

INSTRUCTION MANUAL



SC-USB USB to CS I/O **Opto-Isolated Interface**

Revision: 9/15



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To obtain a Returned Materials Authorization (RMA), contact CAMPBELL SCIENTIFIC, INC., phone (435) 227-9000. After an application engineer determines the nature of the problem, an RMA number will be issued. Please write this number clearly on the outside of the shipping container. Campbell Scientific's shipping address is:

CAMPBELL SCIENTIFIC, INC.

RMA# _____
815 West 1800 North
Logan, Utah 84321-1784

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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.

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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, 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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Figure

1-1. Most of the components shipped with the SC-USB, SC12 cable
and ResourceDVD not shown..... 2

SC-USB USB to CS I/O Opto-isolated Interface

The SC-USB is designed to allow Campbell Scientific dataloggers to communicate directly with computers fitted with a USB interface. It provides an isolated connection which can also operate at higher speeds than conventional RS-232 connections.

1. Introduction

The SC-USB is optically isolated thus preventing possible noise pickup associated with PC power supplies and ground connections. It also supports synchronous communications modes, available in some models of dataloggers, which allow multiple devices to be connected in parallel. The SC-USB can be used in place of an SC32B interface. The SC-USB also has the potential for high-speed data transfer to the PC at up to 1 MBit/second where the datalogger supports it.

The SC-USB will appear in PC software as a new virtual serial port, allowing it to be used with many software packages.

The SC-USB PC drivers support various operating systems including Windows 2000, XP, Vista, 7, 8, and 10. The SC-USB is shipped with a software CD containing suitable drivers and a set-up/programming utility called SC-USB.exe which can be found in a directory named 'Utility' on the CD. The CD also contains a comprehensive help file and manual. These files can be accessed directly from the CD, if required, by running the setup program.

The SC-USB will normally operate 'straight from the box' for most applications using the default settings. However, you can change the baud rate, the communication rate, and its USB ID by using the Sc-usb.exe set-up utility provided (see Section 4, *Set-up Modes – the SC_USB Programming Utility* (p. 13)). This utility can also be used to upgrade the SC-USB operating system.

Refer to Section 4, *Set-up Modes – the SC_USB Programming Utility* (p. 13), if using a 21X, CR7, CR10X-TD, or CR23X-TD datalogger, using call-back, or when upgrading a datalogger operating system using the CSOS or *Device Configuration Utility*.

Please check with Campbell Scientific if you wish to use the SC-USB with a CR9000X.

NOTE

If you are using a CR5000 datalogger, make sure the datalogger operating system is version 2.0 or later as this will enable the highest communication speeds. For older versions set the SC-USB to work in ME Comms Mode (see Section 4, *Set-up Modes – the SC_USB Programming Utility* (p. 13)).



FIGURE 1-1. Most of the components shipped with the SC-USB.
SC12 cable and ResourceDVD not shown.

2. Technical Specifications

2.1 USB Specifications

- USB Version 1.1
- USB transfer rate up to 12 MBits/second
- Active current consumption less than 85 mA (current drawn from PC)
- Standby current consumption less than 18 mA (current drawn from PC)
- 17648 Cable Description: 6 ft (1.8 m) length; USB Type A male to Type B male.

2.2 CS I/O Port Specifications

- Opto-isolated from the PC/USB to 47 V AC or DC. Note that this is *signal isolation only*, and does not provide safety isolation.
- Supports asynchronous communication from 9600 to 115200 baud and synchronous communication up to 1 MBit/second.
- Campbell Scientific protocols implemented: supports Modem-Enable (ME), Synchronous Device Communications protocol (SDC) and Concurrent-SDC (CSDC) modes. Some of these modes may require that the datalogger operating system be a specific version or higher. The SDC mode only works with operating systems created since October 2002 (CR10X 1.18 or higher, CR23X 1.15 or higher, etc.) The CSDC mode only works with a PakBus (PB) operating system and the CR5000.
- Dataloggers supported 21X, CR7X, CR500, CR510, CR10, CR10X / TD / PB, CR23X / TD / PB, CR6, CR1000, CR800 series, CR3000 and CR5000.

- PC software compatibility *PC200W*, *PC400*, *LoggerNet*, *RTDAQ* and most other packages that support virtual serial ports.
- Active current consumption less than 19 mA (current drawn from datalogger).
- Quiescent current consumption less than 80 μ A (current drawn from datalogger).

2.3 General Specifications

- Height: 0.8 in (2 cm)
Width: 1.6 in (4 cm)
Length: 3.0 in (7.5 cm)
- Weight: 3.0 oz
- Operating temperature range -25° to +50°C
- EMC compliance: complies with EN61326:1998 (see Section 6.3, *Electronic Interference* (p. 18))
- Driver support for Windows 2000 / Windows XP / Windows Vista / Windows 7 / Windows 8 / Windows 10 supplied on CD (Contact Campbell Scientific for other drivers)

2.4 Ships With

- 17648 USB cable for connection to the PC's USB port.
- SC12 CS I/O cable for connection to the datalogger.
- Driver CD containing setup utility and manual.
- ResourceDVD.

