SoilVUE™ 10
Complete Soil Profiler
Limited warranty

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To obtain a Returned Materials Authorization (RMA) number, contact CAMPBELL SCIENTIFIC, INC., phone (435) 227-9000. Please write the issued RMA 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

For all returns, the customer must fill out a “Statement of Product Cleanliness and Decontamination” form and comply with the requirements specified in it. The form is available from our website at www.campbellsci.com/repair. A completed form must be either emailed to repair@campbellsci.com or faxed to (435) 227-9106. Campbell Scientific is unable to process any returns until we receive this form. If the form is not received within three days of product receipt or is incomplete, the product will be returned to the customer at the customer’s expense. Campbell Scientific reserves the right to refuse service on products that were exposed to contaminants that may cause health or safety concerns for our employees.
**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.com or by telephoning (435) 227-9000 (USA). 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, 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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1. Introduction

The SoilVUE™10 is a time-domain reflectometer-based, soil-profile probe that measures volumetric water content, permittivity, electrical conductivity, and temperature at multiple depths. This probe was designed with environmental researchers and environmental monitoring network operators in mind, and is ideal for long-term outdoor operation and for applications that require highly accurate measurements.

The SoilVUE 10 has two probe length options. The 0.5 m option makes measurements at six depths (5, 10, 20, 30, 40, and 50 cm), and the 1 m option makes measurements at nine depths (5, 10, 20, 30, 40, 50, 60, 75, and 100 cm). Waveguides (measurement rods) are embedded in threads and are centered on the measurement depths. The threaded design allows it to screw into a hole created by a standard 5-cm (2-inch) hand auger. This simple installation procedure reduces cost, complexity, and disturbance of the soil.

NOTE:
This manual provides information only for CRBasic data loggers. For retired Edlog data logger support, contact Campbell Scientific.

2. Precautions

- READ AND UNDERSTAND the Safety (p. iii) section at the front of this manual.
- Although the SoilVUE 10 is rugged, it should be handled as a precision instrument.
- Depth of the hole that the SoilVUE 10 is installed in needs to match the SoilVUE 10 length. Mark the installation tool to align with the length of the probe to ensure a proper depth is obtained. Gaps between the bottom of the SoilVUE 10 and the bottom of the hole adversely affect the measurements.
- Water should be used to wet the sides of the hole, reducing the force needed to install the probe.
- Care should be taken to ensure the sides of the hole are even and do not become tapered with repeated removal of soil.
- External radio frequency (RF) sources can affect the probe operation. Therefore, the SoilVUE 10 should be located away from significant RF sources such as ac power lines and motors.
3. Initial Inspection

- Upon receipt of the SoilVUE 10, inspect the packaging and contents for damage. File any damage claims with the shipping company.
- The model number and cable length are printed on a label at the connection end of the cable. Check this information against the shipping documents to ensure the expected product and cable length are received.

4. QuickStart

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

The following procedure also shows using Short Cut to program the SoilVUE 10.

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 SoilVUE10 or locate the probe in the **Sensors | Soil** folder. Double-click **SoilVUE10 Complete Soil Profiler**. Type the correct **SDI-12 Address**: default address is 0. The **Probe length** defaults to 0.5 m. This is changed by clicking the **Probe length** box and selecting 1 m. Select whether to **Measure every** hour (default) or every fifteen minutes. For each measurement depth, temperature defaults to degrees Celsius. This can be changed by clicking the **Deg C** box and selecting **Deg F**, for degrees Fahrenheit, or **K** for Kelvin.

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

5. Repeat steps three and four for other sensors.
6. In **Output Setup**, type the scan rate, meaningful table names, and **Data Output Storage Interval**.

**CAUTION:**
The scan rate must be evenly divisible into fifteen minutes or one hour (depending on the **Measure every** selected in step 3). The 0.5 m probe can take one minute, and the 1 m probe can take one and a half minutes to complete measurements. If the scan rate is less than that length of time, skipped scans will be registered by the data logger.

7. Select the measurement and its associated output option.

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 logger support software data display in LoggerNet, PC400, RTDAQ, or PC200W to make sure it is making reasonable measurements.

5. Overview

The SoilVUE 10 uses time-domain reflectometry (TDR) to measure soil volumetric water content (VWC) and electrical conductivity (EC). The waveguides (measurement rods) are embedded in threads and centered on the measurement depths of 5, 10, 20, 30, 40, and 50 cm for the 0.5 m option (FIGURE 5-1 (p. 5)) and 60, 75, and 100 cm are added on for the 1 m option. The threaded design maximizes soil contact and minimizes preferential flow—two major drawbacks to smooth-sided soil profiling probes. Campbell Scientific’s proprietary implementation of TDR produces a clean, high resolution measurement that provides accuracy and assurance that cannot be found among other commercially available sensors.

