USER GUIDE

CS205
Temperature and Relative Humidity Probe

Issued: 16.9.15

Guarantee

This equipment is guaranteed against defects in materials and workmanship. This guarantee applies for twelve months from date of delivery. We will repair or replace products which prove to be defective during the guarantee period provided they are returned to us prepaid. The guarantee will not apply to:

- Equipment which has been modified or altered in any way without the written permission of Campbell Scientific
- Batteries
- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

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Please inform us before returning equipment and obtain a Repair Reference Number whether the repair is under guarantee or not. Please state the faults as clearly as possible, and if the product is out of the guarantee period it should be accompanied by a purchase order. Quotations for repairs can be given on request. It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment, in support of this policy a "Declaration of Hazardous Material and Decontamination" form will be issued for completion.

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Note that goods sent air freight are subject to Customs clearance fees which Campbell Scientific will charge to customers. In many cases, these charges are greater than the cost of the repair.

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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 in^2 (square inch) = 645 mm^2

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/in^2) = 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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CS205 10-hour Fuel Temperature Stick

1. Introduction

The CS205 is a hollowed-out ponderosa-pine dowel that emulates the temperature of similarly sized twigs on the forest floor. Fuel temperature is measured by inserting the thermistor-based 107 probe inside the CS205 dowel. The CS205 and 107 probe are often incorporated in our prewired or custom fire-weather stations.

NOTE This manual provides information only for CRBasic dataloggers. It is also compatible with our retired Edlog dataloggers. For Edlog datalogger support, see an older manual at *www.campbellsci.com/old-manuals* or contact a Campbell Scientific application engineer for assistance.

2. Cautionary Statements

- READ AND UNDERSTAND the *Precautions* section at the front of this manual.
- Avoid touching the dowel of the CS205's dowel with your bare hands. Your hands can contaminate the dowel with oils and dirt that can affect the measurements.

3. Initial Inspection

- Upon receipt of the CS205 and 107, inspect the packaging and contents for damage. File damage claims with the shipping company.
- The model number and cable length are printed on a label at the connection end of the 107's cable. Check this information against the shipping documents to ensure the expected product and cable length are received.

4. Quickstart

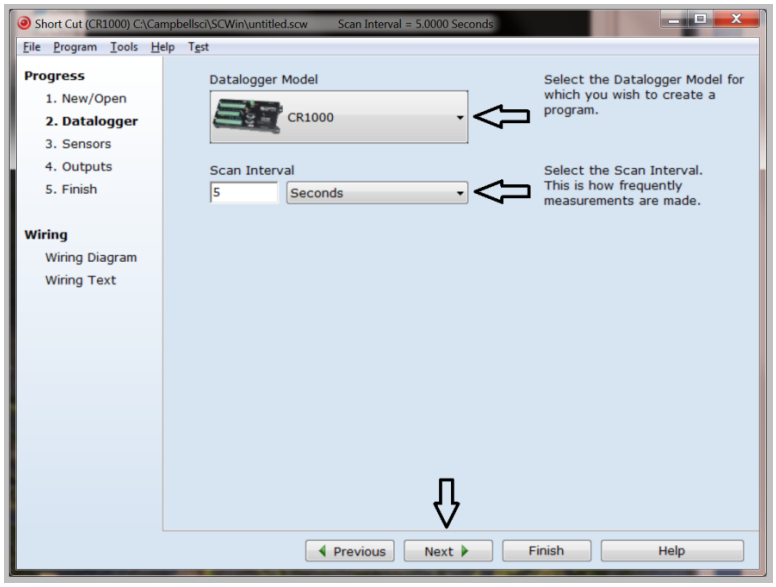
Short Cut is an easy way to program your datalogger to measure the 107 and assign datalogger wiring terminals. The following procedure shows using *Short Cut* to program the 107.

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.

