Product Manual

Sensor

CS100

Barometric Pressure Sensor

Revision: 03/2020

CSL I.D - 533

RELIABLE SINCE 1974 MONITORING

CAMPBELL SCIENTIFIC

Guarantee

This equipment is guaranteed against defects in materials and workmanship. We will repair or replace products which prove to be defective during the guarantee period as detailed on your invoice, 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
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- Any product which has been subjected to misuse, neglect, acts of God or damage in transit.

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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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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.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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CS100 Barometric Pressure Sensor

1. Introduction

The CS100 measures barometric pressure for the range of 600 to 1100 hPa. This range equates to from below sea level (as in a mine) up to 3658 m (12,000 feet) above sea level. Designed for use in environmental applications, the CS100 is compatible with all Campbell Scientific data loggers.

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 front of this manual.
- Warning: Failure to protect the sensor from condensation may result in permanent damage.
- Warning: Improper wiring may damage the CS100 beyond repair.
- Care should be taken when opening the shipping package to not damage or cut the cable jacket. If damage to the cable is suspected, contact Campbell Scientific.
- Although the CS100 is rugged, it should be handled as a precision scientific instrument.
- The black outer jacket of the cable is Santoprene® rubber. This compound was chosen for its resistance to temperature extremes, moisture, and UV degradation. However, this jacket will support combustion in air. It is rated as slow burning when tested according to U.L. 94 H.B. and will pass FMVSS302. Local fire codes may preclude its use inside buildings.

3. Initial Inspection

- Upon receipt of the CS100, inspect the packaging and contents for damage. File damage claims with the shipping company.

4. QuickStart

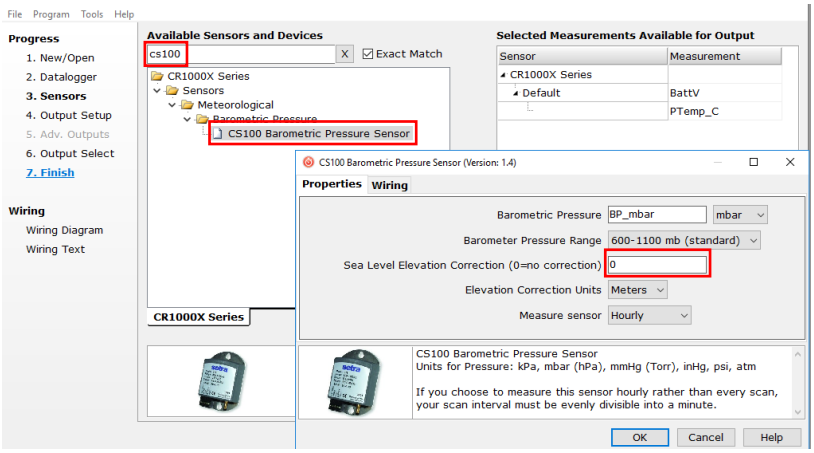
A video that describes data logger programming using *Short Cut* is available at: *www.campbellsci.eu/videos/cr1000x-datalogger-getting-started-program-part-3*. *Short Cut* is an easy way to program your data logger to measure the CS100 and assign data logger wiring terminals. *Short Cut* is available as a download at *www.campbellsci.eu*. It is included in installations of *LoggerNet*, *RTDAQ*, *PC400*, and *PC200W*.

The following procedure also describes programming with *Short Cut*.

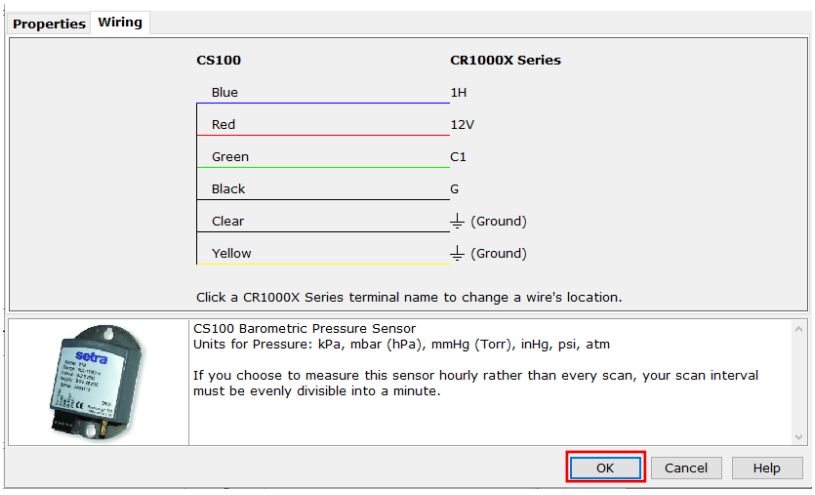
1. Open *Short Cut* and click **Create New Program**.