FIGURE 5-1. SoilVUE 10 waveguides and measurement depths
The SoilVUE 10 should be installed in a hole made by a standard 5-cm (2-inch) hand auger tool. Auger the hole to the proper depth and screw the SoilVUE 10 into the hole (Field installation (p. 8)). Water should be used to lubricate the sides of the hole to aid in installation and to ensure the probe is not damaged due to excessive force. The threaded design presses the sensing elements into the side of the hole, producing optimal contact with the soil and minimizing air gaps that are common with alternative profile probes.

The SoilVUE 10 also has a detachable cable that allows either the probe or cable to be independently replaced if it gets damaged.

All of these design factors combine to result in a more accurate measurement.

6. Specifications

Features:

- Volumetric water content (VWC), electrical conductivity (EC), permittivity, and temperature measurements at six depths over 0.5 m or 9 depths over 1.0 m using one probe
- Campbell Scientific proprietary TrueWave™ TDR technology uses advanced waveform analysis to determine the true travel time of a high frequency pulse that provides defensible measurements that can be universally compared with other TDR systems
- Threaded design with individual waveguides built into the threads for optimal contact with soil, which minimizes air-gap errors
- Installation using a standard 5-cm (2-inch) hand auger eliminating the need for excavation machinery or expensive proprietary tools
- Quick and low impact installation
- Detachable cable that facilitates field replacement
- SDI-12 digital output
- Designed for long-term outdoor operation
- Compatible CRBasic data loggers: CR200(X) Series, CR300 Series, CR6, CR800 Series, CR1000X, CR1000, CR3000, CR5000

Maximum installation torque: 54 N m (40 ft•lb)
Diameter without threads: 5.2 cm (2.05 in)
Diameter including threads: 5.8 cm (2.3 in)
Length: 0.55 m/1.05 m (21.5 in/41.2 in)
Weight: 1.9 kg/3.6 kg (4.2 lb/7.9 lb)
Output: SDI-12 Version 1.4 compliant
Operating voltage: 9 to 36 VDC
Current drain at 12 VDC: ~1.5 mA (quiescent), ~64 mA (active)
Measurement depths
0.5 m option: 5, 10, 20, 30, 40, and 50 cm (2, 4, 8, 12, 16, 20 inch)
1 m option: 5, 10, 20, 30, 40, 50, 60, 75, and 100 cm (2, 4, 8, 12, 16, 20, 24, 30, and 40 inch)
Permittivity range: 1 to 80
Electrical conductivity range: 0 to 10 dS/m
Accuracy
Volumetric water content: ±1.5% typical with most soils; soils with high organic matter (>12% soil organic carbon) or high clay content (>45% clay) may need a soil specific calibration due to the dispersive nature of these materials.
Permittivity: ±1 permittivity unit between 4 and 42 permittivity
Electrical Conductivity: ±2% (0 to 2.5 dS/m), ±5% (full range)
Temperature: ±0.15 °C between –30 and 40 °C
Compliance documents: View at: www.campbellsci.com/soilvue10

7. Installation

If you are programming your data logger with Short Cut, skip Wiring (p. 10) and SDI-12 programming (p. 10). Short Cut does this work for you. See QuickStart (p. 2) for a tutorial.

7.1 Siting

Proper installation of the SoilVUE 10 is critical. This includes selecting a monitoring site that is representative of the soil of interest, ensuring good contact between the waveguides and the surrounding soil, minimizing disturbance to the soil, and minimizing preferential flow of water along the probe.

Factors that affect the distribution of water in soil include soil properties such as texture, depth, and compaction, slope, land usage, vegetation, and disturbance history.
The selected site should be representative of the soil of interest. Certain soil types may present a challenge to properly installing the probe. For instance, sandy soil types are likely to collapse into the augered hole. Pre-wetting the installation location may help in firming up the soil and allow a hole to be created.

Rocky soils may prevent an auger from creating a hole deep enough for the probe or may damage the probe during the installation process. Minor abrasions and dents to the body or threads should not influence the measurements. However, rocky soils may require a different approach to the installation. Either create a larger hole and use a slurry method to install the probe, or excavate the soil then back fill the soil around the probe.

### 7.2 Field installation

Campbell Scientific offers a SoilVUE 10 Installation Kit (FIGURE 7-1 (p. 8)).

![FIGURE 7-1. Components of the installation kit](image)

A – Auger extension shaft
B – Hex socket
C – Hex socket handle
D – Edelmann auger
E – Auger clean-out tool
F – Rods to aid in disassembly (insert through holes in extension shaft)
G – T-handle for auger/extension shaft

The installation kit is not necessary to install the SoilVUE 10. A standard 5 cm (2-inch) hand auger may be used instead of the auger supplied in the kit. The SoilVUE 10 can then be inserted into the hole using a standard six-sided 2.25-inch socket.

**CAUTION:**
Do not use a power auger since they may enlarge the hole diameter beyond the desired specification for a properly installed probe. Power augers also tend to bring soil up from lower depths, coating the sides of the hole, which may have adverse effects on the measurements.
1. Connect the T-handle (FIGURE 7-1 (p. 8), G) to the auger extension shaft (FIGURE 7-1 (p. 8), A) then connect the shaft to the auger (FIGURE 7-1 (p. 8), D).