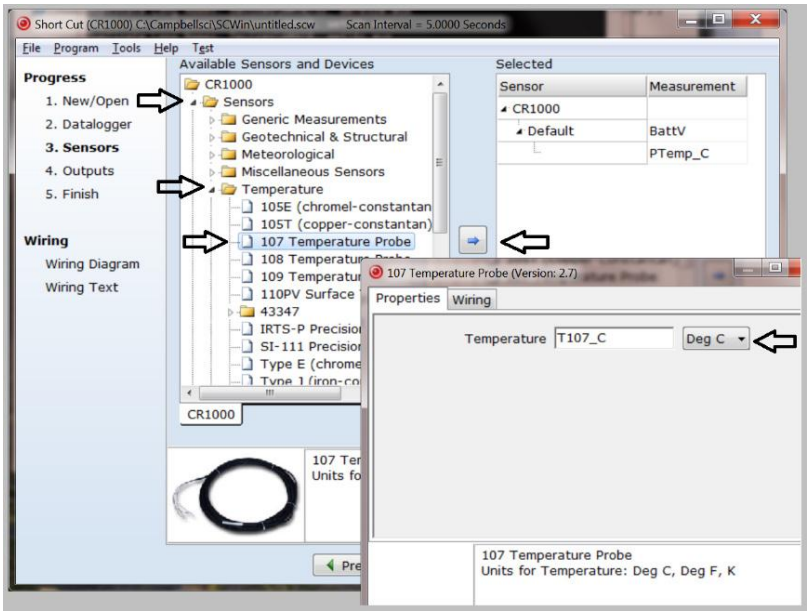
2. The *Short Cut* installation should place a shortcut icon on the desktop of your computer. To open *Short Cut*, click on this icon.

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

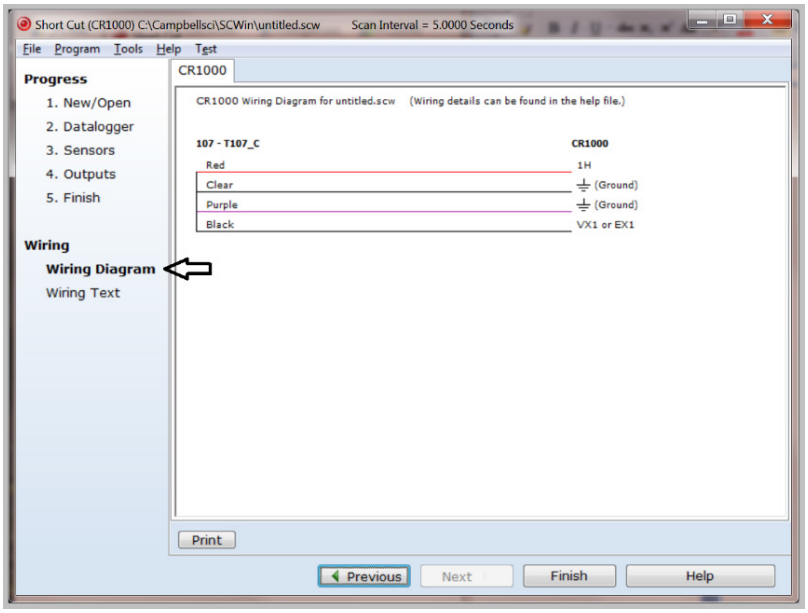
4. Select **Datalogger Model** and **Scan Interval** (default of **5** seconds is OK for most applications). Click **Next**.



5. Under the **Available Sensors and Devices list**, select the **Sensors | Temperature | 107 Temperature Probe**. Click  to move the selection to the **Selected** device window. Data defaults to degree Celsius. This can be changed by clicking the **Deg C** box and selecting **Deg F**, for degrees Fahrenheit, or K for Kelvin.