2. Double-click the data logger model.

3. In the **Available Sensors and Devices** box, type CS100, or locate the sensor in the **Sensors** > **Meteorological** > **Barometric Pressure** folder. Double-click **CS100 Barometric Pressure Sensor**. Type the **Sea Level Elevation Correction**. If not using the standard range, select another **Barometer Pressure Range**. The default units for the sea level elevation correction is metres; this can be changed by clicking the **Elevation Correction Units** box and selecting **Feet**. Defaults for the barometric pressure measurement and frequency of the measurement are **mmHg** and **Hourly**, consecutively. These can be changed by clicking the **Barometric Pressure** and **Measure sensor** boxes and selecting different values.



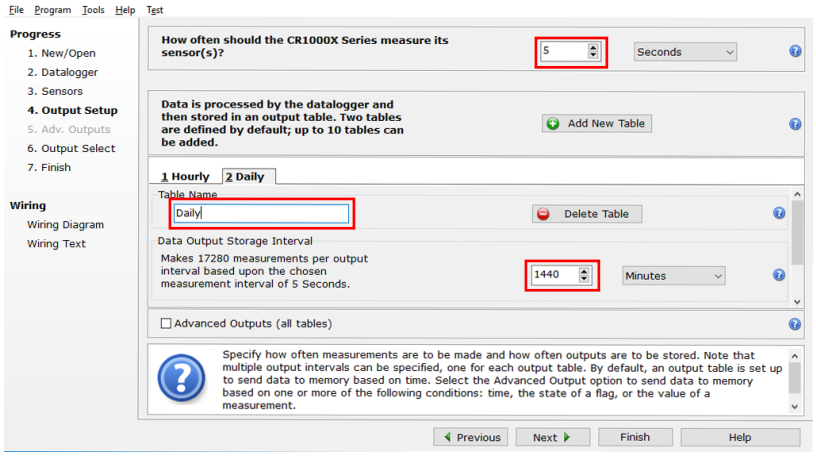
4. Click on the **Wiring** tab to see how the sensor is to be wired to the data logger. Click **OK** after wiring the sensor.



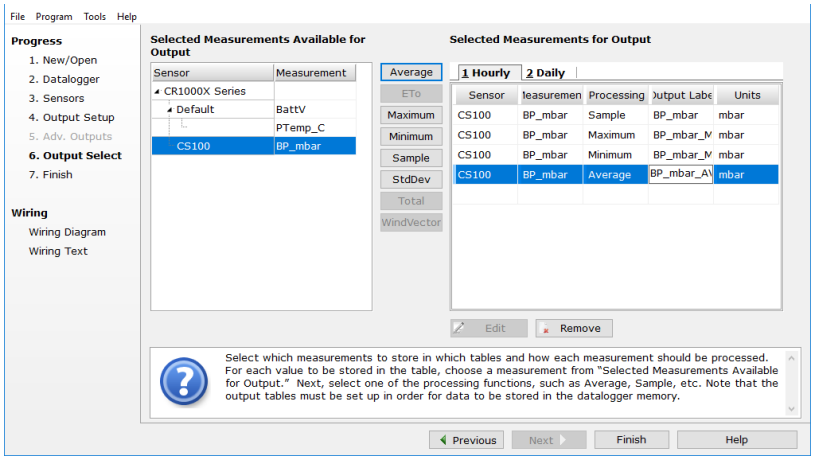
WARNING **Improper wiring may damage the CS100 beyond repair.**

5. Repeat steps three and four for other sensors. Click **Next**.

6. In **Output Setup**, enter the scan rate, **Data Output Storage Intervals**, and meaningful table names.



7. Select the measurement and its associated 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*, *PC400*, or *PC200W* to make sure it is making reasonable measurements.

5. Overview

The CS100 is a capacitive pressure transducer that uses the Setra's electrical capacitor technology for barometric pressure measurements. The transducer is encased in a stainless steel and polyester case fitted with an 1/8-inch barbed fitting for pressure connection (FIGURE 5-1).

