APPLICATION NOTE # 118

CONFIGURING THE FTS AXIOM DATALOGGER FOR USE WITH AN SR50A SONIC RANGING SENSOR

Purpose

Detail the connections and set-up required to record snow depth measurements from an SR50A sonic ranging sensor connected to an FTS Axiom F6 Datalogger.

Description

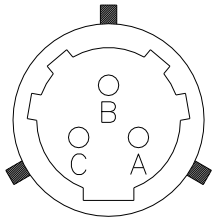
The Axiom Datalogger can be configured to retrieve data from any SDI-12 compliant sensor. Instructions for establishing an SDI-12 connection to an SR50A sonic ranging sensor and for configuring the Axiom Datalogger to read data from the attached SR50A are detailed.

Equipment

FTS Axiom F6 Datalogger
FTS SDI-12 connector (FTS part number 520-83AP)
FTS THS3 Air Temperature and Humidity sensor
Datalogger battery cable
12 V, absorbed glass mat, deep cycle battery
Campbell Scientific SR50A Sonic Ranging sensor with SDI-12 output
SR50A sensor cable

Electrical Connection

The SDI-12 connector used on the Axiom Datalogger is an environmentally sealed, bayonet mount, keyed, military style connector. SDI-12 sensors provided by FTS come assembled with the appropriate mating connector. Connector details and signal connections are as follows.



Mating Connector: Souriau MIL-C-26482 Series 1 family
Souriau Part number: 851-06JC8-3AP50
(FTS Part Number: 520-83AP)

PIN	Function
A	SDI Power
B	SDI Data

C SDI Ground

Figure 1 shows the SDI-12 wiring connections for the SR50A.