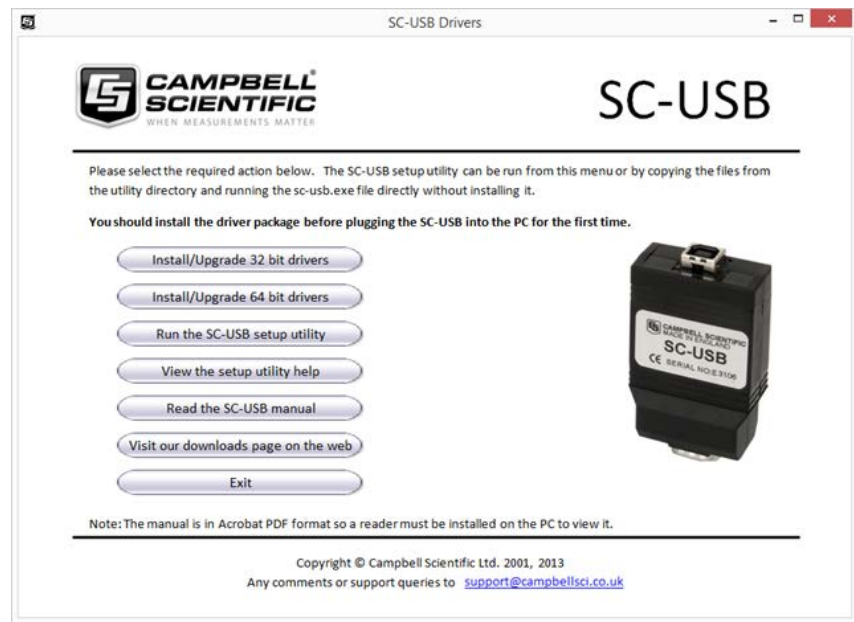
3. Installation

3.1 Driver Installation

The installation procedure is straightforward. Whenever possible you should install the drivers for the SC-USB on the PC before plugging in the SC-USB for the first time. The drivers need to be installed from the CD provided with the product or using the package downloaded from the internet.

If using a CD, the setup program should start to run when the CD is first inserted into the machine, if allowed by the security settings of the PC. If this does not happen, browse to the CD and run the autorun.exe program in the root directory of the CD.

When started, the program will present a menu like this:

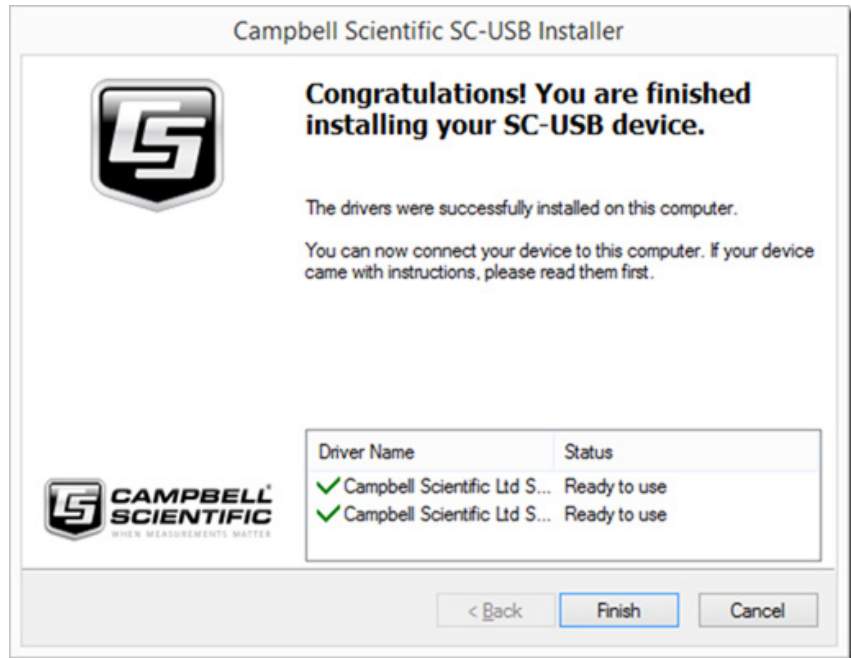


Select the option to install the 32- or 64-bit drivers depending on your PC operating system (32-bit is the only valid option for Windows XP and Windows 2000).

A separate installer program will start if you have selected the appropriate driver set for your copy of Windows.



After clicking **Next**, the drivers will be installed. The program should complete with the following screen.



Once this step has been reached, click on **Finish** and you can proceed to connect the SC-USB to your computer.

3.2 Installing the SC-USB for the First Time

Connect the SC-USB to a USB port on your PC. If the drivers have been installed on the machine using the process above, the PC should find the correct drivers. After going through two cycles of finding and installing drivers, the PC should show the newly found USB device and display a message that the device is ready to use. If you have upgraded the drivers, you may be asked to reboot your computer before using the interface.

3.3 Fixing a Failed Installation/Upgrading the Drivers

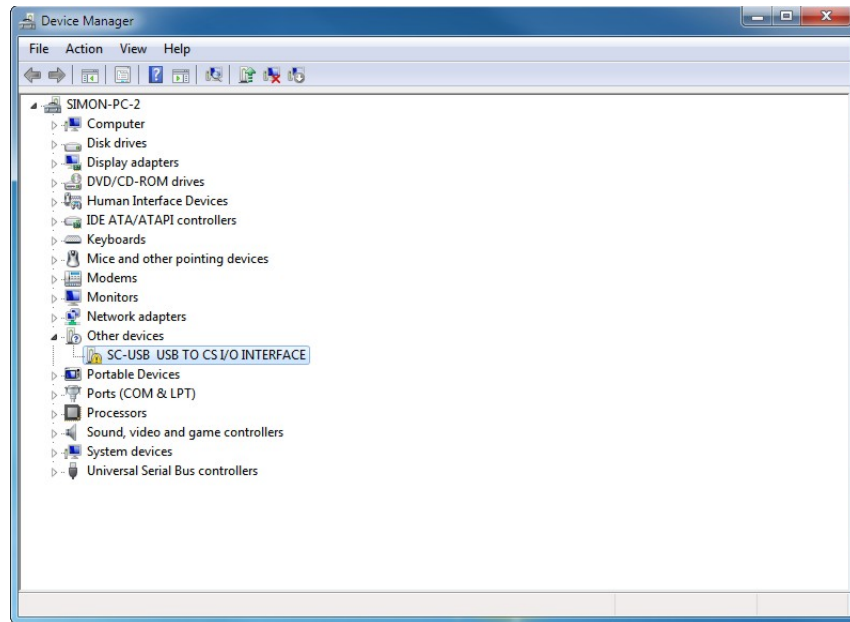
If you have not installed the drivers prior to plugging in the SC-USB, depending on the version of Windows that you have, the installation will either fail with no option to search for the drivers or it will fail and ask for a disk to be installed. In the latter case, you can insert the SC-USB driver disk in the computer, browse to the CD, and let Windows install the drivers from the CD.

