

INSTRUCTION MANUAL



A100LK Anemometer

Revision: 10/16

®



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PLEASE READ FIRST

About this manual

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

Some useful conversion factors:

Area: 1 in² (square inch) = 645 mm²

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

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

Pressure: 1 psi (lb/in²) = 68.95 mb

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

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

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

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

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

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

Recycling information



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

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

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



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Precautions

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

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

General

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

Utility and Electrical

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

Elevated Work and Weather

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

Maintenance

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

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

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A100LK Anemometer

1. Introduction

The Windspeed Ltd Model 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. The “-L” designation after the A100LK model number designates a cable length.

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 A100LK is a precision instrument. Please handle it with care.
- If the A100LK is to be installed at heights over 6 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 A100LK or before raising a tower.

3. Initial Inspection

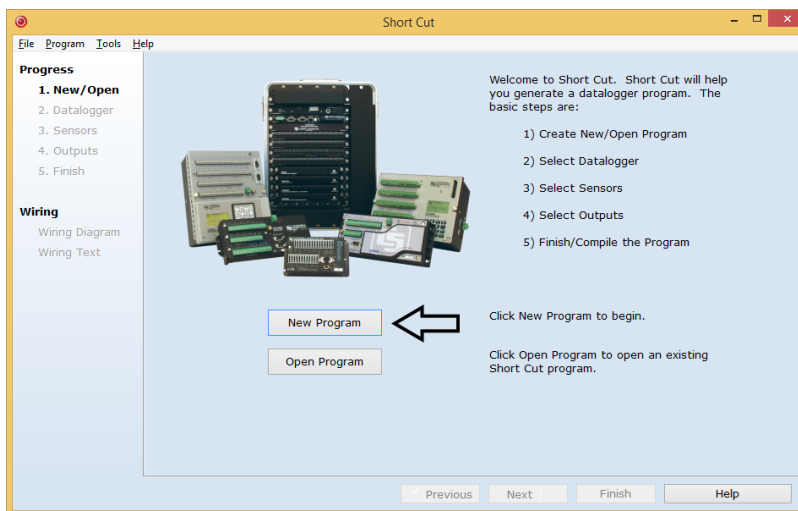
- Upon receipt of the A100LK, inspect the packaging and contents for damage. File damage claims with the shipping company. Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.
- The model number and cable length are printed on a label at the connection end of the cable. Check this information against the shipping documents to ensure the expected product and cable length are received.
- Each A100LK anemometer is shipped with a MEASNET calibration certificate that contains information concerning where the anemometer was calibrated, the calibration procedure used, the calibration equation obtained, and the serial number of the anemometer. 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

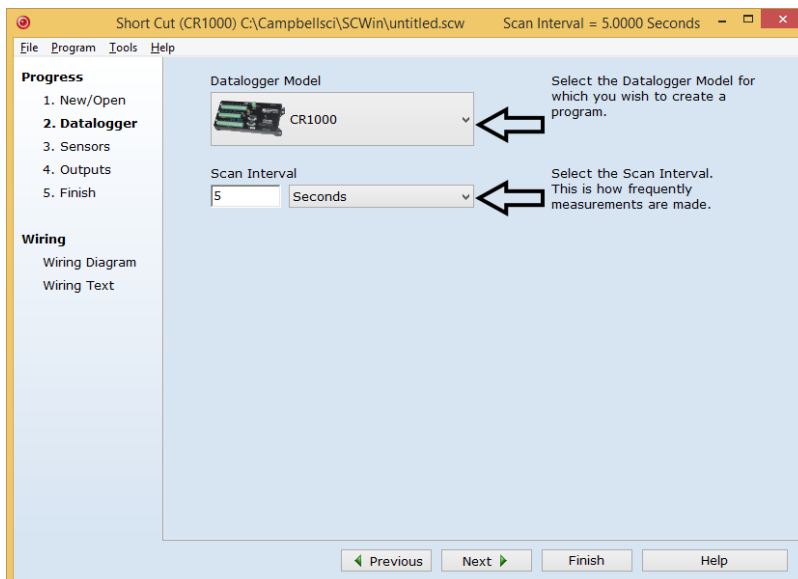
Short Cut is an easy way to program your datalogger to measure the A100LK and assign datalogger wiring terminals. *Short Cut* is available as a download on www.campbellsci.com and the *ResourceDVD*. It is included in installations of *LoggerNet*, *PC200W*, *PC400*, or *RTDAQ*.


Use the following procedure to get started.