2. Use the auger assembly to create a hole with a diameter of 5 cm (2 inch) diameter and a depth that matches the SoilVUE 10 length.

   **CAUTION:**
   Gaps between the bottom of the SoilVUE 10 and the bottom of the hole adversely affect the measurements.

   a. Care should be taken to ensure the sides of the hole are even and do not become tapered with repeated removal of soil
   b. Water can be used to wet the sides of the hole, reducing the force needed to install the probe.

   **CAUTION:**
   When adding water to the sides of the hole, do not over saturate the soil. There should not be standing water at the bottom of the hole. Care should also be taken not to erode the sides of the hole, introducing air gaps.

3. Insert the hex socket handle into the small holes in the hex socket (FIGURE 7-2 (p. 9)).

4. Place the hex socket on top of the probe and use the handle to screw the probe into the augered hole.
a. Leave the plastic cap on the cable connector until the probe is completely installed.
b. When the probe is partially installed, remove 5 cm (2 inch) of soil from the top of the hole. This will prevent the connector from digging into the soil as the probe is installed, and provide room for connecting the cable. The soil should be replaced after the probe is installed.
c. When the top of the probe is flush with the soil surface, the top sensor is at 5 cm (2 inch) depth.

5. Connect the cable to the SoilVUE 10, and tighten the cable connector nut a quarter turn past finger tight to ensure a water-tight seal.

6. Route the cable to the data logger.

### 7.3 Wiring

Table 7-1 (p. 10) provides the connections for the SoilVUE 10.

**Table 7-1: Wire color, function, and data logger connection**

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Wire function</th>
<th>Data logger connection</th>
</tr>
</thead>
<tbody>
<tr>
<td>White</td>
<td>SDI-12 signal</td>
<td>C, SDI-12, or U configured for SDI-12¹</td>
</tr>
<tr>
<td>Clear</td>
<td>Shield</td>
<td>↓ (analog ground)</td>
</tr>
<tr>
<td>Brown</td>
<td>Power</td>
<td>12V</td>
</tr>
<tr>
<td>Black</td>
<td>Power ground</td>
<td>G</td>
</tr>
</tbody>
</table>

¹ U and C terminals are automatically configured by the measurement instruction.

For the CR6 and CR1000X data loggers, triggering conflicts may occur when a companion terminal is used for a triggering instruction such as `TimerInput()`, `PulseCount()`, or `WaitDigTrig()`. For example, if the SoilVUE 10 is connected to C3 on a CR1000X, C4 cannot be used in the `TimerInput()`, `PulseCount()`, or `WaitDigTrig()` instructions.

### 7.4 SDI-12 programming

This instruction sends a request to the sensor to make a measurement and then retrieves the measurement from the sensor. See SDI-12 measurements (p. 11) for more information.

For most data loggers, the `SDI12Recorder()` instruction has the following syntax:

```plaintext
SDI12Recorder(Destination, SDIPort, SDIAddress, "SDICommand", Multiplier, Offset, FillNAN, WaitonTimeout)
```
For the **SDIAddress**, alphabetical characters need to be enclosed in quotes (for example, “A”). Also enclose the **SDICommand** in quotes as shown. The **Destination** parameter must be an array. The required number of values in the array depends on the command (see Table 8-1 (p. 11)).

**FILLNAN** and **WAITONTIMEOUT** are optional parameters (refer to CRBasic Help for more information).

# 8. Operation

## 8.1 SDI-12 measurements

The SoilVUE 10 responds to the SDI-12 commands shown in Table 8-1 (p. 11). Because of the delays the **M!** command requires, Campbell Scientific recommends measurement scans of at least 10 seconds per sensor. For instance, the recommended scan rate for a 0.5 m probe with six sensors is at least 60 seconds. A **C!** command does not require the data logger to pause its operation until the values are ready.

<table>
<thead>
<tr>
<th>SDI-12 command (a is the SDI-12 address)</th>
<th>Values returned or function</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>aM!</strong></td>
<td>1. Volumetric Water Content, 5 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Volumetric Water Content, 10 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>3. Volumetric Water Content, 20 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>4. Volumetric Water Content, 30 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>5. Volumetric Water Content, 40 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>6. Volumetric Water Content, 50 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>7. Volumetric Water Content, 60 cm³</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>8. Volumetric Water Content, 75 cm³</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>9. Volumetric Water Content, 100 cm³</td>
<td>m³/m³</td>
</tr>
</tbody>
</table>