FIGURE 5-1. CS100 Barometric Pressure Sensor

The compact and rugged polyester housing contains two closely-spaced, parallel, electrically-isolated metallic surfaces. One of the surfaces is essentially a diaphragm constructed of a Setra's proprietary compound of fused glass and ceramic (Setraceram™) or a low-hysteresis material, such as 17-4 PH SS. The diaphragm is capable of detecting a slight change in the applied pressure, which is then converted to an analogue voltage signal by Setra's custom application-specific integrated circuit (ASIC). Campbell Scientific data loggers can directly measure the analogue signal generated by the barometer.

The standard measurement range is 600 to 1100 hPa. Other available measurement ranges are 500 to 1100 hPa and 800 to 1100 hPa. Please contact Campbell Scientific to order these special versions.

The CS100 is supplied in the triggered mode that allows the data logger to switch 12 VDC power to the barometer before the measurement. The data logger then powers down the barometer after the measurements to conserve power.

If the CS100 and data logger will be housed in different enclosures, the CABLE5CBL-L should be used instead of the cable that is shipped with the CS100. The CABLE5CBL-L has a user-specified length; if pertinent, see Section 8.2, *Long Cable Lengths* *(p. 10)*.

Features:

- Integral switching circuit limits power consumption to measurement cycle
- Calibration NIST traceable
- Meets CE conformance standards
- Compatible with Campbell Scientific CRBasic data loggers: GRANITE-series, CR6, CR3000, CR1000X, CR800-series, CR300-series, CR1000

6. Specifications

6.1 Performance

Operating Temperature Range: –40 to 60 °C (–40 to 140 °F)

Storage Temperature Range: –60 to 120 °C (–76 to 248 °F)

Proof Pressure: 1500 hPa

Burst Pressure: 2000 hPa

Humidity Range: non-condensing (up to 95% RH)

Media Compatibility: non-corrosive, non-condensing air or gas

Resolution: 0.01 hPa

6.1.1 Performance for "Standard" Range Option

Measurement Range: 600 to 1100 hPa (mBar)

Total Accuracy[1]: ±0.5 hPa @ 20 °C
±1.0 hPa @ 0 to 40 °C
±1.5 hPa @ –20 to 50 °C
±2.0 hPa @ –40 to 60 °C

Linearity: ±0.4 hPa

Hysteresis: ±0.05 hPa

Repeatability: ±0.03 hPa

Long-term Stability: ±0.1 hPa per year

[1]The root sum squared (RSS) of end point non-linearity, hysteresis, non-repeatability and calibration uncertainty.

6.1.2 Performance for 500 to 1100 hPa Range Option

Measurement Range: 500 to 1100 hPa

Total Accuracy[1]: ±0.6 hPa @ 20 °C
±1.2 hPa @ 0 to 40 °C
±2.0 hPa @ –20 to 50 °C
±2.5 hPa @ –40 to 60 °C

Linearity: ±0.5 hPa

Hysteresis: ±0.06 hPa

Repeatability: ±0.04 hPa

[1]The root sum squared (RSS) of end point non-linearity, hysteresis, non-repeatability and calibration uncertainty.

6.1.3 Performance for 800 to 1100 hPa Range Option

Measurement Range: 800 to 1100 hPa

Total Accuracy[1]: ±0.3 hPa @ 20 °C
±0.6 hPa @ 0 to 40 °C
±1.0 hPa @ –20 to 50 °C
±1.5 hPa @ –40 to 60 °C

Linearity: ±0.25 hPa

Hysteresis:	±0.03 hPa
Repeatability:	±0.02 hPa

[1]The root sum squared (RSS) of end point non-linearity, hysteresis, non-repeatability and calibration uncertainty.

6.2 Electrical

Supply Voltage:	9.5 to 28 VDC
External Trigger Voltage	
Sleep Mode:	0 VDC
Operating Mode:	3 to 28 VDC
Current Consumption:	3 mA nominal (operating mode) 1 µA quiescent (sleep mode)
Signal Output:	0 to 2.5 VDC
Warm-up Time:	<1 s from shutdown mode
Response Time:	<100 ms

6.3 Physical

Dimensions (Main Box):	9.1 x 6.1 x 2.5 cm (3.6 x 2.4 x 1.0 in)
Weight:	135 g (4.8 oz)
Mounting Hole Centres:	7.62 cm (3 in)
Pressure Connector:	1/8 in ID barbed fitting

7. Installation

If you are programming your data logger with *Short Cut*, skip Section 7.3, *Wiring* (p. 7), and Section 7.4, *Programming* (p. 9). *Short Cut* does this work for you. See Section 4, *QuickStart* (p. 1), for a *Short Cut* tutorial.