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. *Short Cut* uses a 3-wire half bridge measurement, and therefore doesn't use the blue, green, and white wires. 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. Specifications

Features:

- Companion product to CS506 fuel moisture sensor; can be mounted on the same stake
- Used with the 107 probe to measure fuel temperature for forest fire applications
- 107 compatible with Campbell Scientific CRBasic dataloggers: CR6, CR800, CR850, CR1000, CR3000, and CR5000

5.1 CS205 10-Hour Temperature Stick

Material:	Ponderosa Pine
Diameter:	1.3 cm (0.5 in)
Length:	11.4 cm (4.5 in)
Weight of Stick Only:	9.07 g (0.32 oz)

5.2 107 Fuel Temperature Sensor

Sensor:	Measurement Specialties 100K6A1iA thermistor
Temperature Measurement Range:	–35 to +50 °C
Steinhart-Hart Equation Error:	≤ ±0.01 °C over measurement range
Time Constant in Air:	30 to 60 s in a wind speed of 5 m s^{-1}
Length:	10.4 cm (4.1 in)
Diameter:	0.762 cm (0.3 in)
Weight with 10-ft Cable:	136 g (5 oz)

6. Installation

6.1 009620 Mounting Kit

The CS205/107 is typically mounted with the CS506/009619 using the 009620 Mounting Kit (Figure 6-1 and Figure 6-2). The kit's bracket places the probes in a horizontal position.

NOTE The 009620 mounting kit is not compatible with the retired CS505 fuel moisture sensor. The CS205/107 is mounted with the retired CS505 fuel moisture sensor using the #10974 mounting kit. See an older manual at *www.campbellsci.com/old-manuals* for information about using the #10974 mounting kit.

1. Choose a site that is representative of the forest-floor duff layer.
2. Carefully hammer the copper stake into the ground so that it is secure and vertical.
3. Place the mounting bracket on the copper stake so that the probes will be approximately 30 cm (12 in) above the ground and pointing south (northern hemisphere) or north (southern hemisphere).
4. Tighten the nuts on the U-bolt.
5. Insert the CS205 fuel temperature stick into the mounting stake's compression fitting.
6. Insert the 107 temperature probe into the CS205 stick.
7. Tighten the compression fitting so that it compresses the split wood and snugly holds the 107 probe.

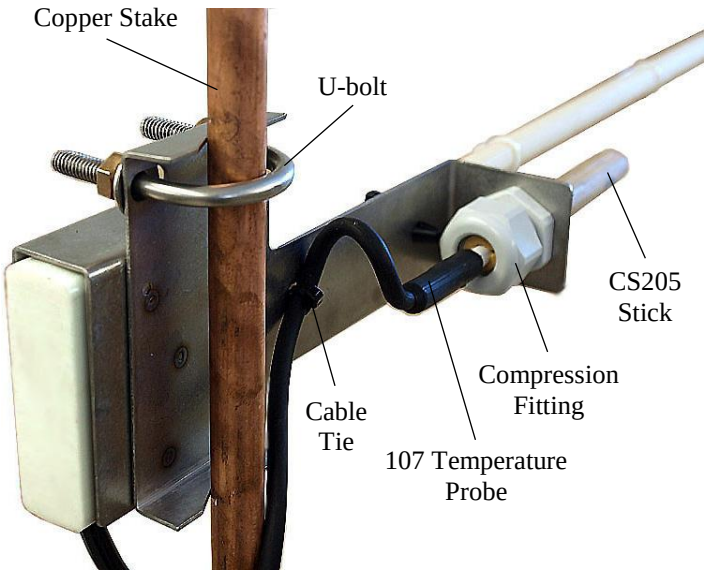


Figure 6-1. Back view of the 009620 fuel moisture/temperature mounting stake

8. Insert the CS506 electronics into the bracket.
9. Secure the 009619 10-hour fuel moisture stick to the CS506 using the Phillips screws.

CAUTION Wear gloves to avoid touching the dowel with your bare hands. Your hands can contaminate the dowel with oils and dirt that can affect the measurements.

10. Use the ultraviolet light resistant cable ties included in the 009620 mounting kit to secure the cables. One cable tie passes through the two slots in the bracket to loosely secure the cable of the CS205/107 (Figure 6-1). The other two cable ties secure both cables to the copper stake (Figure 6-2).