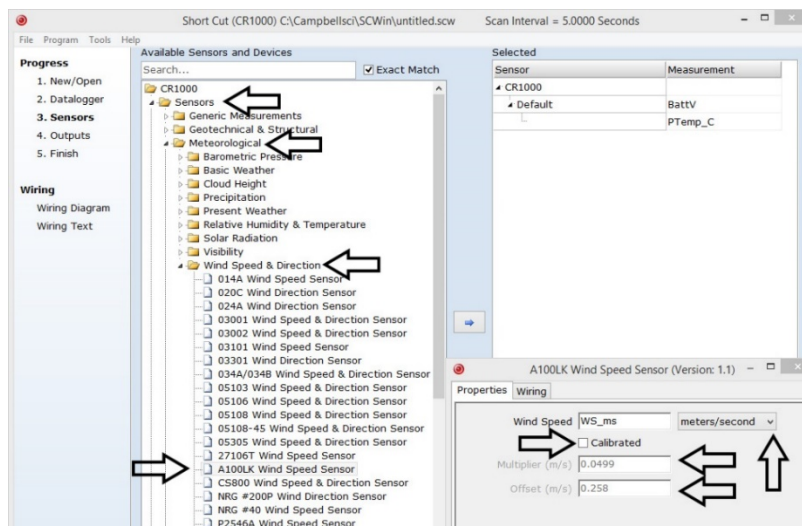
1. Open *Short Cut*. Click **New Program**.



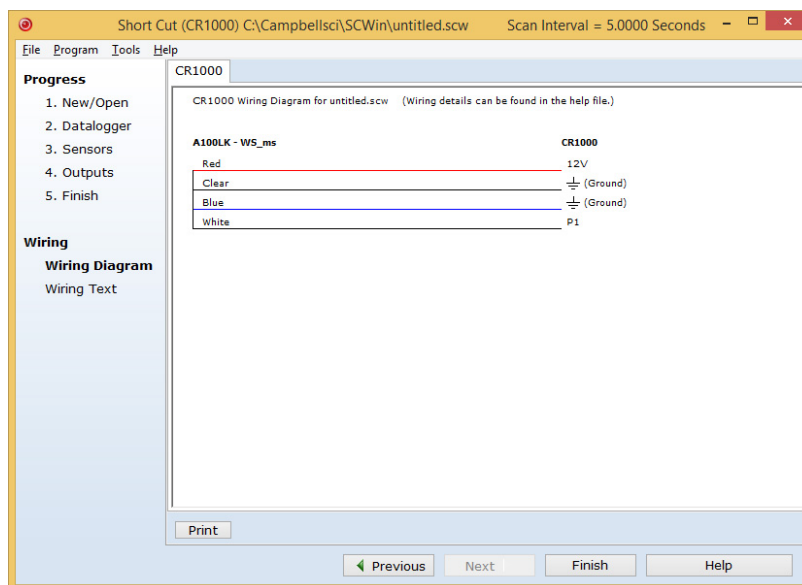
2. Select **Datalogger Model** and **Scan Interval** (default of 5 seconds is OK for most applications). Click **Next**.



- Under the **Available Sensors and Devices** list, select the **Sensors | Meteorological | Wind Speed & Direction** folder. Select **A100LK Wind Speed Sensor** and click  to move the selection to the selected device window. 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 enter the **Multiplier** and **Offset**.



- 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.



- 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 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's 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 dataloggers in wind-power site surveying applications.

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

6. Specifications

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 dataloggers: CR200(X) series, CR300 series, CR6 series, CR800 series, CR1000, CR3000, CR5000, and CR9000(X)

Threshold: 0.15 ms⁻¹ (starting speed 0.2 ms⁻¹, stopping speed 0.1 ms⁻¹)

Maximum speed: 77.22 ms⁻¹

Accuracy: 1% ±0.1 ms⁻¹

Distance Constant:	2.3 m \pm 10%
Calibration Data:	Supplied for anemometer and rotor at one test speed to an accuracy of \pm 1% at +15 °C, 12 Vdc supply and an analogue output load of 1 M Ω
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 datalogger with *Short Cut*, skip Section 7.3, *Wiring* (p. 6), and Section 7.4, *Programming* (p. 7). *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 (e.g., trees and building). As a general rule, there should be a horizontal distance of at least ten times the height of the obstruction between the anemometer and the obstruction. If mounting 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. 9), 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.

7.2 Assembly and Mounting

To mount the sensor, refer to FIGURE 7-1 and do the following.

1. Mount a CM202, CM204, or CM206 crossarm to a tripod or tower.
2. Secure the CM220 Mount to the crossarm.
3. Place the 27739 30-inch pole in the bottom of the A100LK and tighten the thumb screws.

4. Place the bottom of the #27739 pole in the CM220's U-bolt and tighten the nuts.
5. Use a bubble level to ensure that the anemometer is level.
6. Route the sensor cable along the underside of the crossarm to the tripod or tower, and to the instrument enclosure.
7. Secure the cable to the #27739 pole, crossarm, and tripod or tower using cable ties.