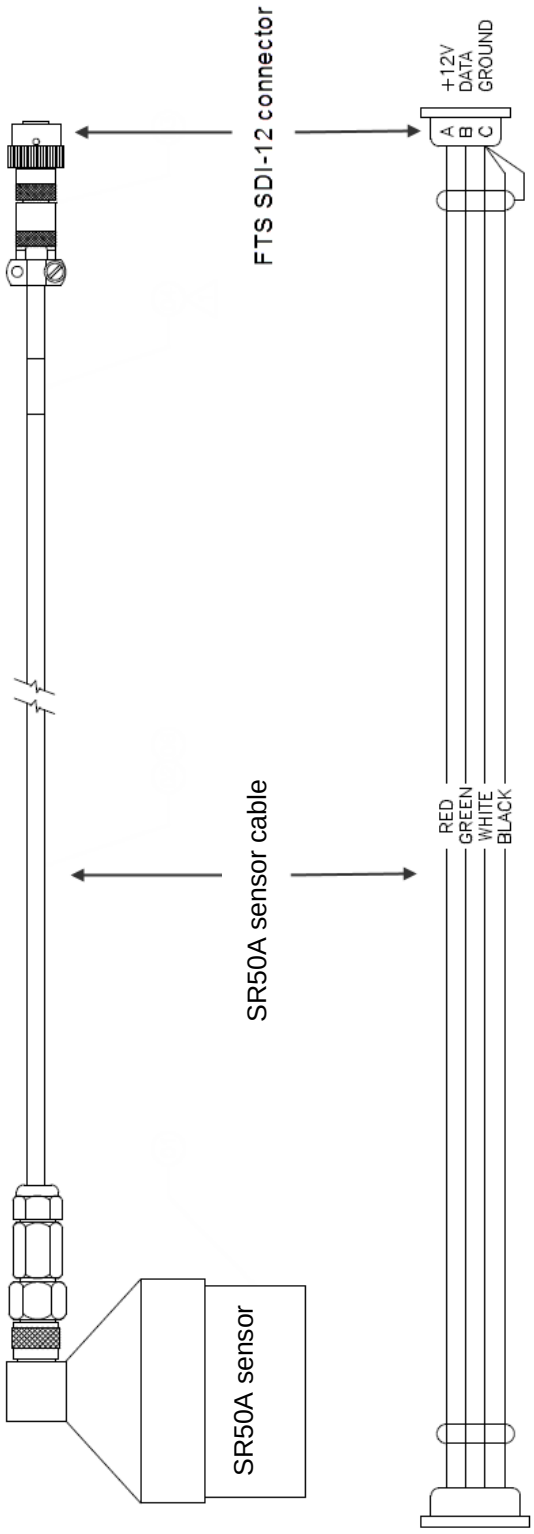

FTS SDI-12 connector
+12V
DATA
GROUND
A
B
C
SR50A sensor cable
RED
GREEN
WHITE
BLACK
SR50A sensor

Figure 1

Configuration

Six easy steps are required to configure the Datalogger to read snow depth data from the SR50A sonic ranging sensor.

1/ Define the SR50A using the SRSnow sensor extension in the Axiom Datalogger.

2/ Set up the SR50A's data fields.

3/ Confirm the sensor's address is correctly set.

4/ Temperature compensate the SR50 distance measurement.

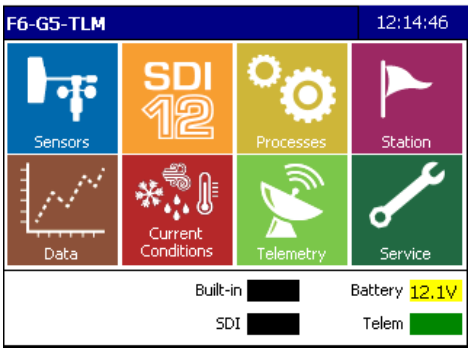
5/ Define the processes to allow the user to enter a zero snow depth so that the actual snow depth can be reported.

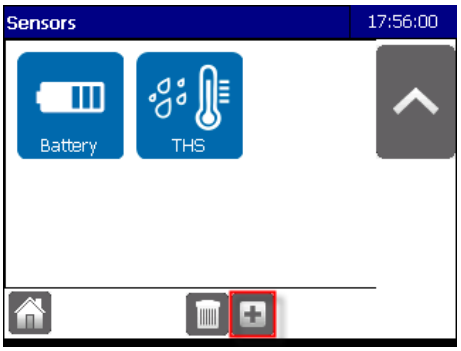
6/ Set up Current Conditions

1/ SR50A Sensor Definition

The following screen captures show how to define an SR50A sonic ranging sensor as a sensor in the Axiom Datalogger.

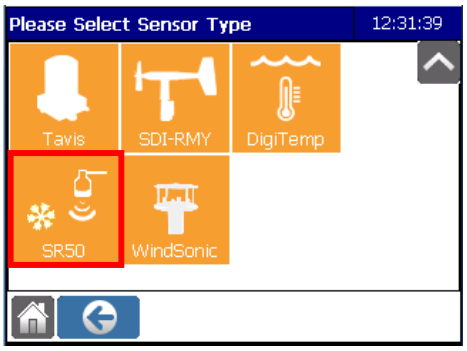
1a/ From the Datalogger Home screen, press the Sensors icon and then press the New Sensor icon ( ).





Note: The above screen shows that a Battery and an FTS THS3 Air sensor have already been defined in the Datalogger. The air temperature reading in Celsius (default name ATC) from the THS sensor will be used to temperature compensate the upcoming SR50A distance reading.

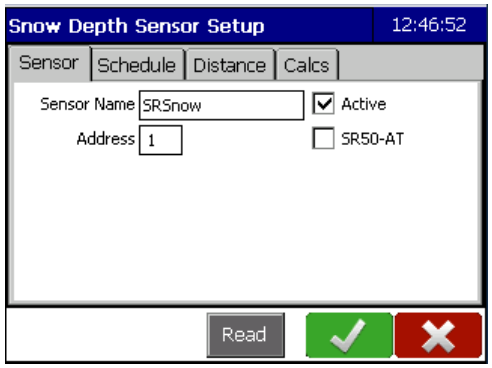
- Scroll through the icons until the SR50 icon is displayed. Press on it to display the Snow Depth Sensor Setup page.