Newer versions of Windows will not give this option before failing. Therefore, you will need to perform the following steps. The same steps can be used to ensure that Windows is using the latest drivers. Please note that the screens below are from Windows 7. The exact appearance and wording will vary with other operating systems.

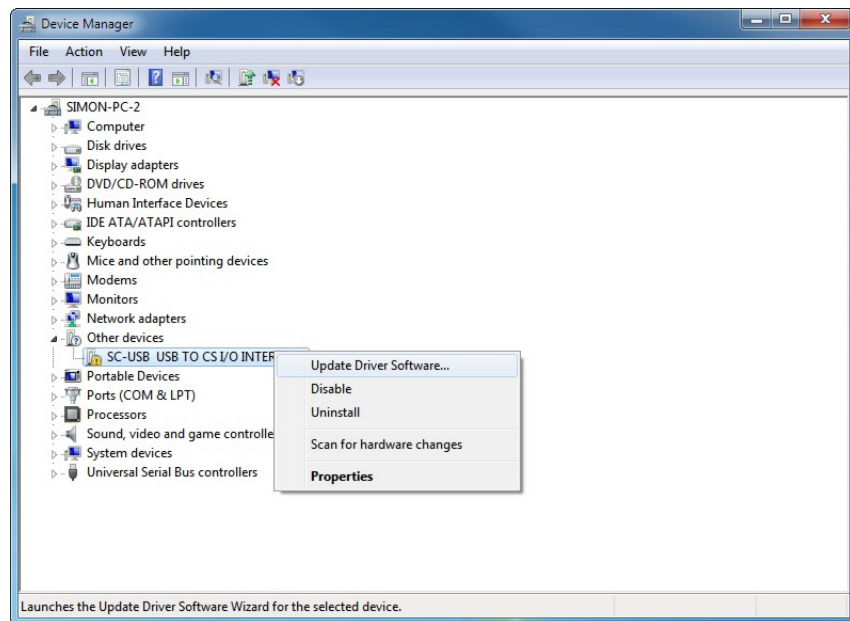
First, use the CD to install the latest drivers onto the PC as described in Section 3.1, *Driver Installation* (p. 3). Next, with the SC-USB plugged into the PC, open up the **Device Manager** screen of Windows. This can be done either by

browsing to the **Device Manager** via the **Control Panel** or by using the search tool and running **devmgmt.msc**.

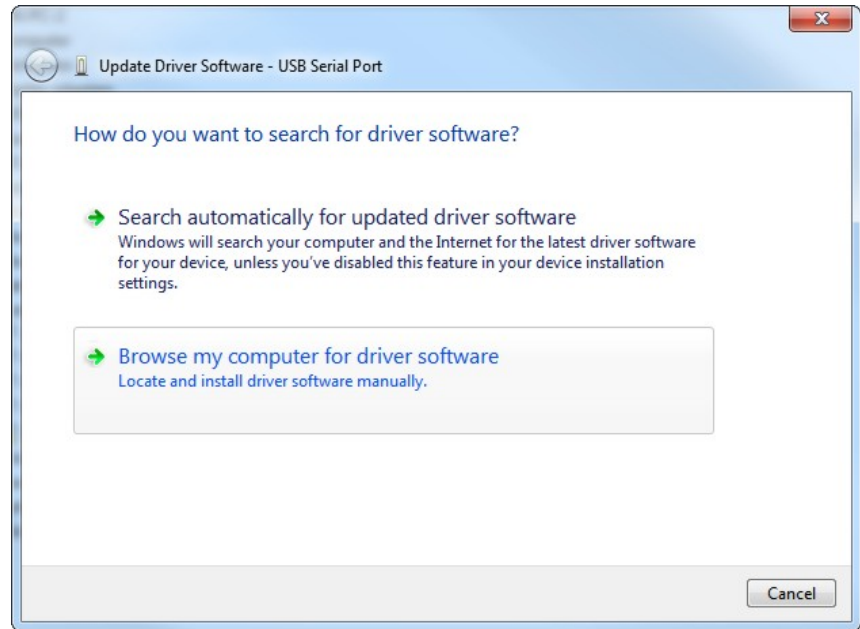
If the install failed, in the **Device Manager** you will see **SC-USB USB TO CS I/O INTERFACE** listed under **Other Devices** with a yellow warning symbol to indicate a problem, as there is no driver installed yet. If you are attempting to upgrade the driver, the yellow symbol may not be present.



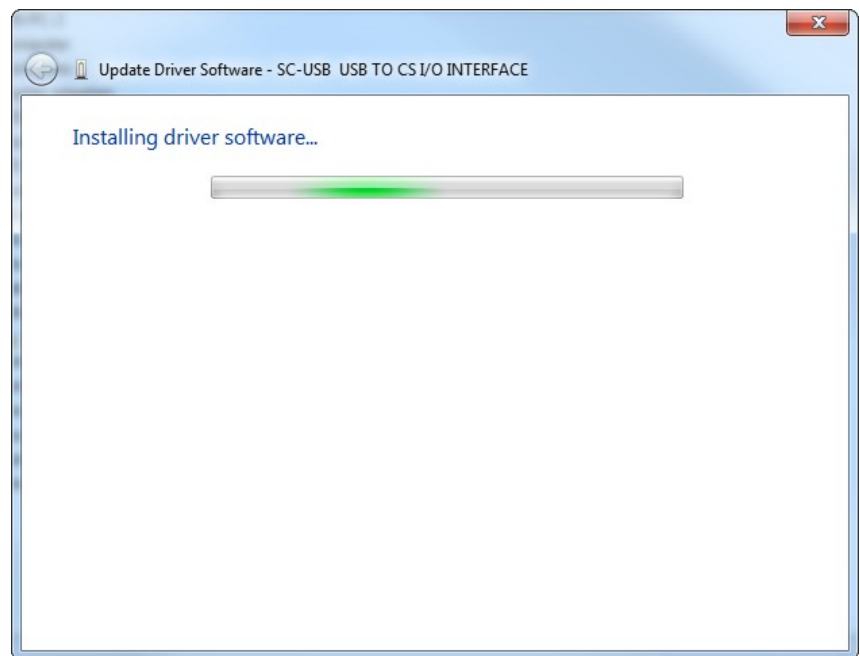
Right click on **SC-USB USB TO CS I/O INTERFACE** and click on **Update Driver Software** in the menu that appears.