7.1 Venting and Condensation

To prevent condensation, install the sensor in an environmentally protected enclosure, complete with desiccant, which should be changed at regular intervals.

CAUTION Failure to protect the sensor from condensation may result in permanent damage.

The CS100 is typically mounted in a Campbell Scientific enclosure next to the data logger. Campbell Scientific also offers the ENC100 for situations where it is desirable to house the CS100 in its own enclosure. The ENC100 is a small enclosure with dimensions of 17.1 x 14.0 x 9.9 cm (6.7 x 5.5 x 3.9 in). It includes a compression fitting for cable entry, a vent for equalization with the atmosphere, a backplate for mounting the CS100, and hardware for mounting the ENC100 to a tripod, tower, or pole (see FIGURE 7-1).

FIGURE 7-1. ENC100 is a very small enclosure that can house one CS100

For the sensor to detect the external ambient pressure, the enclosure must vent to the atmosphere (not be hermetically sealed), which may require the addition of a vent hole on the outer wall. In this situation, do not make the hole on one of the vertical side walls, as wind blowing around it can cause transient changes in pressure.

7.2 Mounting

The mounting holes for the sensor are one-inch-centred (three inches apart), and will mount directly onto the holes on the backplates of the Campbell Scientific enclosures. Mount the sensor with the pneumatic connector pointing vertically downwards to prevent condensation collecting in the pressure cavity, and also to ensure that water cannot enter the sensor.

7.3 Wiring

7.3.1 5-pin Screw Terminal Plug Connector

The CS100 is shipped with a cable that connects to the CS100 using a 5-pin screw terminal plug connector. The cable is shipped with a connector key attached to the connector to help ensure the connector is correctly plugged into the CS100 (see FIGURE 7-2). The connector should easily plug into the barometer.

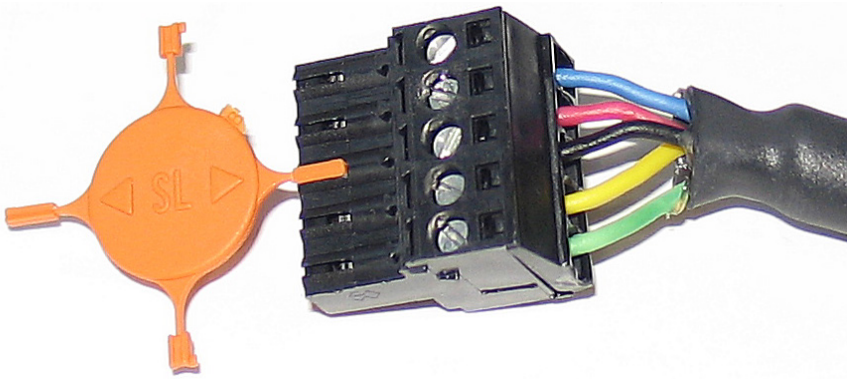


FIGURE 7-2. Connector key attached to 5-pin screw terminal plug connector

WARNING **A 5-pin screw terminal that is plugged in upside down will damage the sensor—perhaps beyond repair.**

7.3.2 Data Logger Connection

Before connecting the barometer to the data logger, a yellow warning label must be removed from the pigtails (see FIGURE 7-3). The warning label reminds the user of the importance of properly connecting the barometer to the data logger. Proper wiring is shown in Table 7-1.

FIGURE 7-3. CS100 and cable with warning label

TABLE 7-1. Wire Colour, CS100 Connection, and Data Logger Connection

Wire	CS100 Terminal	Data Logger Terminal, Single-Ended Measurement	Data Logger Terminal, Differential Measurement
Blue	VOUT	**U** configured for single-ended analogue input[1], **SE** (single-ended, analogue-voltage input)	**U** configured for differential high[1], **DIFF H** (differential high, analogue-voltage input)
Yellow	AGND	⏚ (analogue ground)	**U** configured for differential low[1], **DIFF L** (differential low, analogue-voltage input)
Black	GND	**G**	**G**
Green	EXT TRIG	**U** configured to turn power on/off[1], **C** (control terminal)	**U** configured to turn power on/off[1], **C** (control terminal)
Red	SUPPLY	**12V**	**12V**
Shield	Shield	⏚ (analogue ground)	⏚ (analogue ground)

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

WARNING **Improper wiring may damage the CS100 beyond repair.**

7.4 Programming

Short Cut is the best source for up-to-date data logger programming code.