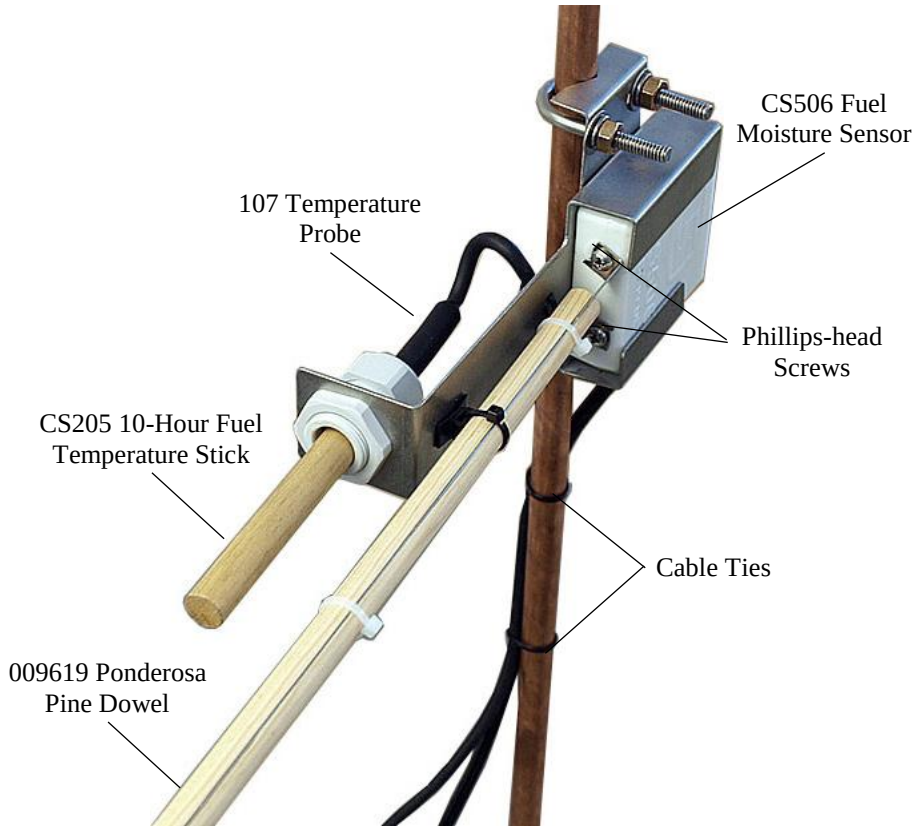


Figure 6-2. Front view of the 009620 fuel moisture/temperature mounting stake

6.2 Wiring

Connections of the 107 probe to Campbell Scientific dataloggers are given in Table 6-1. Figure 6-3 provides schematic for the 107. Temperature is measured with one single-ended input channel and an excitation channel.

Table 6-1. Wiring for 107

Colour	Description	CR800 CR5000 CR3000 CR1000	CR6
Black	Excitation	Switched Excitation	Universal channel
Red	Temperature Signal	Single-Ended Input	Universal channel
White	Signal Ground	⏚	⏚
Clear	Shield	⏚	⏚

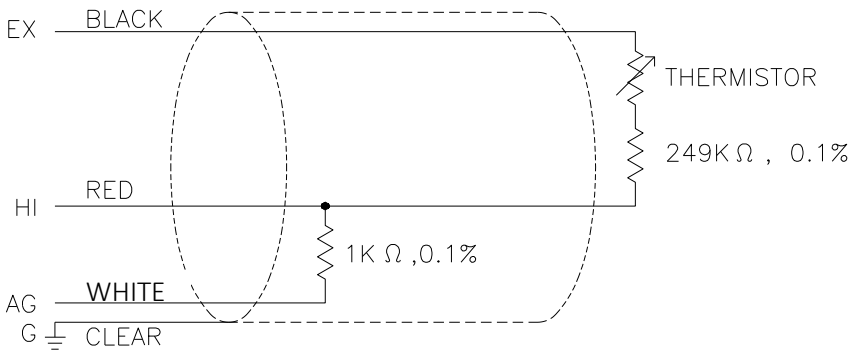


Figure 6-3. 107 Thermistor Probe Schematic

6.3 Datalogger Programming

Short Cut is the best source for up-to-date datalogger programming code. Programming code is needed,

- when creating a program for a new datalogger installation
- when adding sensors to an existing datalogger program.