<p>| <strong>aM1!</strong> or <strong>aC1!</strong> | 1. Volumetric Water Content, 5 cm | m³/m³ |
|                     | 2. Relative Permittivity, ε, 5 cm |       |
|                     | 3. Temperature, 5 cm | °C |
|                     | 4. Bulk Electrical Conductivity, 5 cm | dS/m |</p>
<table>
<thead>
<tr>
<th>SDI-12 command (a is the SDI-12 address)</th>
<th>Values returned or function</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>aM2! or aC2!</td>
<td>1. Volumetric Water Content, 10 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 10 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 10 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 10 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM3! or aC3!</td>
<td>1. Volumetric Water Content, 20 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 20 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 20 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 20 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM4! or aC4!</td>
<td>1. Volumetric Water Content, 30 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 30 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 30 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 30 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM5! or aC5!</td>
<td>1. Volumetric Water Content, 40 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 40 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 40 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 40 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM6! or aC6!</td>
<td>1. Volumetric Water Content, 50 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 50 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 50 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 50 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM7! or aC7!¹</td>
<td>1. Volumetric Water Content, 60 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 60 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 60 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 60 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>aM8! or aC8!¹</td>
<td>1. Volumetric Water Content, 75 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 75 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 75 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 75 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td>SDI-12 command (a is the SDI-12 address)</td>
<td>Values returned or function</td>
<td>Units</td>
</tr>
<tr>
<td>----------------------------------------</td>
<td>-----------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td><code>aM9</code> or <code>aC9</code>!</td>
<td>1. Volumetric Water Content, 100 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 100 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 100 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 100 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td><code>aC</code>!</td>
<td>1. Volumetric Water Content, 5 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>2. Relative Permittivity, ε, 5 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Temperature, 5 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>4. Bulk Electrical Conductivity, 5 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>5. Volumetric Water Content, 10 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>6. Relative Permittivity, ε, 10 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>7. Temperature, 10 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>8. Bulk Electrical Conductivity, 10 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>9. Volumetric Water Content, 20 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>10. Relative Permittivity, ε, 20 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>11. Temperature, 20 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>12. Bulk Electrical Conductivity, 20 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>13. Volumetric Water Content, 30 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>14. Relative Permittivity, ε, 30 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>15. Temperature, 30 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>16. Bulk Electrical Conductivity, 30 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>17. Volumetric Water Content, 40 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>18. Relative Permittivity, ε, 40 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>19. Temperature, 40 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>20. Bulk Electrical Conductivity, 40 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>21. Volumetric Water Content, 50 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>22. Relative Permittivity, ε, 50 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>23. Temperature, 50 cm</td>
<td>°C</td>
</tr>
<tr>
<td></td>
<td>24. Bulk Electrical Conductivity, 50 cm</td>
<td>dS/m</td>
</tr>
<tr>
<td></td>
<td>25. Volumetric Water Content, 60 cm</td>
<td>m³/m³</td>
</tr>
<tr>
<td></td>
<td>26. Relative Permittivity, ε, 60 cm</td>
<td></td>
</tr>
<tr>
<td></td>
<td>27. Temperature, 60 cm</td>
<td>°C</td>
</tr>
</tbody>
</table>
Table 8-1: SoilVUE 10 SDI-12 commands

<table>
<thead>
<tr>
<th>SDI-12 command (a is the SDI-12 address)</th>
<th>Values returned or function</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>28. Bulk Electrical Conductivity, 60 cm$^1$</td>
<td>dS/m</td>
<td></td>
</tr>
<tr>
<td>29. Volumetric Water Content, 75 cm$^1$</td>
<td>m$^3$/m$^3$</td>
<td></td>
</tr>
<tr>
<td>30. Relative Permittivity, ε, 75 cm$^1$</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>31. Temperature, 75 cm$^1$</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>32. Bulk Electrical Conductivity, 75 cm$^1$</td>
<td>dS/m</td>
<td></td>
</tr>
<tr>
<td>33. Volumetric Water Content, 100 cm$^1$</td>
<td>m$^3$/m$^3$</td>
<td></td>
</tr>
<tr>
<td>34. Relative Permittivity, ε, 100 cm$^1$</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>35. Temperature, 100 cm$^1$</td>
<td>°C</td>
<td></td>
</tr>
<tr>
<td>36. Bulk Electrical Conductivity, 100 cm$^1$</td>
<td>dS/m</td>
<td></td>
</tr>
<tr>
<td>?! Returns the SDI-12 Address</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

$^1$ One meter probe only.

**NOTE:**
SDI-12 sensor support (p. 20) describes the SDI-12 commands. Additional SDI-12 information is available in SDI-12 Support, or at [www.sdi-12.org](http://www.sdi-12.org).

### 8.2 Measurements at fast scan rates

Using the **SlowSequence** function allows the SDI-12 instruction to run as a background process, causing minimum interference to other measurements that use the analog hardware. Measuring the SoilVUE 10 in a **SlowSequence** section of the program allows faster programs to run as the main scan. However, if the data logger is too busy to complete all of its tasks, some slow sequence commands may be skipped resulting in NANs (not a number) instead of measurements.