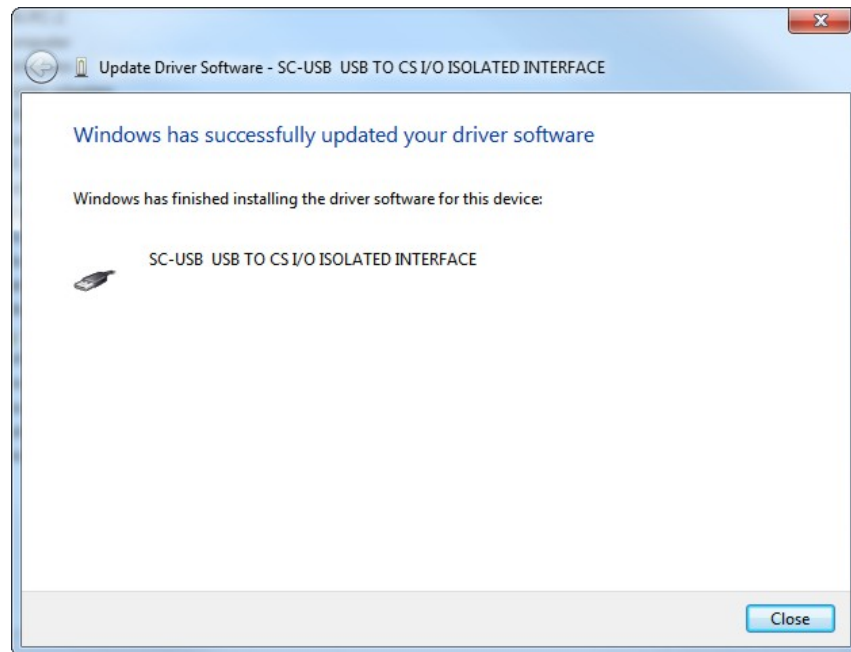
You will then be prompted as to whether to search for the driver or browse the computer.



If the driver installation as shown in Section 3.1, *Driver Installation* (p. 3), was successful, you can select the first option and the new drivers already installed on the machine should be found. If not, browse to the CD and see if Windows will find the drivers from there. If the drivers are found, you should see a screen like this:

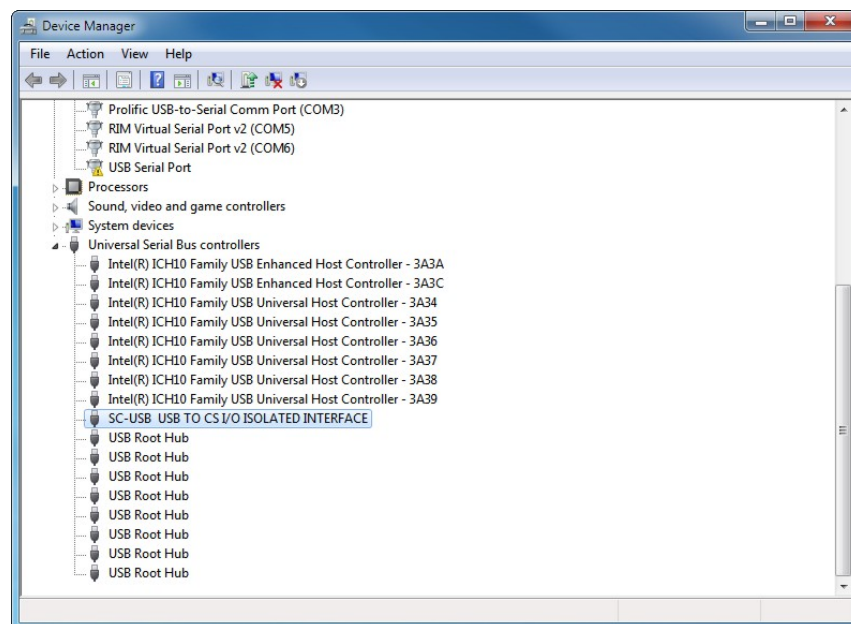


Once this part of the installation is complete, you will see the following confirmation:

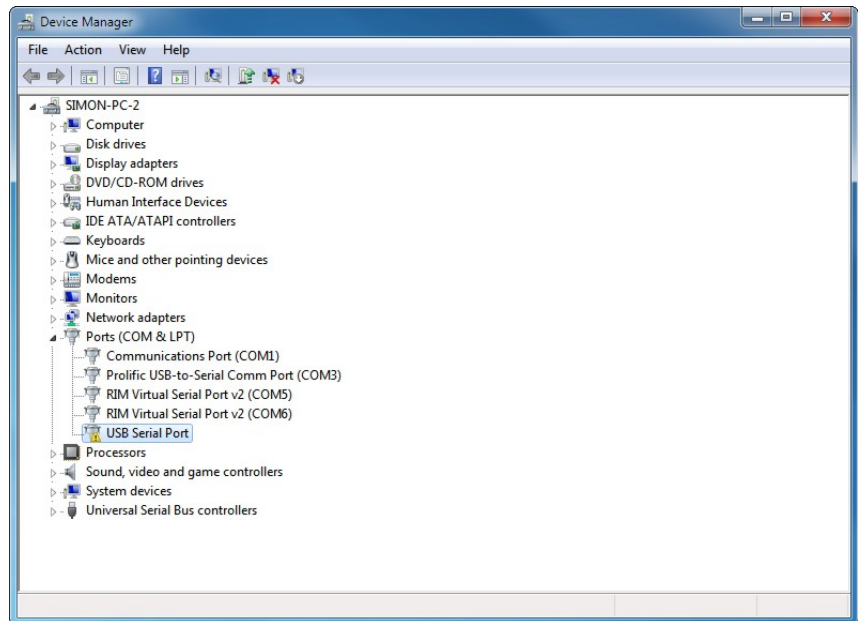


Click **Close** to return to the **Device Manager**.