If your data acquisition requirements are simple, you can probably create and maintain a data logger 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 Into CRBasic Editor* *(p. A-1)*. Programming basics for CRBasic data loggers are in the following section. Complete program examples for select CRBasic data loggers can be found in Appendix B, *Example Programs* *(p. B-1)*. Programming basics and programming examples for Edlog data loggers are provided at *www.campbellsci.com\old-manuals*.

7.4.1 CRBasic Instructions

The **VoltSE()** measurement instruction typically programs the data logger to measure the CS100.

```
VoltSE( Dest, Reps, Range, SEChan, MeasOff, SettlingTime,
Integration, Multiplier, Offset )
```

The appropriate multiplier and offset depends on the measurement range. TABLE 7-2 provides multipliers and offsets. The offset will need to be adjusted if the barometer is not at sea level (see Section 8.4, *Correcting Pressure to Sea Level (p. 11)*). If barometric pressure units other than mbar or hPA are desired, see Section 8.1, *Conversion Factors (p. 10)*.

TABLE 7-2. Multipliers and Offsets

Range Options	Multiplier	Offset
600 to 1100 hPa (standard range)	0.2	600
500 to 1100 hPa	0.24	500
800 to 1100 hPa	0.12	800

Often the **TimeIntoInterval()** instruction is used to only power the barometer while making the measurements.

Atmospheric pressure changes little with time. In most weather station applications, measuring the barometer pressure once an hour is adequate. See Appendix B, *Example Programs (p. B-1)*, for more information.

8. Operations

8.1 Conversion Factors

In Appendix B, *Example Programs (p. B-1)*, pressure is reported in hPa (mb). To report pressure in different units, multiply the measured pressure by the appropriate conversion factor. This is done by including an expression in the CRBasic program. See TABLE 8-1 for conversion factors.

TABLE 8-1. Conversion Factors for Alternative Pressure Units

To Find	Multiply by
mBar	1.0
kPa	0.1
mm of Hg	0.75006
in of Hg	0.02953
Psi	0.0145
Atm	0.00099
Torr	0.75006

8.2 Long Cable Lengths

Long cable lengths cause a voltage drop that will raise the barometric reading. Therefore, for cable lengths greater than 6 m (20 feet), use the differential instruction (**VoltDiff()**) to measure the CS100.

8.3 Output Resolution

To retain 0.01 hPa resolution, use the IEEE4 format; for example, **Sample (*1,BP_mmHG,IEEE4*)**. See Appendix B, *Example Programs* *(p. B-1)*, for more information.

8.4 Correcting Pressure to Sea Level

The weather service, most airports, radio stations, and television stations adjust the atmospheric pressure to a common reference (sea level). Equation 1 can be used to find the difference in pressure between the sea level and the site. That value (*dP*) is then added to the offset (600 hPa in our example programs) in the measurement instruction. U. S. Standard Atmosphere and dry air were assumed when Equation 1 was derived (Wallace, J. M. and P. V. Hobbes, 1977: *Atmospheric Science: An Introductory Survey*, Academic Press, pp. 59-61).

$$dP = 1013.25\left\{1-\left(1-\frac{E}{44307.69231}\right)^{5.25328}\right\} \quad (1)$$

The value *dP* is in hPa and the site elevation, *E*, is in metres. Add *dP* value to the offset in the measurement instruction.

Use Equation (2) to convert feet to metres.

$$E(m) = \frac{E(ft)}{3.281 ft/m} \quad (2)$$

The corrections involved can be significant. For example, at 1000 hPa and 20 °C, barometric pressure will decrease by 1.1 hPa for every 10 m increase in altitude.

9. Maintenance and Calibration

NOTE All factory repairs and recalibrations require a returned material authorization (RMA) and completion of the "Declaration of Hazardous Material and Decontamination" form. Refer to the *Read First* page at the front of this manual for more information.

Since the sensor is semi-sealed, minimum maintenance is required:

- Visually inspect the cable connection to ensure it is clean and dry.
- Visually inspect the casing for damage.
- Ensure that the pneumatic connection and pipe are secure and undamaged.

The external case can be cleaned with a damp, lint-free cloth and a mild detergent solution.

You can purchase a replacement five terminal connector from Campbell Scientific.