### 8.3 Measurement theory

The SoilVUE 10 is a multiparameter soil profile probe that measures soil volumetric water content using a time-domain reflectometry (TDR) method. The probe consists of TDR circuitry connected to a series of six or nine helical waveguides that makeup part of the overall threaded design.
The travel time for a pulsed electromagnetic signal along a waveguide is dependent on the velocity of the signal and the waveguide length. The velocity is dependent on the dielectric constant of the material surrounding the waveguide. This relationship can be expressed by:

$$\Delta t = \frac{2L\sqrt{K_a}}{c}$$  \hspace{1cm} \text{Eq. 1}

Where,
- $K_a$ is the apparent permittivity
- $c$ is the velocity of electromagnetic signals in free space
- $\Delta t$ is the travel time
- $L$ is the waveguide length

Eq. 1 (p. 15) can be simplified to express the apparent permittivity as the ratio of the apparent probe length ($L_a = c \cdot \Delta t/2$) to the real probe length.

$$K_a = \left(\frac{L_a}{L}\right)^2$$ \hspace{1cm} \text{Eq. 2}

The permittivity of water relative to other soil constituents is high. Consequently, changes in volumetric water content can be directly related to the change in the permittivity of bulk soil material. The relationship between permittivity and volumetric water content has been described by, among others, Topp et al. (1980) and Ledieu et al. (1986) in an empirical fashion using both polynomial and linear forms.

9. Maintenance and troubleshooting

**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 Assistance page at the beginning of this manual for more information.

The SoilVUE 10 does not require periodic maintenance. For troubleshooting, Table 9-1 (p. 16) provides symptoms, possible causes, and solutions.
<table>
<thead>
<tr>
<th>Symptom</th>
<th>Possible cause</th>
<th>Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>All SoilVUE 10 output values read 0</td>
<td>No <code>SDI12Recorder()</code> instruction in data logger program.</td>
<td>Add <code>SDI12Recorder()</code> instruction to data logger program</td>
</tr>
<tr>
<td></td>
<td>Conditional statement that triggers reading is not evaluating as true</td>
<td>Check logic of conditional statement that triggers readings</td>
</tr>
<tr>
<td>First value reads NAN and all other values read 0 or never change from one measurement to another.</td>
<td>SoilVUE 10 SDI-12 address does not match address specified in data logger program SoilVUE 10 is not connected to the SDI-12 terminal specified in data logger program SoilVUE 10 not being powered</td>
<td>Change SoilVUE 10 SDI-12 address or modify program so that they match Connect wire to correct terminal or modify program to match wiring Make sure the SoilVUE 10 is wired correctly and that it matches the data logger program</td>
</tr>
<tr>
<td>Readings erratic, including NANS and 9999999s</td>
<td>Multiple devices with same SDI-12 address sharing same <strong>U</strong> or <strong>C</strong> terminal</td>
<td>Connect each SDI-12 device to a different <strong>U</strong> or <strong>C</strong> terminal or give them unique SDI-12 addresses. Ensure that you revise the data logger program to account for these changes.</td>
</tr>
</tbody>
</table>
Appendix A. Importing Short Cut code into CRBasic Editor

Short Cut creates a .DEF file that contains wiring and memory usage 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 following the procedure in QuickStart (p. 2). 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 program

The following example program collects the volumetric water content, relative permittivity, soil temperature, and bulk electrical content for each of the depths for a 0.5 m probe. The program is for the CR6; other CRBasic data loggers are programmed similarly. Table B-1 (p. 18) provides the wiring for the example program.

<table>
<thead>
<tr>
<th>Wire color</th>
<th>Function</th>
<th>CR6 terminal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown</td>
<td>Power</td>
<td>12V</td>
</tr>
<tr>
<td>White</td>
<td>SDI-12 signal</td>
<td>U1</td>
</tr>
<tr>
<td>Black</td>
<td>Power ground</td>
<td>G</td>
</tr>
<tr>
<td>Clear</td>
<td>Shield</td>
<td>☩ (analog ground)</td>
</tr>
</tbody>
</table>

**Table B-1: Example program data logger connections**

**CRBasic Example 1: CR6 program measuring a 0.5 m SoilVUE 10 probe**

'CR6 Series Datalogger

Public PTemp, batt_volt

'SoilVUE variables

Public SoilVUE_05cm(4)
Alias SoilVUE_05cm(1) = VWC_5cm
Alias SoilVUE_05cm(2) = Perm_5cm
Alias SoilVUE_05cm(3) = TC_5cm
Alias SoilVUE_05cm(4) = EC_5cm
Public SoilVUE_10cm(4)
Alias SoilVUE_10cm(1) = VWC_10cm
Alias SoilVUE_10cm(2) = Perm_10cm
Alias SoilVUE_10cm(3) = TC_10cm
Alias SoilVUE_10cm(4) = EC_10cm
Public SoilVUE_20cm(4)
Alias SoilVUE_20cm(1) = VWC_20cm
Alias SoilVUE_20cm(2) = Perm_20cm
Alias SoilVUE_20cm(3) = TC_20cm
Alias SoilVUE_20cm(4) = EC_20cm
Public SoilVUE_30cm(4)
Alias SoilVUE_30cm(1) = VWC_30cm
Alias SoilVUE_30cm(2) = Perm_30cm
CRBasic Example 1: CR6 program measuring a 0.5 m SoilVUE 10 probe

