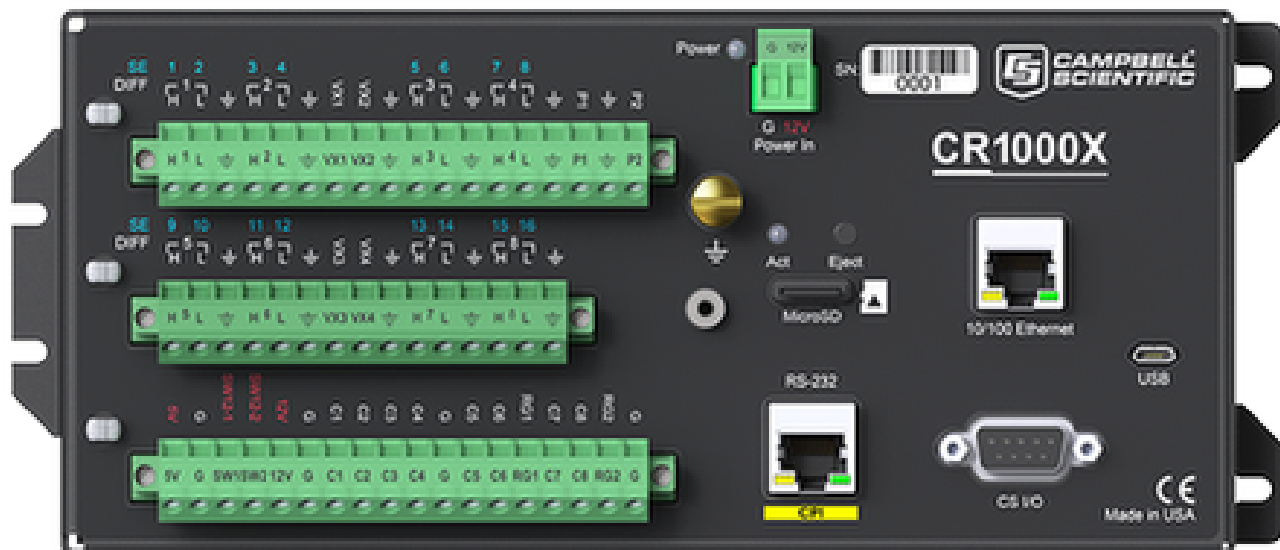


# CR1000X

## Measurement and Control Datalogger



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# 1. Get started

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**Getting Started** provides a cursory view of data acquisition and walks you through a procedure to set up a simple system. You may not find it necessary to progress beyond **Getting Started**. However, should you want to dig deeper into the complexity of the datalogger functions or quickly look for details, extensive information is available in the online help or product manual.

This exercise will guide you through the following steps:

- Connecting the datalogger to a computer
- Attaching a sensor to the datalogger
- Creating a program for the datalogger to measure the sensor
- Making a simple measurement
- Storing measurement data on the datalogger
- Collecting data from the datalogger with a computer
- Viewing real-time and historical data with a computer

In addition to your datalogger, the following items are used in this exercise (many are shipped with your datalogger and all are available on [www.campbellsci.com](http://www.campbellsci.com)). If you do not have all of these items, you can provide suitable substitutes.

- Power supply (if not connecting via USB)
- Type-T Thermocouple, 4 to 5 inches long; one is shipped with the datalogger
- For a USB connection:
  - Computer with a USB port
  - USB cable
- For an RS-232/CPI connection:
  - Computer with a nine-pin RS-232 port
  - Serial cable or RS-232/CPI RJ45 to DB9 cable
- Datalogger support software

Additional Campbell Scientific publications are available online at [www.campbellsci.com](http://www.campbellsci.com). Generally, if a particular feature of the datalogger requires a peripheral hardware device, more information is available in the help or manual written for that device.



# 2. USB or RS-232 communications

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Setting up a USB or RS-232 connection is a good way to begin communicating with your datalogger. Because these connections do not require configuration (like an IP address), you need only set up the communications between your computer and the datalogger. Use the following instructions or watch a video.



Initial setup instruction follows. These settings can be revisited using the datalogger support software **Edit Datalogger Setup** option .