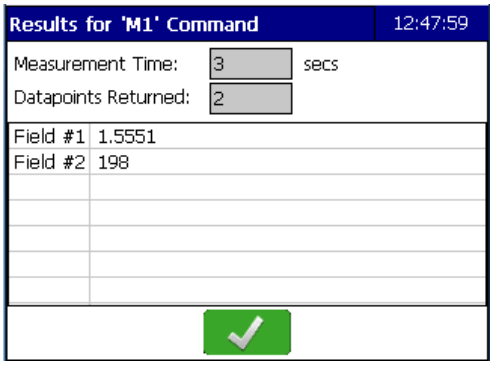
2/ Set up the SR50A's data fields

2a/ Sensor Tab:

- You can keep the default Sensor Name (SRSnow) or change it by pressing on the name field and using the keyboard to enter the new name.
- Enter the sensor's SDI-12 address (1 in this example).
  - The **Active** box will be ticked by default and must remain ticked.
  - The default sensor is the SR50-A. If using the SR50-AT, ensure the SR50-AT check box is ticked.



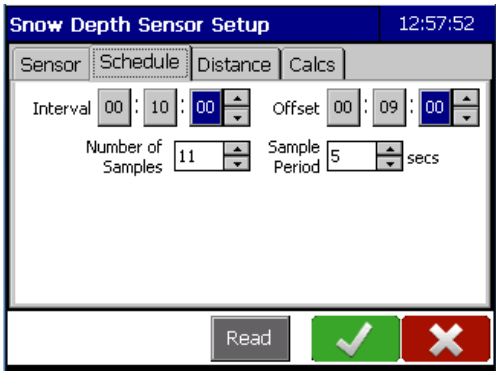
- Press the Read button to confirm sensor operation. This sends a hard coded M1 command to the sensor. It will return a read of the measurements.
- The sensor returns 2 data fields[1] in response to the M1 command. These fields respectively correspond to distance in meters and a measurement quality factor.



[1] Refer to the Campbell Scientific SR50A Instruction Manual for details on the data fields

2b/ Schedule Tab

- The Schedule Tab on the Snow Depth Sensor Setup page is set to the manufacturer's recommended settings.
  - An Offset of 9 minutes is assigned so that there is time for all 11 samples to be measured and for that data to be ready by the 10 minute mark.



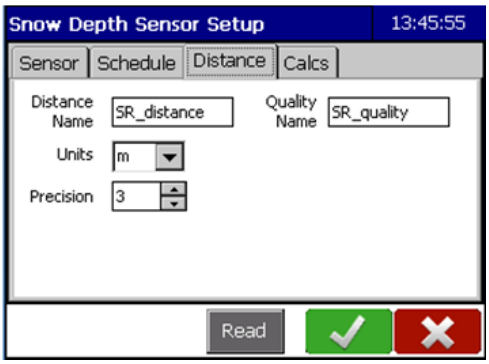
Number of Samples and Sample Period: 11 samples will be taken every 5 seconds. Each sampling of 11 will be used to run the calculations.

Note: An error message will appear if the sensor was not detected in the previous step. If this is the case press OK and proceed with the setup process.

- Press OK to continue.

2c/ Distance Tab

- This tab defines the distance measured by the sonic rangefinder (ie: snow depth).



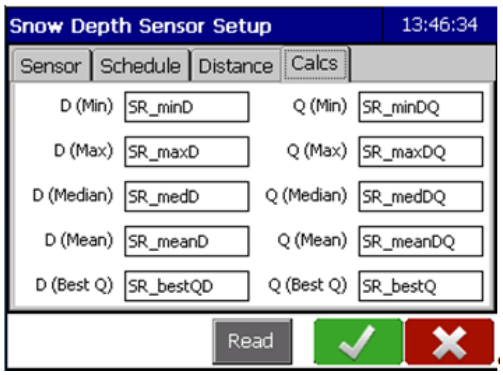
Distance Name: name assigned to the data field returning the measured distance

Quality Name: name assigned to the data field returning the quality of the measurement. Refer to the manufacturer's equipment manual for an explanation of the quality numbers.