Alias SoilVUE_30cm(3) = TC_30cm
Alias SoilVUE_30cm(4) = EC_30cm
Public SoilVUE_40cm(4)
Alias SoilVUE_40cm(1) = VWC_40cm
Alias SoilVUE_40cm(2) = Perm_40cm
Alias SoilVUE_40cm(3) = TC_40cm
Alias SoilVUE_40cm(4) = EC_40cm
Public SoilVUE_50cm(4)
Alias SoilVUE_50cm(1) = VWC_50cm
Alias SoilVUE_50cm(2) = Perm_50cm
Alias SoilVUE_50cm(3) = TC_50cm
Alias SoilVUE_50cm(4) = EC_50cm

'Table for SoilVUE data
DataTable (SoilVUEdata,1,-1)
  DataInterval (0,60,Min,10)
  Minimum (1,batt_volt,FP2,False,False)
  Sample (1,PTemp,FP2)
  Sample (4,SoilVUE_05cm(),IEEE4)
  Sample (4,SoilVUE_10cm(),IEEE4)
  Sample (4,SoilVUE_20cm(),IEEE4)
  Sample (4,SoilVUE_30cm(),IEEE4)
  Sample (4,SoilVUE_40cm(),IEEE4)
  Sample (4,SoilVUE_50cm(),IEEE4)
EndTable

'Main Program
BeginProg
  Scan (5,Sec,0,0)
    PanelTemp (PTemp,60)
    Battery (batt_volt)
  NextScan
  SlowSequence
  Scan (60,Min,0,0)
  'Queries to SoilVUE soil profiling probe
  SDI12Recorder (SoilVUE_05cm(),U1,0,"M1!",1.0,0,-1)
  SDI12Recorder (SoilVUE_10cm(),U1,0,"M2!",1.0,0,-1)
  SDI12Recorder (SoilVUE_20cm(),U1,0,"M3!",1.0,0,-1)
  SDI12Recorder (SoilVUE_30cm(),U1,0,"M4!",1.0,0,-1)
  SDI12Recorder (SoilVUE_40cm(),U1,0,"M5!",1.0,0,-1)
  SDI12Recorder (SoilVUE_50cm(),U1,0,"M6!",1.0,0,-1)
  CallTable SoilVUEdata
  NextScan
EndProg
Appendix C. SDI-12 sensor support

SDI-12, Serial Data Interface at 1200 baud, is a protocol developed to simplify sensor and data logger compatibility. Only three wires are necessary — serial data, ground, and 12 V. With unique addresses, multiple SDI-12 sensors can connect to a single SDI-12 terminal on a Campbell Scientific data logger.

This appendix discusses the structure of SDI-12 commands and the process of querying SDI-12 sensors. For more detailed information, refer to version 1.4 of the SDI-12 protocol, available at www.sdi-12.org.

For additional information, refer to the SDI-12 Sensors | Transparent Mode and SDI-12 Sensors | Watch or Sniffer Mode videos.

C.1 SDI-12 command basics

SDI-12 commands have three components:

- **Sensor address (a)** – a single character and the first character of the command. Use the default address of zero (0) unless multiple sensors are connected to the same port.
- **Command body** – an upper case letter (the “command”), optionally followed by one or more alphanumeric qualifiers.
- **Command termination (!)** – an exclamation mark.

An active sensor responds to each command. Responses have several standard forms and always terminate with <CR> <LF> (carriage return and line feed). Standard SDI-12 commands are listed in Table C-1 (p. 20).

<table>
<thead>
<tr>
<th>Name</th>
<th>Command</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acknowledge Active</td>
<td>a!</td>
<td>a&lt;CR&gt; &lt;LF&gt;</td>
</tr>
<tr>
<td>Send Identification</td>
<td>aI!</td>
<td>allccccccccmmmmmmvxxxx...xx &lt;CR&gt; &lt;LF&gt;</td>
</tr>
<tr>
<td>Start Verification</td>
<td>aV!</td>
<td>atttn &lt;CR&gt; &lt;LF&gt;</td>
</tr>
</tbody>
</table>
### Table C-1: Campbell Scientific sensor SDI-12 command and response set

