaft (see Figure 7-2 [p. 8] and Figure 7-3 [p. 9]).

3. Remove screw in bottom of the sensor body and screw in pipe mount (see Figure 7-2 [p. 8] and Figure 7-3 [p. 9]).

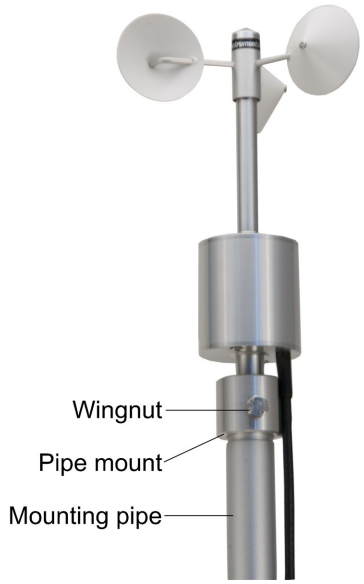


Figure 7-3. Assembled A100LK

4. Mount a CM202, CM204, or CM206 crossarm to a tripod or tower.
5. Secure the 3/4 x 1 inch Nu-Rail Crossover Fitting to the crossarm.
6. Place the 76 cm (30 in) mounting pipe in the bottom of the pipe mount and tighten the thumb screws.
7. Place the bottom of the 76 cm (30 in) mounting pipe in the 3/4 x 1 inch Nu-Rail Crossover Fitting.

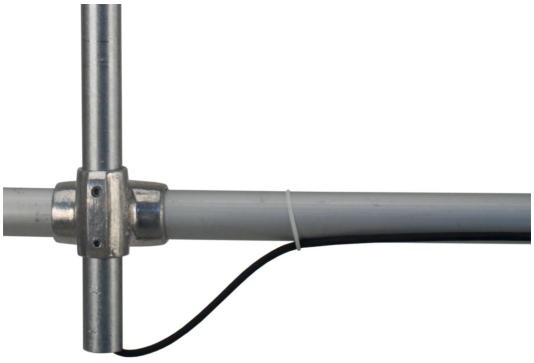


Figure 7-4. Mounting pipe secured to a crossarm using the Nu-Rail Crossover Fitting

8. Use a bubble level to ensure that the anemometer is level.
9. Route the sensor cable along the underside of the crossarm to the tripod or tower, and to the instrument enclosure.
10. Secure the cable to the mounting pipe, crossarm, and tripod or tower using cable ties.

The A100LK can also use a CM221 Right-Angle Mounting Kit. The CM221 uses U-bolts to secure the sensor to a crossarm.

Figure 7-5. CM221 Right-Angle Mounting Kit

8. Troubleshooting and maintenance

> NOTE:
> All factory repairs and recalibrations require a returned material authorization (RMA) and completion of the "Statement of Product Cleanliness and Decontamination" form. Refer to the Assistance page at the end of this manual for more information.

8.1 Troubleshooting

Symptom: No wind speed

1. Check that the sensor is wired to the Pulse channel specified by the `PulseCount()` instruction.
2. Verify that the Configuration Code, and `Multiplier` and `Offset` parameters for the `PulseCount()` instruction are correct for the data logger type.

Symptom: Wind speed does not change

1. For the data loggers that are programmed with Edlog, the input location for wind speed is not updated if the data logger is getting "Program Table Overruns". Increase the execution interval (scan rate) to prevent overruns.

8.2 Maintenance

Every month do a visual/audio inspection of the anemometer at low wind speeds. Verify that the anemometer bearings rotate freely. Inspect the sensor for physical damage. Replace the anemometer bearings when they become noisy, or the wind speed threshold increases above an acceptable level.

> CAUTION:
> Disassembling an anemometer to change the bearings will invalidate the MEASNET calibration.

MEASNET calibrations are normally valid for 12 months in the field (assuming the anemometer is installed within 6 months of the calibration test). In high-accuracy applications, Campbell Scientific recommends that the anemometer be returned to us for maintenance/overhaul between deployments; we can arrange for a new MEASNET calibration after maintenance/overhaul where required.

9. References

IEC 61400 Part 12-1: *Wind turbine generator systems Part 12: Wind Turbine Power Performance Testing*.

Wind vector information: http://www.windspeed.co.uk/ws/index.php?option=faq&task=viewfaq&Itemid=5&artid=29.