1. Using datalogger support software, launch the EZSetup Wizard.
  - PC200W and PC400 users, click **Add Datalogger** .
  - LoggerNet users, click **Setup** , click the **View** menu to ensure you are in the **EZ (Simplified)** view, then click **Add Datalogger**.
2. Click **Next**.
3. Select your datalogger from the list, type a name for your datalogger (for example, a site or project name), and click **Next**.
4. If prompted, select the **Direct Connect** connection type and click **Next**.
5. If this is the first time connecting this computer to a CR1000X via USB, click **Install USB Driver**, select your datalogger, click **Install**, and follow the prompts to install the USB drivers.
6. Plug the datalogger into your computer using a USB or RS-232 cable. The USB connection supplies 5 V power as well as a communications link, which is adequate for setup, but a 12V battery will be needed for field deployment. If using RS-232, external power must be provided to the datalogger and a CPI/RS-232 RJ45 to DB9 cable is required to connect to the computer.

**NOTE:**

The Power LED on the datalogger indicates the program and power state. Because the datalogger ships with a program set to run on power-up, the Power LED flashes 3 times every 10 seconds when powered over USB. When powered with a 12 V battery, it flashes 1 time every 10 seconds.

7. From the **COM Port** list, select the COM port used for your datalogger.
8. USB and RS-232 connections do not typically require a **COM Port Communication Delay** - this allows time for the hardware devices to "wake up" and negotiate a communications link. Accept the default value of **00 seconds** and click **Next**.
9. The baud rate and PakBus address **must match** the hardware settings for your datalogger. The default PakBus address is **1**. A USB connection does not require a baud rate selection. RS-232 connections default to 115200 baud.

**NOTE:**


Unlike the RS-232 port on some other Campbell Scientific dataloggers that autobaud, the CR300 RS-232 port does not. If the hardware and software settings for baud rate and PakBus address do not match, you will not be able to connect.

10. Set an **Extra Response Time** if you have a difficult or marginal connection and you want the datalogger support software to wait a certain amount of time before returning a communication failure error.
11. LoggerNet and PC400 users can set a **Max Time On-Line** to limit the amount of time the datalogger remains connected. When the datalogger is contacted, communication with it is terminated when this time limit is exceeded. A value of **0** in this field indicates that there is no time limit for maintaining a connection to the datalogger.
12. Click **Next**.
13. By default, the datalogger does not use a security code or a PakBus encryption key. Therefore, the **Security Code** can be set to **0** and the **PakBus Encryption Key** can be left blank. If either setting has been changed, enter the new code or key.
14. Click **Next**.
15. Review the **Communication Setup Summary**. If you need to make changes, click **Previous** to return to a previous window and change the settings.

Setup is now complete, and the EZSetup Wizard allows to you click **Finish** or click **Next** to test communications, set the datalogger clock, and send a program to the datalogger. See [Testing communications and completing EZ Setup](#) (p. 4) for more information.

# 3. Testing communications and completing EZ Setup

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1. Using datalogger support software EZ Setup, access the **Communication Test** window. This window is accessed during EZ Setup (see [USB or RS-232 communications](#) on page 2 for more information). Alternatively, you can double-click a datalogger from the station list to open the EZ Setup Wizard and access the **Communication Test** step from the left side of the window.
2. Ensure the datalogger is connected to the computer, select **Yes** to test communications, then click **Next** to initiate the test.
3. With a successful connection, the **Datalogger Clock** window displays the time for both the datalogger and the computer.
  - The **Adjusted Server Date/Time** displays the current reading of the clock for the computer or server running your datalogger support software. If the **Datalogger Date/Time** and **Adjusted Server Date/Time** don't match, you can set the datalogger clock to the **Adjusted Server Date/Time** by clicking **Set Datalogger Clock**.
  - Use the **Time Zone Offset** to specify a positive or negative offset to apply to the computer time when setting the datalogger clock. This offset will allow you to set the clock for a datalogger that needs to be set to a different time zone than the time zone of the computer (or to accommodate for changes in daylight saving time).
4. Click **Next**.
5. The datalogger ships with a default **GettingStarted** program. If the datalogger does not have a program, you can choose to send one by clicking **Select and Send Program**. Click **Next**.
6. LoggerNet only - Watch a [video](#)  or use the following instructions:
  - The **Datalogger Table Output Files** window displays the data tables available to be collected from the datalogger and the output file name. By default, all data tables set up in the datalogger program will be included for collection. Make note of the **Output File Name** and location. Click **Next**.
  - Check **Scheduled Collection Enabled** to have LoggerNet automatically collect data from the datalogger according to a schedule. When the **Base Date** and **Time** are in




the past, scheduled collection will begin on the first **Collection Interval**. Click **Next** twice.