Units: use the drop down menu to select the desired units of measurement. Choices are metres, centimetres, millimetres, feet and inches.

Precision: indicates the number of decimal places to which the measurements will be made. The maximum number is four.

2d/ Calculations (Calcs) Tab



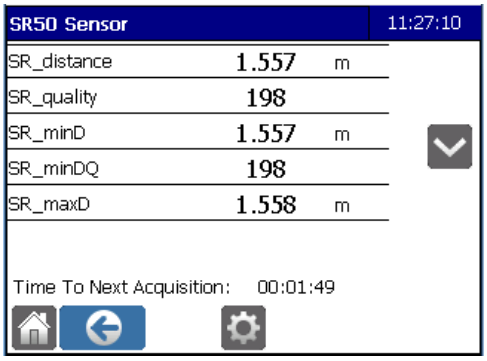
- This tab displays the selected calculations which will be run using the measured data.
- Calculations are run after every sample period using the number of samples taken during that interval.
- Fields are populated with the default names. If a field is left blank, it will not return a calculation.

D(Min): minimum returned distance (depth)
Q(Min): quality of the D(Min)
D(Max): maximum returned distance (depth)
Q(Max): quality of the D(Max)
D(Median): median retuned distance (depth)
Q(Median): quality of the D(Median)
D(Mean): mean returned distance (depth)
Q(Mean): quality of the D(Median)
D(Best Q): best quality distance (depth)
Q(Best Q): quality of the D(Best Q)

- Press OK (checkmark). The SR50 Sensor screen will be displayed.

2e/ SR50 Sensor Screen

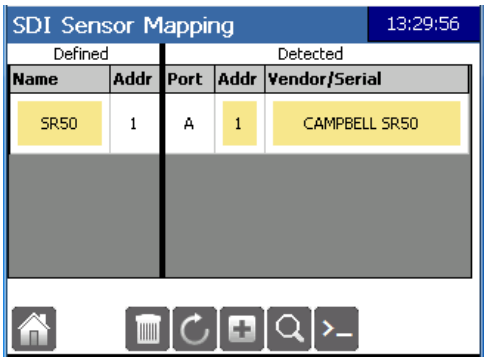
- After the first 10 minute command cycle is complete and if the sensor's address is correct, the screen will display the values read from the SR50A.



- Press the Home button to return to the Datalogger Home screen.

3/ Confirm the SR50A's address is correctly set.

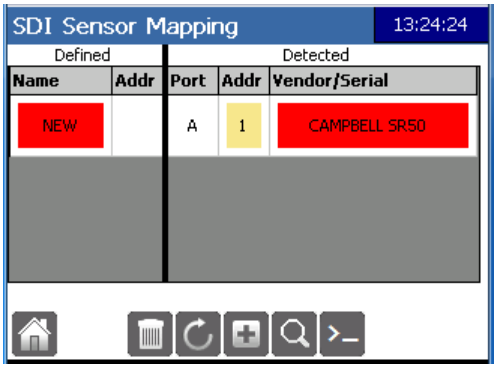
- Press the Home screen's SDI-12 icon. If the sensor is correctly mapped, the SDI Sensor Mapping screen will not have any red fields associated with the SR50.
- In the example the SR50A has been named SR50 and is mapped to address 1 on Port A.



3a/ Mapping the Sensor

"Mapping" the sensor lets the Datalogger know which sensor is expected for the previously defined SR50A sensor.