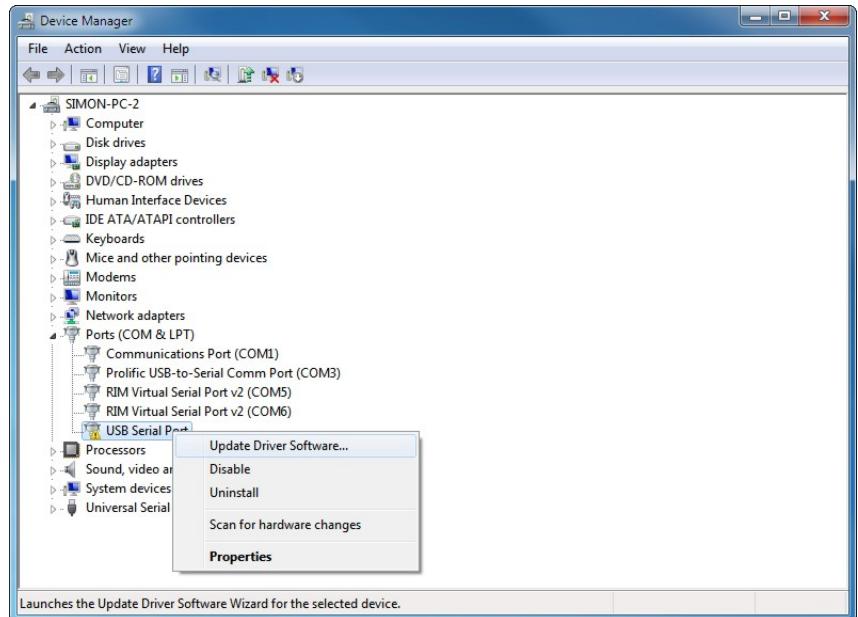
You will now see **SC-USB USB TO CS I/O ISOLATED INTERFACE** displayed under **Universal Serial Bus controllers** as shown below:



You will now notice a new device **USB Serial Port** displayed under **Ports (COM & LPT)**, again with a yellow warning symbol as a driver is not installed yet.

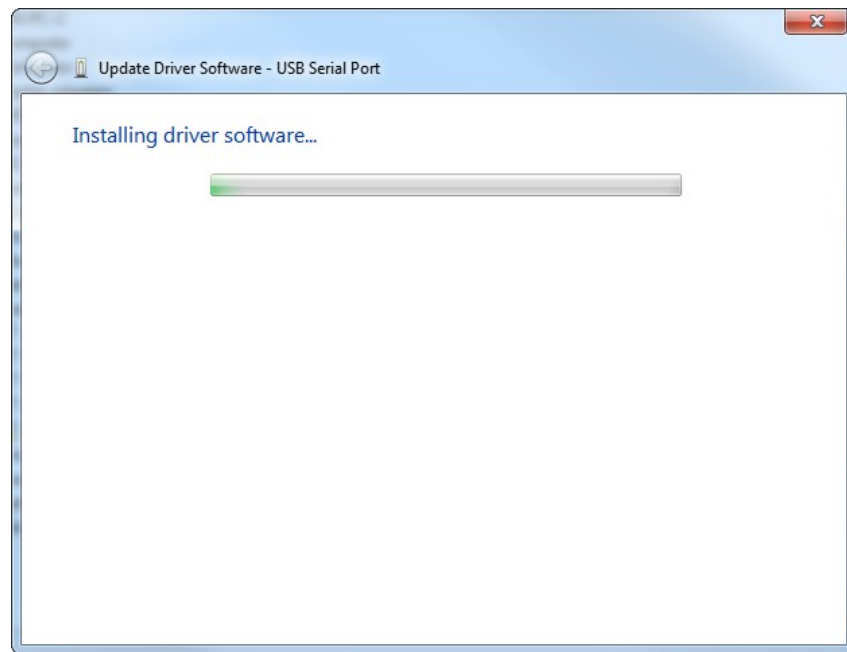


Right click on **USB Serial Port** and click **Update Driver Software** in the menu that appears:

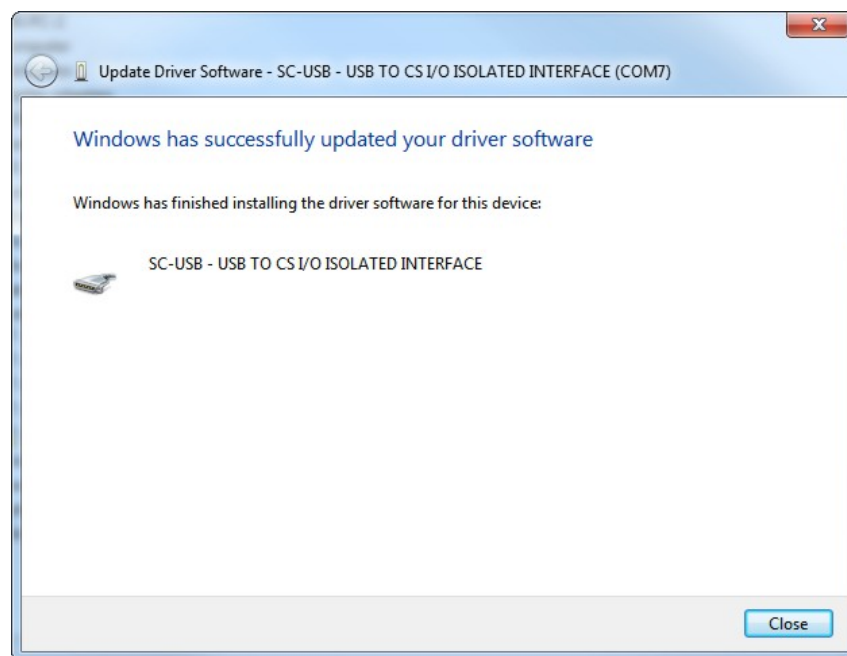


You will now be given the choice to search automatically or browse for driver software. If previously installed successfully, click on **Search**. If it was not successful, browse to the CD to point to the drivers.