If your data acquisition requirements are simple, you can probably create and maintain a datalogger program exclusively with *Short Cut*. If your data acquisition needs are more complex, the files that *Short Cut* creates are a great source for programming code to start a new program or add to an existing custom program.

NOTE *Short Cut* cannot edit programs after they are imported and edited in *CRBasic Editor*.

A *Short Cut* tutorial is available in Section 4, *Quickstart* *(p. 1)*. If you wish to import *Short Cut* code into *CRBasic Editor* to create or add to a customized program, follow the procedure in Appendix A, *Importing Short Cut Code* *(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.campbellsci.com\old-manuals*. Refer to the 107 manual for information about electrically noisy environments, long lead lengths, and measurement and output linearization.

6.3.1 Therm107() Instruction

The **Therm107()** measurement instruction programs CRBasic dataloggers (CR6- and CR800-series, CR1000, CR3000, and CR5000) to measure the 107 probe. It supplies 2500 mV excitation, makes a half-bridge resistance measurement, and converts the result to temperature using the Steinhart-Hart equation.

```
Therm107(Dest, Reps, SEChan, VxChan, SettlingTime, Integ/Fnotch, Mult, Offset)
```

Variations:

- Temperature reported as °C — set Mult to 1 and Offset to 0
- Temperature reported as °F — set Mult to 1.8 and Offset to 32
- AC mains noise filtering — set Integ/Fnotch to _60Hz or _50Hz (see 107 Manual)
- Compensate for long cable lengths — Set SettlingTime to 20000 (see 107 Manual)

7. Maintenance and Calibration

The 107 Probe requires minimal maintenance. Please refer to the 107 manual for more detail.

The CS205 Fuel Moisture Stick should be changed annually or more frequently as required. The wood should visually appear fresh and new not grey or discoloured.

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

Short Cut creates files that can be imported into *CRBasic 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)
- .CR1 (CR1000 datalogger code)
- .CR8 (CR800 datalogger code)
- .CR3 (CR3000 datalogger code)
- .CR5 (CR5000 datalogger code)

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

1. Create the *Short Cut* program following the procedure in Section 4, *Quickstart (p. 1)*. Finish the program and exit *Short Cut*. Make note of the file name used when saving the *Short Cut* program.

2. Open *CRBasic Editor*.

3. Click **File** | **Open**. Assuming the default paths were used when *Short Cut* was installed, navigate to C:\CampbellSci\SCWin folder. The file of interest has a ".CR6", ".CR1", ".CR8", ".CR3", or ".CR5" extension, for CR6, CR1000, CR800, CR3000, 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

This example can be used directly with CR800 series, CR1000, CR3000 and CR5000 dataloggers.

```
'CR1000
'This example program measures a single 107 Thermistor probe
'every 10 seconds and stores the average temperature every 60 minutes.

'Declare the variables for the temperature measurement
Public T107_C

'Define a data table for 60 minute averages:
DataTable(Table1,True,-1)
  DataInterval(0,60,Min,0)
  Average(1,T107_C,IEEE4,0)
EndTable

BeginProg
  Scan(10,Sec,1,0)
    'Measure the temperature
    Therm107(T107_C,1,1,Vx1,0,_60Hz,1.0,0.0)
    'Call Data Table
    CallTable(Table1)
  NextScan
EndProg
```

The following example can be used directly with CR6 series dataloggers.

```
'Program measures one 107 temperature probe once a second and
'stores the average temperature every 60 minutes.
'Wiring Diagram
'==============
' 107
' Probe
' Lead                                    CR6
' Colour      Function                     Terminal
' -----       --------                     ------
' Black       Voltage-excitation input     U10
' Red         Analogue-voltage output        U1
' White       Bridge-resistor ground       Ground Symbol
' Clear       Shield                       Ground Symbol

'Declare the variables for the temperature measurement
Public T107_C

'Define a data table for 60 minute averages:
DataTable(Table1,True,-1)
  DataInterval(0,60,Min,0)
  Average(1,T107_C,IEEE4,0)
EndTable
```

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