- If the sensor does not appear in the detected column, press the Detect button to have the Datalogger find the SR50A connected to the Datalogger. One of the following screens should be displayed:

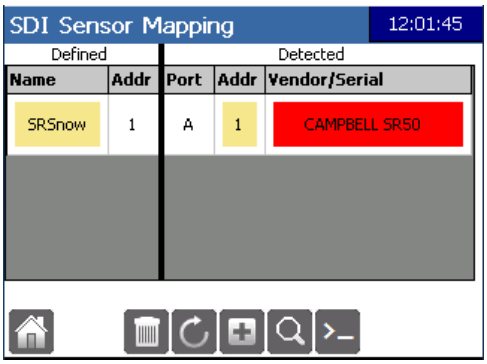


1) Sensor detected but not defined:

Press on the red "New" button to bring up the Snow Sensor Setup Screen (see 2b).

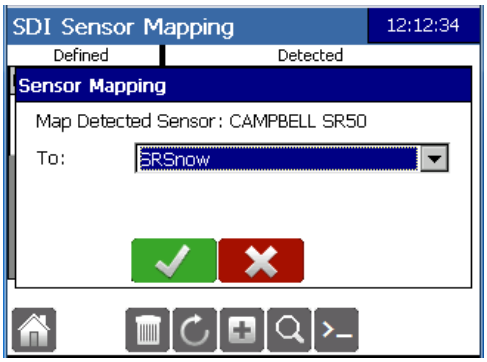
Type in the desired sensor name then OK.

2) **The Detected sensor is not mapped to the Defined SR50A sensor** (named SRSnow)

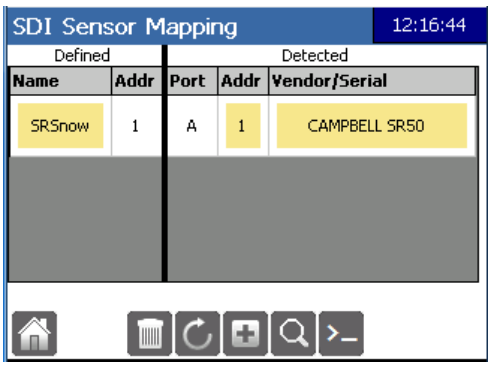


- Press the red Vendor/Serial box.

Note: the Red Vendor box identifying the Campbell SR50A may not appear on the same line as the beige SR50A



- A drop down menu will appear with all the defined sensor names in the Datalogger.
- Scroll down to the desired defined sensor name. The example uses the default name of SRSnow.



- Press OK.
- The sensor will be displayed as mapped.

If the Datalogger still does not display an SR50A sensor in the Detected column of the SDI Sensor Mapping screen, then it is likely that the sensor has been wired incorrectly or there are sensors with duplicate SDI addresses connected to the Datalogger. The situation will need to be addressed in order to have the sensor work properly with the Datalogger. Refer to the Axiom Operator's Manual for details.

4/ Snow Distance Measurement Temperature Compensation

The Campbell Scientific SR50A Operating Instruction manual states:

> "The SR50A calculates a distance reading using the speed of sound at zero Celsius (331.4 m/s). The following temperature correction formula needs to be applied in order for distance readings to be accurate at temperatures other than zero Celsius."

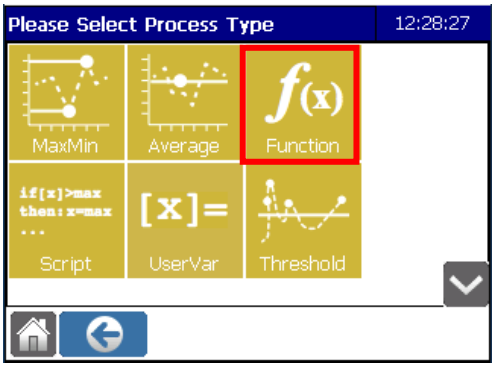
$$DISTANCE = READING_{SR50A}\sqrt{\frac{T°KELVIN}{273.15}}$$

The following steps show how to temperature compensate the SR50A's distance measurement.