<table>
<thead>
<tr>
<th>Name</th>
<th>Command</th>
<th>Response¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>Address Query</td>
<td>?!</td>
<td>a&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>Change Address</td>
<td>aAb!</td>
<td>b&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>Start Measurement</td>
<td>aM!</td>
<td>atttn&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td></td>
<td>aM1!...aM9!</td>
<td></td>
</tr>
<tr>
<td>Start Measurement and Request CRC</td>
<td>aMC!</td>
<td>atttn &lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td></td>
<td>aMC1!...aMC9!</td>
<td></td>
</tr>
<tr>
<td>Start Concurrent Measurement</td>
<td>aC!</td>
<td>atttnn&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td></td>
<td>aC1!...aC9!</td>
<td></td>
</tr>
<tr>
<td>Start Concurrent Measurement and Request CRC</td>
<td>aCC!</td>
<td>atttnn&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td></td>
<td>aCC1!...aCC9!</td>
<td></td>
</tr>
<tr>
<td>Send Data</td>
<td>aD0!...aD9!</td>
<td>a&lt;values&gt;&lt;CR&gt;&lt;CR&gt;&lt;LF&gt; or a&lt;values&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>Continuous Measurement</td>
<td>aR0!...aR9!</td>
<td>a&lt;values&gt;&lt;CR&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>Continuous Measurement and Request CRC</td>
<td>aRC0!...aRC9!</td>
<td>a&lt;values&gt;&lt;CRC&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
<tr>
<td>Extended Commands</td>
<td>aXNNN!</td>
<td>a&lt;values&gt;&lt;CR&gt;&lt;CR&gt;&lt;LF&gt;</td>
</tr>
</tbody>
</table>

¹ Information on each of these commands is given in the following sections.

### C.2 Acknowledge active command (a!)

The Acknowledge Active command (a!) is used to test a sensor on the SDI-12 bus. An active sensor responds with its address.

### C.3 Send identification command (aI!)

Sensor identifiers are requested by issuing command aI!. The reply is defined by the sensor manufacturer but usually includes the sensor address, SDI-12 version, manufacturer’s name, and sensor model information. Serial number or other sensor specific information may also be included.

<table>
<thead>
<tr>
<th>aI!</th>
<th>allccccccccccmmmmmmvxxxxxx...xx&lt;CR&gt;&lt;LF&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>a</td>
<td>Sensor SDI-12 address</td>
</tr>
</tbody>
</table>
### Table

<table>
<thead>
<tr>
<th>II</th>
<th>SDI-12 version number (indicates compatibility)</th>
</tr>
</thead>
<tbody>
<tr>
<td>cccccccc</td>
<td>8-character vendor identification</td>
</tr>
<tr>
<td>mmmmmm</td>
<td>6 characters specifying the sensor model</td>
</tr>
<tr>
<td>vvw</td>
<td>3 characters specifying the sensor version (operating system)</td>
</tr>
<tr>
<td>xxx...xx</td>
<td>Up to 13 optional characters used for a serial number or other specific sensor information that is not relevant for operation of the data logger</td>
</tr>
<tr>
<td>&lt;CR&gt;&lt;LF&gt;</td>
<td>Terminates the response</td>
</tr>
</tbody>
</table>

*Source: SDI-12: A Serial-Digital Interface Standard for Microprocessor-Based Sensors (see References).*

### C.4 Start verification command (aV!)

The response to a Start Verification command can include hardware diagnostics, but like the aI! command, the response is not standardized.

**Command:** aV!

**Response:** atttn<CR><LF>

- a = sensor address
- ttt = time, in seconds, until verification information is available
- n = the number of values to be returned when one or more subsequent D! commands are issued

### C.5 Address query command (?!)

**Command:** ?!

Requests the address of the connected sensor. The sensor replies to the query with the address, a. This command should only be used with one sensor on the SDI-12 bus at a time.

### C.6 Change address command (aAb!)

Multiple SDI-12 sensors can connect to a single SDI-12 terminal on a data logger. Each device on a single terminal must have a unique address.

A sensor address is changed with command aAb!, where a is the current address and b is the new address. For example, to change an address from 0 to 2, the command is 0A2!. The sensor responds with the new address b, which in this case is 2.

**NOTE:**

Only one sensor should be connected to a particular terminal at a time when changing...
C.7 Start measurement commands (aM!)

A measurement is initiated with the M! command. The response to each command has the form 
\texttt{atttn<CR><LF>}, where
\[ a = \text{sensor address} \]
\[ ttt = \text{time, in seconds, until measurement data is available.} \]
\[ n = \text{the number of values returned when one or more subsequent D commands are issued.} \]

When the \texttt{aM!} is issued, the data logger pauses its operation and waits until either it receives the data from the sensor or the time, \texttt{ttt}, expires. Depending on the scan interval of the data logger program and the response time of the sensor, this may cause skipped scans to occur. In this case make sure your scan interval is longer than the longest measurement time (\texttt{ttt}).

<table>
<thead>
<tr>
<th>Table C-2: Example aM! sequence</th>
</tr>
</thead>
<tbody>
<tr>
<td>\texttt{OM!}</td>
</tr>
<tr>
<td>\texttt{00352&lt;CR&gt;&lt;LF&gt;}</td>
</tr>
<tr>
<td>\texttt{0&lt;CR&gt;&lt;LF&gt;}</td>
</tr>
<tr>
<td>\texttt{0DO!}</td>
</tr>
<tr>
<td>\texttt{0+.859+3.54&lt;CR&gt;&lt;LF&gt;}</td>
</tr>
</tbody>
</table>

C.8 Stopping a measurement command

A measurement command (M!) is stopped if it detects a break signal. A break signal is sent by the data logger before most commands.

