# Setting SDI-12 Addresses in the 5TE using Campbell Scientific Dataloggers and LoggerNet

Note 3/18/09: Only 5TE sensors with PCB R2-04 or greater and Firmware R2.12 or greater support the SDI-12 communication protocol. Currently, EC-TM sensors do not support SDI-12. We also strongly recommend that users power cycle the sensors using the switched 12 V port. This not only drastically reduces power consumption, but also ensures that the 5TE sensors are routinely reset preventing undetermined sensor function from momentary power outages. The 5TE sensors must be powered continuously when setting sensor addresses.

Update 4/13/10: All 5TE and 5TM sensors V3 and higher are SDI-12 compatible and do NOT require a power cycle so may be powered continuously.

## Entering SDI-12 Communication "Transparent" Mode

CRBasic (CR200, CR1000, CR3000, etc.)

1. Connect to the datalogger by clicking the "Connect" button on the LoggerNet toolbar and click on "Connect" on the "Connect Screen".
2. Select "Tools" from the top menu and click on "Terminal Emulator"
3. Click the "Open Terminal" button at the bottom of the window.
4. Press the "Enter" key a few times until a "CRXXXX>" prompt appears (i.e. CR1000>)
5. Type "SDI12" next to the prompt
   a. Note: the datalogger will exit this mode relatively quickly so if things don't respond, repeat steps 4 and 5 again.
   b. The datalogger will respond with "Enter Cx Port 1,3,5 or 7" or something similar.
6. Enter the control port that the SDI-12 sensor is plugged in to.
   a. The datalogger will respond with "Entering SDI12 Terminal"
7. Proceed to "Setting SDI-12 Sensor Address" section

Edlog (CR10X, CR23X, etc.)
1. Connect to the datalogger by clicking the "Connect" button on the LoggerNet toolbar and click on "Connect" on the "Connect Screen".
   a. Note: In our tests, you have to be running a program with the SDI-12 Recorder instruction (P105) in that program to allow it to go into the SDI-12 transparent mode.
2. Select "Tools" from the top menu and click on "Terminal Emulator"

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3. Click the "Open Terminal" button at the bottom of the window.
    a. The terminal window should say "Active", highlighted in green at the top.
4. Enter "pX" at the asterisk prompt where 'p' is the control port number (1-8) attached to the SDI-12 sensor.
    a. If you don't see an asterisk, press 'Enter' and one should appear.
    b. Datalogger should respond: "entering SDI-12"
    c. The datalogger will exit out of this mode reasonably quickly. Once it exits, you must repeat step 4.
5. Proceed to "Setting SDI-12 Sensor Address" section

## Setting SDI-12 Sensor Address

Note: Sensors must be addressed individually so only ONE sensor may be connected to the communication port at any time during addressing.

1. Connect first SDI-12 sensor to the communication port you entered in step 6 above.
2. Query its address by typing: ?!
    a. The sensor will return its address such that, if its address is "0" then the line will read: ?!0
3. Assign its new address by typing: 0AX! where X is the new address you want to assign the sensor.
    a. For example, if the sensor was assigned address "2" and you wanted to change it to "5" you would type: 2A5!
    b. The computer would return the new address so the line would look like: 2A5!5
    c. Possible addresses for SDI-12 communication with CR Basic type loggers are are 0 through 9, a through z and A through Z. With Edlog type loggers, only addresses 0-9 are recognized.
4. Repeat steps 2 and 3 for all sensors you need to address, choosing different addresses for each sequential sensor.
5. Once all sensors are individually addressed, all communication lines can be connected together at a single node and the datalogger will address each sensor individually using the addresses that we assigned and the appropriate SDI-12 program.

## Appendix: Complete information on SDI-12 Communication using the 5 TE

When power is applied to the probe it transmits data values initially in a serial string. If power is not switched off, it then enters a low power SDI-12 state waiting for input. The commands it recognizes follow the SDI-12 protocol (see http://www.sdi-12.org for detailed information on the SDI-12 protocol).

Communication is at 1200 baud, but logic levels are opposite to those for the initial transmission (start bit high; stop bit low) to conform to SDI-12 protocol. A communication starts with a SDI-12 break or any transmitted character. This "wakes" the sensor. No activity on the

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communication line for approximately 10 s returns it to sleep mode (30 ua current drain). Since there is only one data line which is used for both transmit and receive, the host must transmit its message and then quickly switch to receive mode to monitor the response. All commands are of the form <address><command><parameters>! The "!" is always the termination character for every command. Multiple device addresses are allowed so several probes can be connected to one port if they have different addresses, and each can be addressed separately. The "?" can be used in place of an address, in which case all devices connected to the port will respond. The following commands are implemented

A<new address>    change the logger address; new address can be any integer 0..9 or letter, A..Z, a..z

I                         returns probe ID

M                        measure probe values

D0                      return measured values

Sample exchanges are:

1I!113DECAGON 5TE 301

Identify probe with address of 1; Return: Probe Address(1), SDI12 Version (13), COMPANY (DECAGON), SENSOR TYPE (5TE), SENSOR VERSION (301)

1M!10013

Measure parameters of probe with address of 1; Return: probe address is 1, data are ready in 001 ms, 3 values will be sent