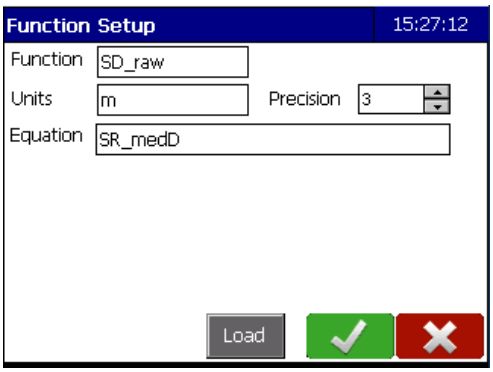
IMPORTANT! Function names are user determined. If you choose not to input the example names used in the following steps, ensure that you exchange your input name for the example name wherever it occurs (especially important in any of the Equations)

4a/ Create 2 new function processes to define SD_Raw (a variable to be used in the following functions equations) and SD_Q

- From the Home screen, select Processes then press Add  .
- From the Process selection screen, select the Function icon to display the Function Setup Screen.



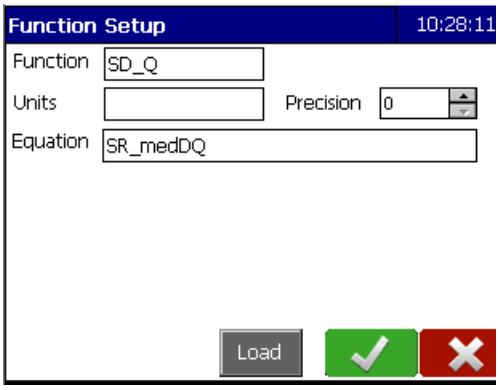
- Input the field information as shown in the screen to the right.



**Note SR_medD is the default name for the median returned distance calculation. If you have changed the default name, you must input that in the equation field

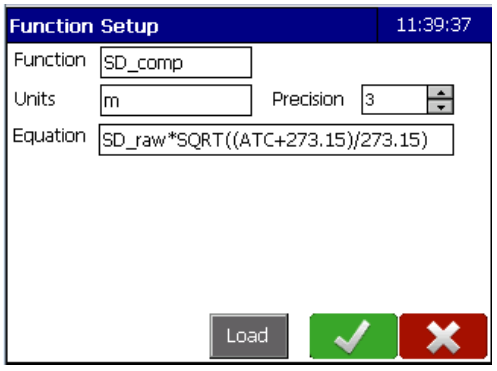
- Select OK, OK.

- Using the same steps outlined abover, create a second function and enter fields as shown to the right



4b/ Create a new function process to compensate the SR50A's distance reading.

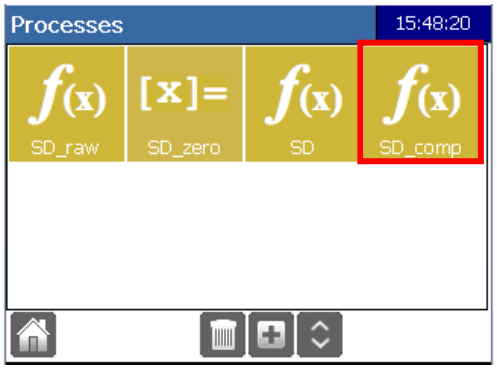
- Follow the steps in 4a to display a new Function Setup screen
- Input the field information as shown in the screen to the right
  - SD_comp signifies the temperature compensated distance to the snow as illustrated in Section 5, Figure 2.
- Press OK.



NOTE: SD_Raw is the function defined in step 4a (based on the median returned distance calculation). ATC is the air temperature measurement, in Celsius, from the defined THS3 air sensor (see step 1a). In the Equation entered for SD_comp, ATC is converted from Celsius to Kelvin.

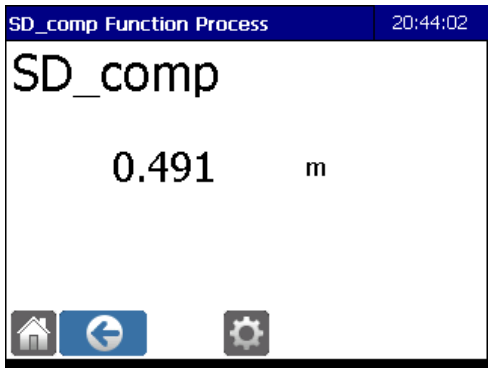
4c/ Display the compensated distance value

- Press the SD_comp icon to display the compensated distance value.