The installation will then proceed and you will see the progress as follows:

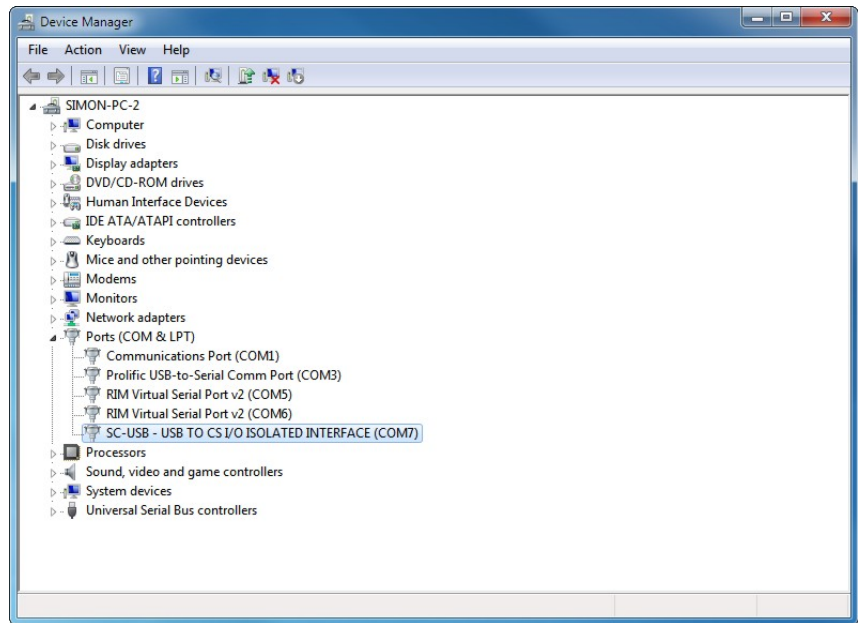


Once this part of the installation is complete, you will see the following confirmation:



Click **Close** to return to the **Device Manager**.

You will now see **SC-USB USB TO CS I/O ISOLATED INTERFACE (COM x)** displayed under **Ports (COM & LPT)**, where x is the number of the COM port assigned by Windows during the installation.



The installation is now complete. You can close the **Device Manager** and start using your SC-USB interface.

3.4 Uninstalling the SC-USB Drivers

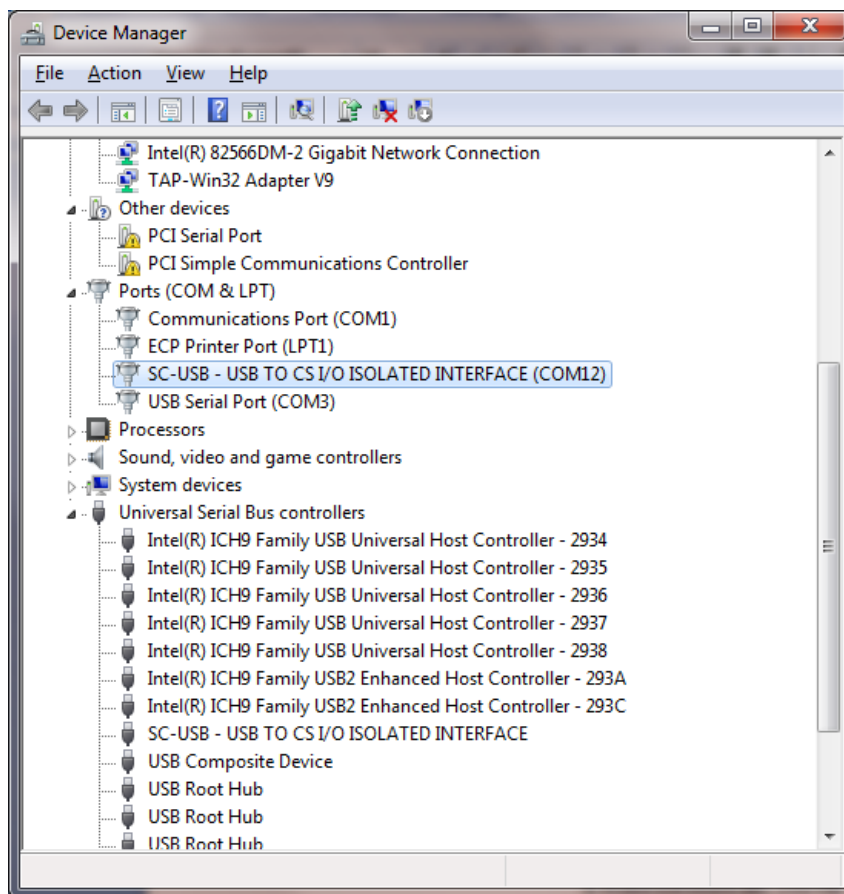
To remove the drivers, start the **Device Manager** (see Section 3.3, *Fixing a Failed Installation/Upgrading the Drivers (p. 5)*). With the SC-USB plugged in, you will see it listed under **Ports**. Right-click on its entry and select the **Uninstall** option. Select the option to delete the files if required. You can then unplug the SC-USB. Plugging the SC-USB back in later should restart the installation process.

3.5 Determining Which COM Port the SC-USB Has Been Assigned

The above installation processes relies on parts of the Windows operating system to assign a COM port number to the SC-USB. Often this will be the next port number that is free. However, if other devices have been installed in the past (some of which may no longer be plugged in), it may be assigned a higher COM port number.

To check which COM port it has been assigned, you can simply monitor the appearance of a new COM port in the list of COM ports offered in your software package (for example, *LoggerNet*) before and after the installation. If there is any question, look in the Windows **Device Manager** list under the **Ports** section (accessed via the **Control Panel**).

As shown below, the COM port number is shown at the end of the description:



In some cases, a PC program may not offer the SC-USB COM port in its selection list of available COM ports. Recent versions of Campbell Scientific packages allow you to manually type the COM port into the selection window to overcome this.

Older software may also limit you up to COM4. In that case, you would need to free lower COM port numbers (by uninstalling an unused COM port) and move the assignment of the SC-USB. To do this, right click on the SC-USB in the **Device Manager** screen (as shown above) and select **Properties**. Select **Port Settings** and then the **Advanced** button. In the next screen you have the option to change the COM port number to another free number. **OK** any change you make and close the **Device Manager** screen before reopening it to confirm the change (it does not automatically refresh this change).