7. Click **Finish**.

# 4. Connecting the datalogger to a computer

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Once you have configured your hardware connection (see [USB or RS-232 communications](#) on page 2)(see [Setting up Communications with the Datalogger](#) for more information), your datalogger and computer can communicate.

- PC200W and PC400 users, select the datalogger from the list and click **Connect** .
- LoggerNet users, select **Main** and click **Connect**  on the LoggerNet toolbar, select the datalogger from the **Stations** list, then **Connect** .

To disconnect, click **Disconnect** .





# 5. Creating a program in Short Cut

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Use the Short Cut software to generate a program for your datalogger. Short Cut is included with your datalogger support software.

This section will guide you through programming a CR1000X datalogger to measure the voltage of the datalogger power supply, the internal temperature of the datalogger, and a thermocouple. With minor changes, these steps can apply to other measurements. Use the following instructions or watch a video.



1. Using datalogger support software, launch Short Cut.
  - PC200W and PC400 users, click **Short Cut** .
  - LoggerNet users, click **Program** then **Short Cut** .
2. Click **Create New Program**.
3. Select **CR1000X Series** datalogger and click **Next**.

## NOTE:

The first time Short Cut is run, a prompt will ask for a noise rejection choice. Select **60 Hz Noise Rejection** for North America and areas using 60 Hz ac voltage. Select **50 Hz Noise Rejection** for most of the Eastern Hemisphere and areas that operate at 50 Hz.

A second prompt lists sensor support options. **Campbell Scientific, Inc. (US)** is usually the best fit outside of Europe.

To change the noise rejection or sensor support option for future programs, use the **Program** menu.

4. A list of **Available Sensors and Devices** and **Selected Measurements Available for Output** display. Battery voltage **BattV** and internal temperature **PTemp\_C** are selected by default. During operation, battery and temperature should be recorded at least daily to assist in

monitoring system status.

5. Use the Search feature or expand folders to locate your sensor or device. Double-click on a sensor or measurement in the **Available Sensors and Devices** list to configure the device (if needed) and add it to the **Selected** list. For the example program, expand the **Sensors/Temperature** folder and double-click **Type T Thermocouple**.
6. If the sensor or device requires configuration, a window displays with configuration options. Click **Help** at the bottom of the window to learn more about any field or option. For the example program, accept the default options:
  - **1 Type T TC sensor**
  - **Temp\_C** as the **Temperature** label, and set the units to **Deg C**
  - **PTemp\_C** as the **Reference Temperature Measurement**.
7. Click **OK**.
8. Click **Wiring Diagram** on the left side of the window to see how to wire the sensor to the datalogger. With the power disconnected from the datalogger, insert the wires as directed in the diagram. Ensure you clamp the terminal on the conductor, not the wire insulation. Use the included flat-blade screwdriver to open/close the terminals.
9. Click **Sensors** on the left side of the window to return to the sensor selection window, then click **Next** at the bottom of the window.
10. Type 1 in the **How often should the datalogger measure its sensor(s)?** box.
11. Use the **Output Setup** options to specify how often measurements are to be made and how often outputs are to be stored. Note that multiple output intervals can be specified, one for each output table (**Table1** and **Table2** tabs). For the example program, only one table is needed. Click the **Table2** tab and click **Delete Table**.
12. In the **Table Name** box, type **OneMin** to change the name of the table.
13. Change the **Data Output Storage Interval** to 1 minute.
14. Click **Next**.
15. Select the measurement from the **Selected Measurements Available for Output** list, then click an output processing option to add the measurement to the **Selected Measurements for Output** list. For the example program, select **BattV** and click the **Average** button to add it to the **Selected Measurements for Output** list. Repeat this procedure for **PTemp\_C** and **Temp\_C**.