A concurrent measurement command (C!) is aborted when another valid command is sent to the sensor before the measurement time has elapsed.
C.9 Send data command (aD0! ... aD9!)

The Send Data command requests data from the sensor. It is issued automatically with every type of measurement command (aM!, aMC!, aC!, aCC!). When the measurement command is aM! or aMC!, the data logger issues the aD0! command once a service request has been received from the sensor. When the data logger is issuing concurrent commands (aC! or aCC!), the Send Data command is issued after the required time has elapsed (no service request will be sent by the sensor). In transparent mode (SDI-12 transparent mode (p. 24)), the user asserts this command to obtain data.

Depending on the type of data returned and the number of values a sensor returns, the data logger may need to issue aD0! up to aD9! to retrieve all data. A sensor may return up to 35 characters of data in response to a D command that follows an M! or MC! command. A sensor may return up to 75 characters of data in response to a D command that follows a C! or CC! command.

Command: aD0! (aD1! ... aD9!)
Response: a<values><CR><LF> or a<values><CRC><CR><LF>
where:

\[ a = \text{the sensor address} \]
\[ <values> = \text{values returned with a polarity sign (+ or –)} \]
\[ <CR><LF> = \text{terminates the response} \]
\[ <CRC> = \text{16-bit CRC code appended if data was requested with aMC! or aCC!}. \]

C.10 SDI-12 transparent mode

System operators can manually interrogate and enter settings in probes using transparent mode. Transparent mode is useful in troubleshooting SDI-12 systems because it allows direct communication with probes. Data logger security may need to be unlocked before activating the transparent mode.

Transparent mode is entered while the PC is communicating with the data logger through a terminal emulator program. It is accessed through Campbell Scientific data logger support software or other terminal emulator programs. Data logger keyboards and displays cannot be used.

The terminal emulator is accessed by navigating to the Datalogger list in PC200W, the Tools list in PC400, or the Datalogger list in the Connect screen of LoggerNet.
Watch the video: SDI-12 Sensors | Transparent Mode.

The following examples show how to enter transparent mode and change the SDI-12 address of an SDI-12 sensor. The steps shown in Changing an SDI-12 address (p. 25) are used with most Campbell Scientific data loggers. Changing an SDI-12 address — CR200(X) Series (p. 26) lists the steps used for CR200(X)-series dataloggers.

C.10.1 Changing an SDI-12 address

The example below was done with a CR1000, but the steps are only slightly different for CR1000X-series, CR300-series, CR6-series, CR800-series, and CR3000 dataloggers. For CR200(X)-series dataloggers, see Changing an SDI-12 address — CR200(X) Series (p. 26).

1. Connect an SDI-12 sensor to the CR1000.
2. In LoggerNet Connect, under Datalogger, click Terminal Emulator. The terminal emulator window opens.
3. Under Select Device, located in the lower left side of the window, select the CR1000 station.
4. Click Open Terminal.
5. Select All Caps Mode.
6. Press Enter until the data logger responds with the CR1000> prompt.
7. Type SDI12 and press Enter.
8. At the Select SDI12 Port prompt, type the number corresponding to the control port where the sensor is connected and press Enter. The response Entering SDI12 Terminal indicates that the sensor is ready to accept SDI-12 commands.
9. To query the sensor for its current SDI-12 address, type ?! and press Enter. The sensor responds with its SDI-12 address. If no characters are typed within 60 seconds, the mode is exited. In that case, simply type SDI12 again, press Enter, and type the correct control port number when prompted.
10. To change the SDI-12 address, type aAb!, where a is the current address from the above step and b is the new address (see FIGURE C-1 (p. 26). Press Enter. The sensor changes its address and responds with the new address.
11. To exit SDI-12 transparent mode, click Close Terminal.
C.10.2 Changing an SDI-12 address — CR200(X) Series

1. Connect a single SDI-12 sensor to the CR200(X).
2. In LoggerNet Connect, under Datalogger, click Terminal Emulator. The terminal emulator window opens.
3. Under Select Device, located in the lower left side of the window, select the CR200Series station.
4. Click Open Terminal.
5. Select All Caps Mode.
6. Press Enter until the data logger responds with the CR2XX> prompt.
7. Type SDI12 and press Enter.
8. The response SDI12> indicates that the sensor is ready to accept SDI-12 commands.
9. To query the sensor for its current SDI-12 address, type ?I and press Enter. The sensor responds with its SDI-12 address. If no characters are typed within 60 seconds, the mode is exited. In that case, simply type SDI12 again and press Enter.
10. To change the SDI-12 address, type aAb!, where a is the current address from the above step and b is the new address (see FIGURE C-2 (p. 27)). Press Enter. The sensor changes its address and responds with the new address.
11. To exit SDI-12 transparent mode, click Close Terminal.
FIGURE C-2. CR200(X) example of using the SDI-12 transparent mode to change the SDI-12 address from 0 to 1
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