CAUTION The CS100 is sensitive to static when the backplate is removed. To avoid damage, take adequate anti-static measures when handling.

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 the *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. After saving the *Short Cut* program, click the **Advanced** tab then the **CRBasic Editor** button. A program file with a generic name will open in CRBasic. 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 it created.

2. To add the *Short Cut* wiring information into the new CRBasic program, open the .DEF file located in the C:\campbellsci\SCWin folder, and copy the wiring information, which is at the beginning of the .DEF file.

3. Go into the CRBasic program and paste the wiring information into it.

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 Programs

The CS100 wiring instructions for the example programs are shown in TABLE B-1.

TABLE B-1. Wiring for Example Programs

Wire Colour	Description	CR1000X
Blue	VOUT – Pressure Signal Out	**SE15**
Red	SUPPLY – 12 VDC Power In	**12V**
Black	GND – Power Ground	**G**
Yellow	AGND – Signal Ground	⏚
Green	EXT. TRIG. – External Trigger	**C4**
Clear	Shield	**G**

B.1 CR1000X Program Using Sequential Mode

This CR1000X program uses the sequential mode, which is the simplest mode and can be used for most meteorological applications. Although the example is for the CR1000X, other CRBasic data loggers, are programmed similarly. In the example, the CR1000X measures the CS100 once an hour. To do this, the CR1000X uses a control terminal to turn on the CS100 one minute before the top of the hour. On the hour, the data logger measures the CS100, and then turns the CS100 off.

CRBasic Example B-1. CR1000X Program Using Sequential Mode

```
'CR1000X

'Declare Variables and Units
Public BattV
Public PTemp_C
Public BP_mmHg

Units BattV=Volts
Units PTemp_C=Deg C
Units BP_mmHg=mmHg

'Define Data Tables
DataTable(Hourly,True,-1)
  DataInterval(0,60,Min,10)
  Sample(1,BP_mmHg,IEEE4)
EndTable

DataTable(Daily,True,-1)
  DataInterval(0,1440,Min,10)
  Minimum(1,BattV,FP2,False,False)
EndTable

'Main Program
BeginProg
  'Main Scan
  Scan(5,Sec,1,0)
    'Default Data Logger Battery Voltage measurement 'BattV'
```

```
    Battery(BattV)
    'Default Wiring Panel Temperature measurement 'PTemp_C'
    PanelTemp(PTemp_C,60)
    'CS100 Barometric Pressure Sensor measurement 'BP_mmHg'
    If TimeIntoInterval(59,60,Min) Then PortSet(C4,1)
    If TimeIntoInterval(0,60,Min) Then
      VoltSE(BP_mmHg,1,mV5000,15,1,0,60,0.2,600)
      BP_mmHg=BP_mmHg*0.75006
      PortSet(C4,0)
    EndIf
    'Call Data Tables and Store Data
    CallTable(Hourly)
    CallTable(Daily)
  NextScan
EndProg
```

B.2 CR1000X Program Using Pipeline Mode

Although this example is for the CR1000X, other CRBasic data loggers are programmed similarly. In the example, the CR1000X measures the CS100 once an hour in a program that runs at 1 Hz. To keep the CR1000X running in a pipeline mode, the measurement instruction is placed outside the **If** statement. The measurement is made every scan, and the measured value is first written into a temporary variable called ***CS100_temp***. One minute before the hour, the CS100 turns on and starts to make the correct pressure measurements. At the top of the hour, the correct value is stored into the ***pressure*** variable, and the sensor is turned off immediately.

CRBasic Example B-2. CR1000X Program Using Pipeline Mode

```
'CR1000X Data Logger

Public CS100_temp
Public pressure
Units pressure = hPa

DataTable (met_data,True,-1)
  DataInterval (0,60,min,10)
    Sample (1,pressure,IEEE4)
EndTable

BeginProg
PipeLineMode
  Scan (1,sec,3,0)

'Measurement is made every scan outside the "If" statement
    VoltSE (CS100_temp,1,mV5000,15,False,200,60,0.2,600)

'Turn on CS100 one minute before the hour
    If (TimeIntoInterval (59,60,min)) Then WriteIO (&b1000,&b1000)

'Copy the correct value to a current variable called "pressure" at the top of the hour
'Turn off CS100 after measurement
  If (TimeIntoInterval (0,60,min)) Then
      pressure = CS100_temp
      WriteIO (&b1000,&b0)
    EndIf

    CallTable met_data

  NextScan
EndProg
```

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