**Selected Measurements Available for Output**

Sensor	Measurement
<ul style="list-style-type: none"> <li>▲ Datalogger               <ul style="list-style-type: none"> <li>▲ Default                   <ul style="list-style-type: none"> <li>BattV</li> <li>PTemp_C</li> <li style="background-color: #0070C0; color: white;">Type T TC</li> </ul> </li> </ul> </li> </ul>	

**Selected Measurements for Output**

1 OneMin 2 Table2

Sensor	Measurement	Processing	Output Label	Units
Default	BattV	Average	BattV_AVG	Volts
Default	PTemp_C	Average	PTemp_C_AVG	Deg C
Type T TC	Temp_C	Average	Temp_C_AVG	Deg C

Average

ETo

Maximum

Minimum

Sample

StdDev

Total

WindVector

16. Click **Finish** to compile the program. Replace the **untitled.cr1x** default name with **MyTemperature.cr1x** and click **Save**.
17. If LoggerNet or other datalogger support software is running on your computer, and the datalogger is connected to the computer (see [Connecting the datalogger to a computer](#) on page 6 for more information), you can choose to send the program. For the example program, click **No**.

**NOTE:**  
 A good practice is to always retrieve data from the datalogger before sending a program; otherwise, data may be lost. See [Collecting data](#) (p. 13) for detailed instruction.


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 using CRBasic. See the CRBasic Editor help for detailed information on program structure, syntax, and each instruction available to the datalogger.

**NOTE:**  
 Once a Short Cut generated program has been edited with CRBasic Editor, it can no longer be modified with Short Cut.

# 6. Sending a program to the datalogger

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The datalogger requires a CRBasic program to direct measurement, processing, control, and data storage operations. The program file may use the extension **.CR1X** or **.DLD**.

A good practice is to always retrieve data from the datalogger before sending a program; otherwise, data may be lost. To collect data using LoggerNet, connect to your datalogger and click **Collect Now** . Some methods of sending a program give the option to retain data when possible. Regardless of the program upload tool used, data will be erased when a new program is sent if any change occurs to one or more data table structures in the following list:

- Data table name(s)
- Data output interval or offset
- Number of fields per record
- Number of bytes per field
- Field type, size, name, or position
- Number of records in table

Use the following instructions or watch a video.



1. Connect the datalogger to your computer (see [Connecting the datalogger to a computer](#) on page 6 for more information).
2. Using your datalogger support software, click **Send New** or **Send Program** (located in the **Current Program** section on the right side of the window).
3. Navigate to the the program, select it, and click **Open**. For the example program created in [Creating a program in Short Cut](#) (p. 7), navigate to **C:\Campbellsci\SCWin** and select **MyTemperature.cr1x**.
4. Confirm that you would like to proceed and erase all data tables saved on the datalogger. The program will send, compile, then display results.

After sending a program, it is a good idea to monitor the data to make sure sensors are taking good measurements.

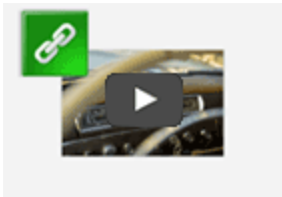
# 7. Working with data


By default, the datalogger includes three tables: **Public**, **Status**, and **DataTableInfo**. Each of these tables only contains the most recent measurements and information.

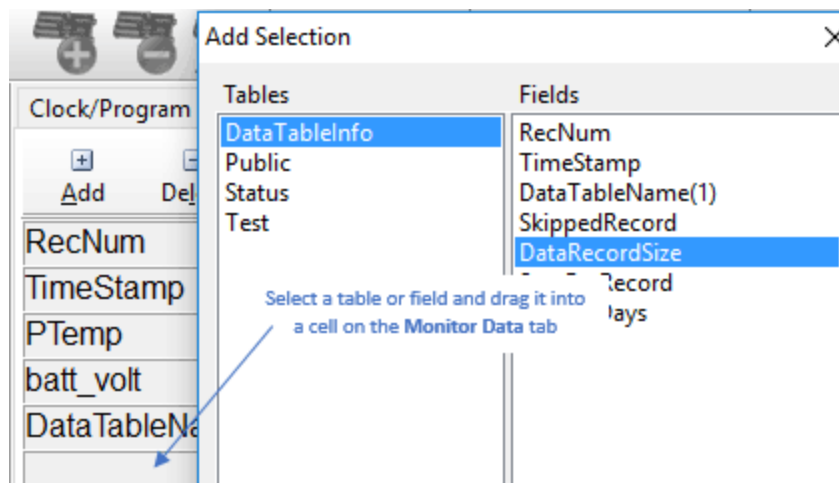
- The **Public** table is configured by the datalogger program, and updated at the scan interval set within the datalogger program, It shows measurement and calculation results as they are made.
- The **Status** table includes information about the health of the datalogger and is updated only when viewed.
- The **DataTableInfo** table reports statistics related to data tables. It also only updates when viewed.
- User-defined data tables update at the schedule set within the program.