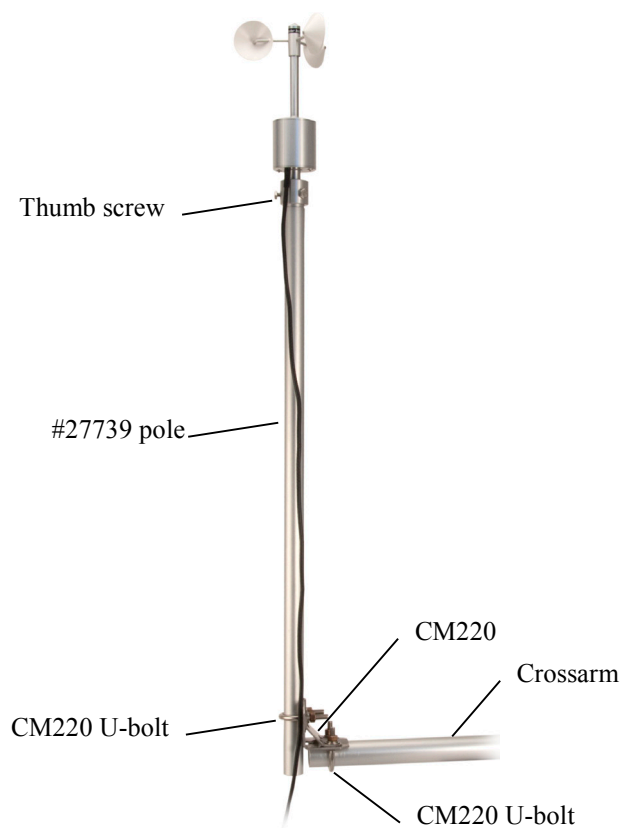


FIGURE 7-1. A100LK mounted to a crossarm via the CM220

7.3 Wiring

TABLE 7-1 shows the connections to Campbell Scientific dataloggers.

TABLE 7-1. Wire Colour, Wire Function, and Datalogger Connection

Wire Colour	Wire Function	Datalogger Connection Terminal
White	Signal	U configured for pulse input ¹ , P (pulse input) or C (control port)
Red	Power	12V
Blue	Ground	G
Clear	Shield	AG or $\frac{1}{2}$ (analogue ground)
¹ U channels are automatically configured by the measurement instruction.		

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, 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 in the following section. A complete program example for a select CRBasic datalogger can be found in Appendix B, *Example Program* (p. B-1). Programming basics and programming examples for Edlog dataloggers are provided at www.campbellsci.com/old-manuals.

7.4.1 PulseCount

For CRBasic dataloggers, wind speed is measured using the **PulseCount()** instruction. Syntax of the **PulseCount()** instruction is:

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

The *PConfig* parameter should be set to 0 (*High Frequency*) and the *POption* parameter should be set to 1 (*Frequency*).

7.4.2 Slope and Offset Calculations

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 datalogger 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 programs contained in this manual use the calculated offset value.

8. Troubleshooting and Maintenance

NOTE

All factory repairs, replacements, and calibrations 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

Symptom: No wind speed

1. Check that the sensor is wired to the Pulse channel specified by the Pulse count instruction.
2. Verify that the Configuration Code, and Multiplier and Offset parameters for the Pulse Count instruction are correct for the datalogger type.

Symptom: Wind speed does not change

1. For the dataloggers that are programmed with Edlog, the input location for wind speed is not updated if the datalogger 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

1. IEC 61400 Part 12-1, “Wind turbine generator systems Part 12: Wind Turbine Power Performance Testing”.
2. <http://www.windspeed.co.uk/ws/index.php?option=faq&task=viewfaq&Itemid=5&artid=29>.

Appendix A. Importing Short Cut Code Into CRBasic Editor

This tutorial shows:

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

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

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

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

1. Create the *Short Cut* program following the procedure in Section 4, *QuickStart* (p. 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, .CR3, .CR5, or .CR9 extension. Select the file and click **Open**.
4. Immediately save the file in a folder different from C:\Campbellsci\SCWin, or save the file with a different file name.

NOTE

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


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

Appendix B. Example Program

The following CR1000 example program uses a pulse port to measure the A100LK-L 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 B-1. CR1000 Program Measuring the A100LK

```
'CR1000 Series Datalogger
'Program to measure A100LK-L and store ten minute averages

'Wiring
'White ----- Signal ----- P1
'Red ----- Power ----- 12V
'Blue ----- Power Ground - G
'White ----- Shield ----- 
'Declarations
Const A100LK_L_mult = .0499
Const A100LK_L_offset = .258

Public PTemp, batt_volt
Public WS_ms

'Define Data Tables
DataTable (Test,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,1,2,0,1,A100LK_L_mult,A100LK_L_offset)
    If WS_ms<0.258 Then WS_ms=0

    'Call data tables
    CallTable Test

  NextScan
EndProg
```


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