NOTE

The baud rate settings in the driver/properties setting have no influence on the operation of the SC-USB. The speed of communication to the datalogger is normally determined automatically by the SC-USB although it can be set in other ways. See the sections below.

4. Set-up Modes – the SC_USB Programming Utility

The Set-up button on the SC_USB.exe utility allows you to configure the SC-USB interface to work with the supported dataloggers and peripherals and their modes of operation. Before pressing the Set-up button, ensure that the correct COM port is selected.

NOTE

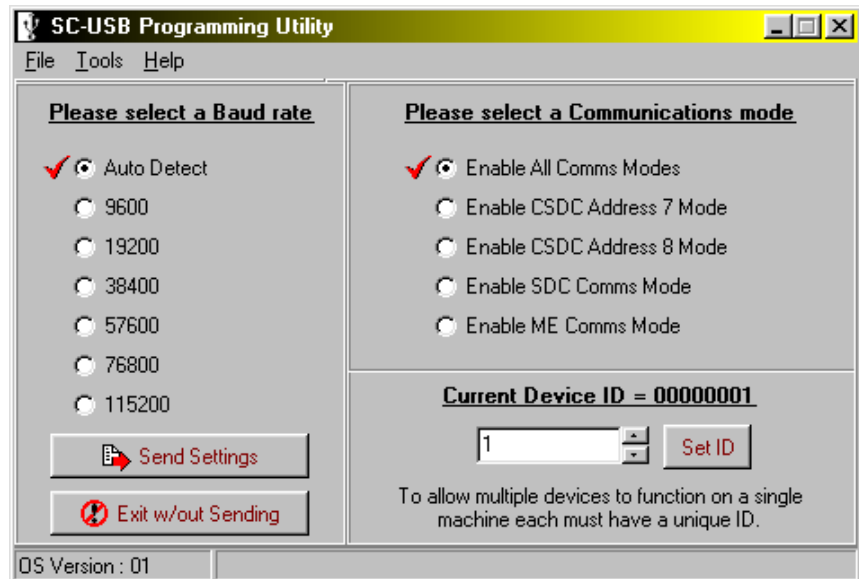
This program is only needed for some older dataloggers or datalogger operating systems.

The set-up screen is shown below, and the set-up modes are explained in detail.

To run this utility you only need to plug the SC-USB in a USB socket on the computer. A datalogger is not needed and should not be connected at the same time.

NOTE

On some newer PCs, when the USB lead is removed as part of the process of starting communication with the utility, an error may be reported. Close the utility and restart the process until successful.



4.1 Settings

4.1.1 Auto Detect (Automatic Baud Rate Detection)

Auto Detect will try to connect at the highest asynchronous baud rate the datalogger can support. This can be used in most cases. The exceptions are:

- Upgrading a datalogger operating system. See Section 5.2.2, *Downloading a Datalogger OS (p. 16)*.
- Using Call Back, when you must fix the baud rate.

- Using a 21X or CR7 datalogger, where the baud rate needs to be fixed and set to either 9600 or 76800 baud (OS dependent).
- Using a non-PakBus CR23X-TD datalogger – the baud rate may be adjusted to the maximum supported by the datalogger. (By default it will run at 9600 baud.) See Section 6.2, *Software Settings* (p. 17), for more details.

Auto Detect is the Factory default.

4.1.2 Selecting a Fixed Baud Rate

Bit rate selections available are 9600, 19200, 38400, 57600, 76800 and 115200 baud as shown in the screenshot above. Select the highest rate supported by the dataloggers being used.

4.1.3 Enable All Comms Modes (Automatic Mode Detection)

Selecting 'Enable all Comms Modes' automatically connects to the datalogger using the communications method that uses the least physical hardware resources. The priorities from highest to lowest are CSDC, SDC, and finally Modem Enable (ME) mode. The default mode can be used in most cases.

Exceptions are:

- When other SDC or CSDC peripherals are being used, in which case a free address must be selected.
- When Call Back is being used, it may be necessary to fix the communication method to ME.
- When using non-PakBus TD dataloggers, where the mode must be set to ME.
- When using a CR5000 datalogger with an operating system version earlier than 2.0, where the mode must be set to ME.

Enable All Comms Modes is the Factory default.

4.1.4 Enable CSDC Address 7 Mode

Selecting 'Enable CSDC Address 7 Mode' will force the SC-USB to *only* respond as the CSDC device with SDC address 7. This is useful when you have another SDC-Concurrent device connected on the CSI I/O port. The modem enable line (pin 5) is not used and is free for other use. CSDC mode allows concurrent communication sessions. It is currently supported by PakBus dataloggers and recent versions of the CR5000 operating system.

4.1.5 Enable CSDC Address 8 Mode

Selecting 'Enable CSDC Address 8 Mode' will force the SC-USB to *only* respond as the CSDC device with SDC address 8. This is useful when you have another CSDC device connected on the CS I/O port. The modem enable line (pin 5) is not used and is free for other use. CSDC mode allows concurrent communication sessions. It is currently supported by PakBus dataloggers and recent versions of the CR5000 operating system.

4.1.6 Enable SDC Comms Mode

Selecting 'Enable SDC Comms Mode' will force the SC-USB to *only* respond as an SDC communication device at address 9. In this mode asynchronous communication is used at the chosen bit rate. The Modem Enable line (pin 5) is not used and is free for other use. SDC mode allows the SC-USB to be connected in parallel with modem devices. This mode is only supported in CR510, CR10X and CR23X dataloggers with post-2002 standard (non-PakBus) operating systems.

4.1.7 Enable ME Comms Mode

Selecting 'Enable ME Comms Mode' will force the SC-USB to *only* respond as a modem-enabled device. This would only be used when all other connection modes are being used by other peripherals or for compatibility with an older datalogger or operating system.

4.1.8 Set ID

Set ID is used to make the SC-USB interface unique. This is useful if you have more than one SC-USB interface connected to the same PC at the same time. The default ID as supplied is 00000001.