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*

Short Cut creates a .DEF file that contains wiring information and a program file that can be imported into *CRBasic Editor*. By default, these files reside in the C:\campbellsci\SCWin folder.

Import *Short Cut* program file and wiring information into *CRBasic Editor*:

1. Create the *Short Cut* program, then save it. Click the **Advanced** tab then the **CRBasic Editor** button. Your program file will open in CRBasic with a generic name. Provide a meaningful name and save the CRBasic program. This program can now be edited for additional refinement.

   > **NOTE:**
   > Once the file is edited with *CRBasic Editor*, *Short Cut* can no longer be used to edit the program.

2. To add the *Short Cut* wiring information into the new CRBasic program, open the .DEF file located in the C:\campbellsci\SCWin folder. Copy the wiring information found at the beginning of the .DEF file.
3. Go into the CRBasic program and paste the wiring information at the beginning of the program.
4. In the CRBasic program, highlight the wiring information, right-click, and select **Comment Block**. This adds an apostrophe (') to the beginning of each of the highlighted lines, which instructs the data logger compiler to ignore those lines when compiling. The **Comment Block** feature is demonstrated at about 5:10 in the CRBasic | Features video.

Appendix B. Example program

The following CR1000X example program uses a pulse terminal to measure the A100LK once a second. The program stores the mean, maximum, minimum, and standard deviation of the measured wind speed over a 10-minute interval.

CRBasic Example 1: CR1000X program measuring the A100LK

```
'CR1000X Series Data Logger
'Program to measure the A100LK and store ten minute averages

'Wiring
'White ------- Signal -------- P1
'Red --------- Power --------- 12V
'Blue -------- Power ground -- G
'White ------- Shield -------- Analog ground
'Declarations
Const A100LK_mult = .0499
Const A100LK_offset = .258

Public PTemp, batt_volt
Public WS_ms

'Define Data Tables
DataTable (TenMinute,1,1000)
  DataInterval (0,10,Min,10)
  Minimum (1,batt_volt,FP2,0,False)
  Sample (1,PTemp,FP2)
  Average (1,WS_ms,FP2,False)
  Maximum (1,WS_ms,FP2,False,False)
  Minimum (1,WS_ms,FP2,False,False)
  StdDev (1,WS_ms,FP2,False)
EndTable

'Main Program

BeginProg
  Scan (1,Sec,0,0)
    PanelTemp (PTemp,250)
    Battery (batt_volt)

    'A100LK Wind Speed Sensor (CSL) measurement 'WS_ms'
    PulseCount(WS_ms,1,P1,3,1,A100LK_mult,A100LK_offset)
    If WS_ms<0.258 Then WS_ms=0
```

CRBasic Example 1: CR1000X program measuring the A100LK

```
    'Call data tables
    CallTable TenMinute

  NextScan
EndProg
```

Limited warranty

Products manufactured by Campbell Scientific are warranted by Campbell Scientific 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 on the corresponding product webpage. See Product Details on the Ordering Information pages at www.campbellsci.com. Other manufacturer's products, that are resold by Campbell Scientific, are warranted only to the limits extended by the original manufacturer.

Refer to www.campbellsci.com/terms#warranty for more information.

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Assistance

Products may not be returned without prior authorization.

Products shipped to Campbell Scientific require a Returned Materials Authorization (RMA) or Repair Reference number and must be clean and uncontaminated by harmful substances, such as hazardous materials, chemicals, insects, and pests. Please complete the required forms prior to shipping equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page for the Global Sales and Support Network or visit www.campbellsci.com/contact to determine which Campbell Scientific office serves your country.

To obtain a Returned Materials Authorization or Repair Reference number, contact your CAMPBELL SCIENTIFIC regional office. Please write the issued number clearly on the outside of the shipping container and ship as directed.

For all returns, the customer must provide a "Statement of Product Cleanliness and Decontamination" or "Declaration of Hazardous Material and Decontamination" form and comply with the requirements specified in it. The form is available from your CAMPBELL SCIENTIFIC regional office. Campbell Scientific is unable to process any returns until we receive this statement. If the statement 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. 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

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations.
- 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, 6 meters (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.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

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.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.
- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

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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Email: sales@campbellsci.co.uk
Website: www.campbellsci.co.uk

USA

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