1D0!1+22.00+1.30+21.8

Send the values; Return: probe address is 1, 22.00 for water content ($\varepsilon = 22.0$), 1.30 dS/m for EC, 21.8 C for temperature
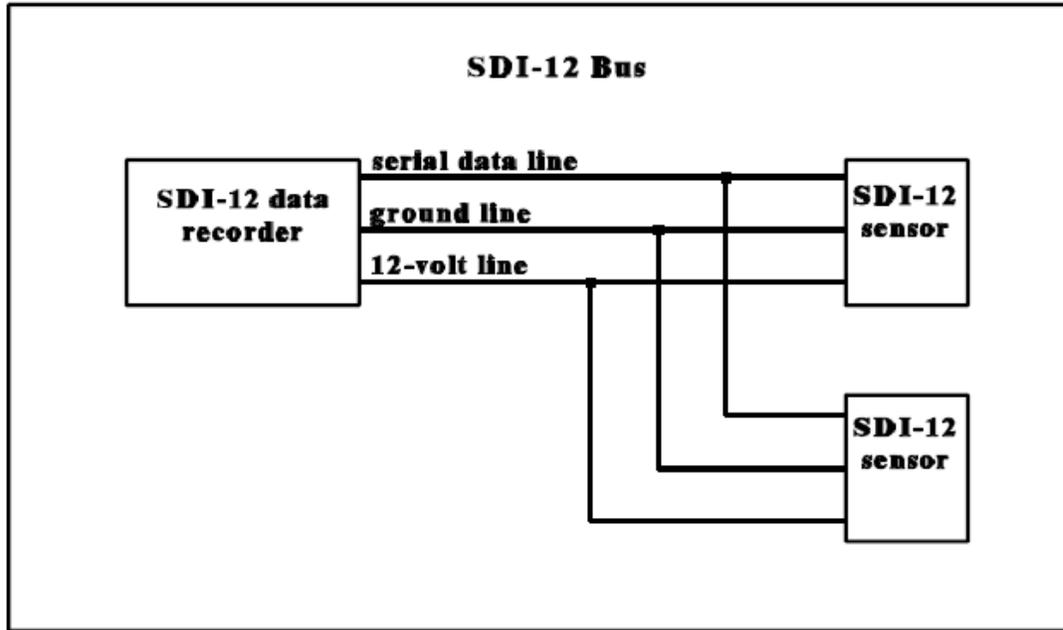
?!0

This returns the device address; Return: probe address is 0

0A1!1

Change the device address to 1; Starting address is 0. Return: new probe address is 1

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The following are from the SDI-12 standard:

**SDI-12 Bus**

serial data line

ground line

12-volt line

SDI-12 data recorder

SDI-12 sensor

SDI-12 sensor

**Figure 1. The SDI-12 Bus**

All sensors must have a unique address.  At least 62 sensors can be connected to a single bus.

| Condition | Binary state | Voltage range |
|---|---|---|
| marking | 1 | -0.5 to 1.0 volts |
| spacing | 0 | 3.5 to 5.5 volts |
| transition | undefined | 1.0 to 3.5 volts |

**Table 1. Logic and voltage levels for serial data**

1 start bit

7 data bits, least significant bit transmitted first

1 parity bit, even parity

1 stop bit

**Table 2. SDI-12 byte frame format**

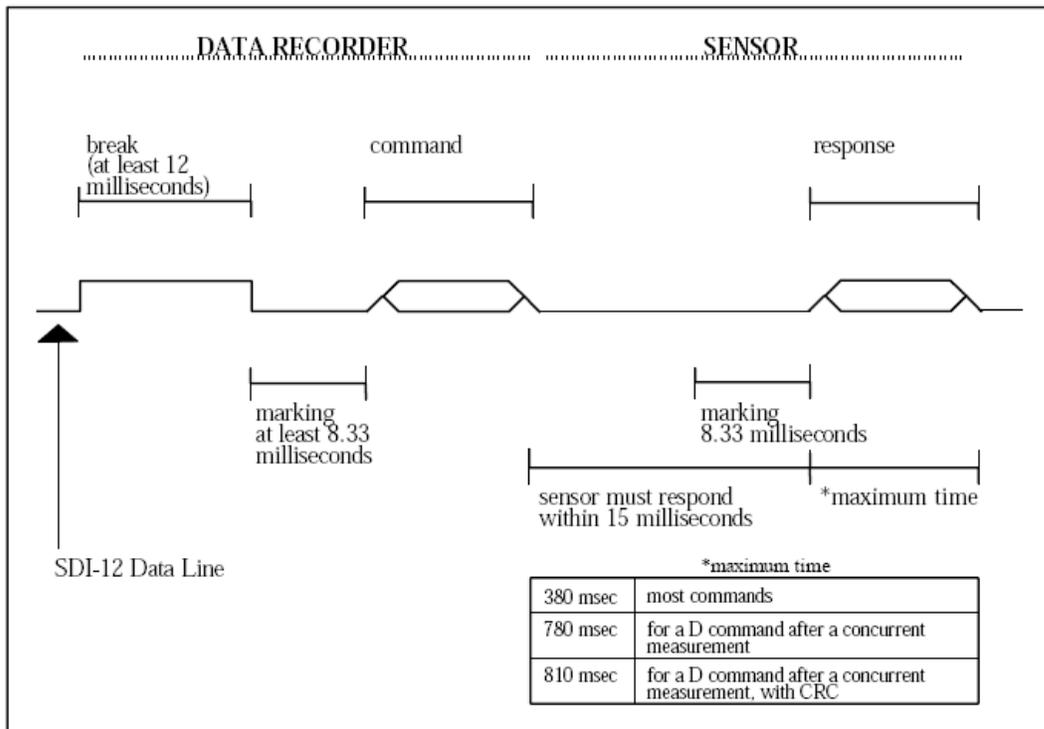Figure 3.  SDI-12 Timing