NOTE

Close the SC-USB utility when you have finished using it, as its method of polling the SC-USB may cause the PC to become very slow when running other programs.

4.2 Operating System (OS) Downloads

The OS download button in the Sc_USB.exe utility allows you to upgrade the OS in the SC-USB to take advantage of new features and allow new product support.

CAUTION

When using this option, do not unplug the SC-USB or turn off the computer, otherwise the operating system may be corrupted and the SC-USB may then need to be returned to the factory for repair.

5. Using the SC-USB with Campbell Scientific Software and Hardware

5.1 LoggerNet EZSetup or Standard Setup

In recent versions, the SC-USB appears as a clearly identified special COM port device within Campbell Scientific software packages. In older versions or third-party software, it appears as a standard COM port.

To use the SC-USB, if using the EZSetup Wizard, you need to specify a "Direct Connect" and then select the new COM port number assigned to the SC-USB (see Section 3.5, *Determining Which COM Port the SC-USB Has Been Assigned (p. 11)*). If using the standard Setup screen in LoggerNet, you need to Add a Root device, select the COM port option and select the relevant

COM port number; then Add the datalogger or PakBusPort directly to the new ComPort.

In general, the baud rate settings that are offered in the EZSetup or Setup screens can be left at the default settings as they do not apply to the SC-USB which determines the best speed to use by automatically negotiating this with datalogger (see Section 4.1.1, *Auto Detect (Automatic Baud Rate Detection)* (p. 13), for exceptions).

NOTE	The SC-USB should plug into and work with any standard USB 1.1 or 2.0 compatible port.
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5.2 Using the *Device Configuration Utility (DevConfig)*

5.2.1 Accessing *DevConfig*

The SC-USB can be used with *DevConfig* to change datalogger settings. To do this, open *DevConfig* and connect the datalogger to the PC's USB port via the SC-USB. Select the appropriate datalogger from the list. For the COM port, select the new COM port number assigned to the SC-USB (see Section 3.5, *Determining Which COM Port the SC-USB Has Been Assigned* (p. 11)), and then press Connect.

5.2.2 Downloading a Datalogger OS

The SC-USB can be used to download operating systems to the CR510, CR10X, and 23X dataloggers using *DevConfig*. This requires that the SC-USB utility be used to set the baud rate to 19200 and the comms mode to ME Comms Mode. See Section 4.1, *Settings* (p. 13), for information about changing these settings. After loading the operating system with *DevConfig*, remember to set the SC-USB back to its default setting to allow normal communications afterwards.

You cannot load operating systems into the CR6, CR800, CR850, CR1000, or CR3000 dataloggers by selecting the "Send OS" tab in *DevConfig* because these dataloggers only support the low-level OS upload via the RS-232 port. However, you can load an operating system into these dataloggers using the option to load a program into the datalogger (under Logger Control) and changing the file type to operating system. (You can load the OS with other Campbell Scientific programs too using the program load options.) This technique does not reset as many settings as the lower level "Send OS" option.

5.3 Use with the DSP4

It is possible to use the SC-USB to communicate with most dataloggers when they are used with a DSP4 Heads-Up Display. As with other means of communication, display of data on the DSP4 is suspended during communication.

NOTE	For the CR5000 it is <i>not</i> possible to run any program that sends data to the DSP4 and then communicate with the SC-USB. This is because the CR5000 reserves the CS I/O port solely for use by the DSP4. Contact Campbell Scientific for further information.
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6. Troubleshooting

6.1 Installation

If when installing the SC-USB the Hardware installation wizard is not displayed immediately, try rebooting the PC with the SC-USB plugged in or run the Add Hardware option in the Control Panel. If the wizard still does not appear, it is possible that drivers are already installed for the SC-USB; check using the Device Manager.

The SC-USB uses a chipset made by FTDI. Many other USB devices also use this chipset. As a consequence, the SC-USB and other FTDI devices may share some common driver files. To ensure that the latest files are used, install the SC-USB after the other devices are installed. Also be aware that re-installing an older device last may result in unreliability, as older drivers may overwrite the newer ones without any warning.

6.2 Software Settings

Generally, no specific settings are required to use the SC-USB with Campbell Scientific software. The datalogger should be entered in the device map as if it were directly connected to the COM port assigned to the SC-USB. The baud rate setting has no effect on the speed that the SC-USB communicates with the datalogger. This is normally determined automatically. The 21X and CR7 and non-PakBus TD dataloggers do not support automatic baud rate detection. In these cases the SC-USB needs to be set to a fixed baud rate. This can either be done using the SC-USB utility program (see Section 4, *Set-up Modes – the SC_USB Programming Utility* (p. 13)) or if your software package supports it; for example by using the ‘Generic modem’ option of *LoggerNet*, the baud rate can be set by sending a single character code at the start of each call to the datalogger. The codes are shown in the table below.

ASCII Character	Baud Rate
1	9600
2	38400
3	57600
4	115200
5	76800
6	115200

The SC-USB can be left in auto mode; the numeric characters will not be echoed.

If using the generic modem option of *LoggerNet*, you would enter a generic modem between the COM port and the datalogger, and enter T"1" in the dial script to force the baud rate to 9600 baud; the other hardware settings can be left at their default values.

Setting the baud rate using the latter method is useful if you use the SC-USB to move between a number of different types of dataloggers and wish to avoid having to reconfigure it too often.

If you experience any problems using this software, please report this to Campbell Scientific, giving full details with any solution if available, for possible inclusion in a future release of this User Guide.

6.3 Electronic Interference

Electronic emissions emanating from the SC-USB interface itself are very low. However, while verifying this during the development of the SC-USB, Campbell Scientific became aware that many PCs have poor filtering of emissions from their USB ports.

These emissions become apparent when a cable is plugged into the USB port, as the cable acts as an antenna. If any such PC emissions (coming from the SC-USB cable) cause problems with other equipment, you may be able to reduce such noise by adding a clip-on ferrite choke to the SC-USB cable. Position the choke on the cable close to the USB connector. The size of ferrite is dependent on the level and frequency of noise emitted by the PC, and so needs to be selected by trial and error. If in doubt, seek advice from the PC manufacturer.

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