For information on collecting your data, see [Collecting data](#) (p. 13).

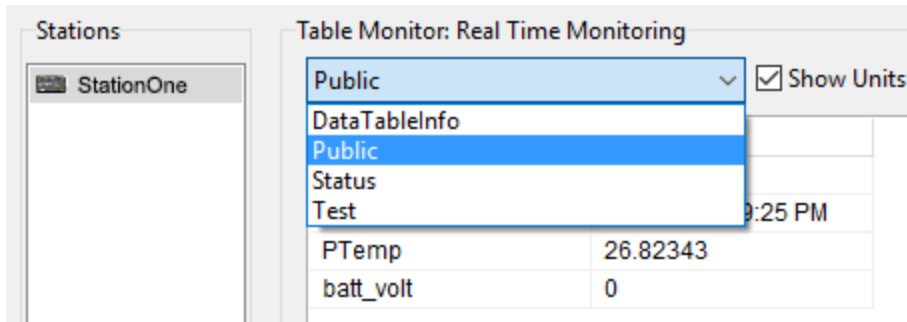
Use these instructions or follow a tutorial to monitor real-time data.



PC200W and PC400 users, click **Connect** , then **Monitor Data**. When this tab is first opened for a datalogger, values from the **Public** table are displayed. To view data from other tables, click **Add** (+), select a table or field from the list, then drag it into a cell on the **Monitor Data** tab.



LoggerNet users, select the **Main** category and **Connect**  on the LoggerNet toolbar, select the datalogger from the **Stations** list, then click **Connect** . Once connected, select a table to view using the **Table Monitor** box.



The screenshot shows the LoggerNet interface. On the left, the 'Stations' list contains 'StationOne'. On the right, the 'Table Monitor: Real Time Monitoring' window is open. It features a dropdown menu with 'Public' selected, a 'Show Units' checkbox, and a table of data.

Parameter	Value
PTemp	26.82343
batt_volt	0




# 8. Collecting data

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The datalogger writes to data tables based on intervals and conditions set in the CRBasic program. After the program has been running for enough time to generate data records, data may be collected by using datalogger support software. During data collection, data is copied to the computer but still remains on the datalogger. Collections may be done manually, or automatically through scheduled collections set in LoggerNet **Setup**. Use these instructions or follow a tutorial.



## 8.1 Collecting data using LoggerNet

1. LoggerNet users, select **Main** and **Connect**  on the LoggerNet toolbar, select the datalogger from the **Stations** list, then click **Connect** .
2. Click **Collect Now** .
3. After the data is collected, the **Data Collection Results** window displays the tables collected and where they are stored on the computer.
4. Select a data file, then **View File** to view the data. See [Viewing historic data](#) (p. 15) for more information.

## 8.2 Collecting data using PC200W or PC400

1. PC200W and PC400 users, click **Connect** .
2. Select the **Collect Data** tab.
3. Select an option for **What to Collect**. Either option creates a new file if one does not already exist.
  - **New data from datalogger (Append to data files)**: Collects only the data in the selected tables stored since the last data collection and appends this data to the end of the existing table files on the computer. This is the default, and most often used option.

- **All data from datalogger (Overwrite data files):** Collects all of the data in the selected tables and replaces the existing data files on the computer.
4. By default, all tables set up in the datalogger program are selected for collection.
  5. Click **Start Data Collection**.
  6. After the data is collected, the **Data Collection Results** window displays the tables collected and where they are stored on the computer.
  7. Select a data file, then **View File** to view the data. See [Viewing historic data](#) (p. 15) for more information.






# 9. Viewing historic data

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Open data files using View Pro. View Pro contains tools for reviewing data in tabular form as well as several graphical layouts for visualization. Use these instructions or follow a tutorial.



Once the datalogger has had enough time to store multiple records, you should collect and review the data.

1. To view the most recent data, connect the datalogger to your computer and collect your data (see [Collecting data](#) on page 13 for more information).
2. Open View Pro:
  - LoggerNet users select **Data** and click **View Pro**  on the LoggerNet toolbar.
  - PC200W and PC400 users click **View Data Files via View Pro** .
3. Click **Open** , navigate to the directory where you saved your tables (the default directory is `C:\Campbellsci\[your datalogger software application]`). For the example program, navigate to the `C:\Campbellsci\LoggerNet` folder and select **OneMin.dat**.

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