- Note: SD_comp will not display a value unless the THS3 sensor is connected to the Datalogger and the SR50A sensor has completed its first command cycle.

- Press the Back button to return to the Datalogger Process screen



5/ Actual Snow Depth Calculation

Figure 2 depicts a typical SR50A sensor installation.

SD_raw = Distance to Snow measurement from the SR50A

SD_comp = Temperature compensated Distance to Snow measurement

SD_zero = Snow Depth zero (user set at time of install)

SD = actual Snow Depth measurement

The snow depth zero (SD_zero) can be entered into the FTS Datalogger so that the actual snow depth (SD) can be calculated in the Datalogger.

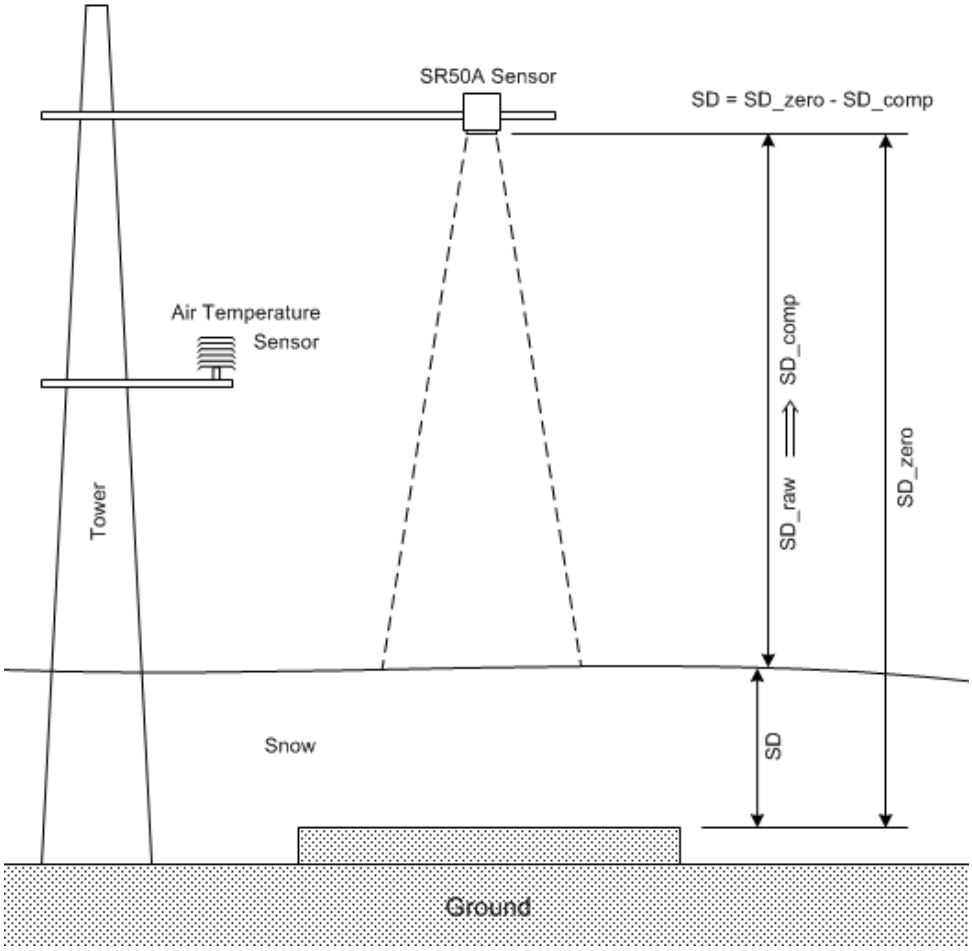
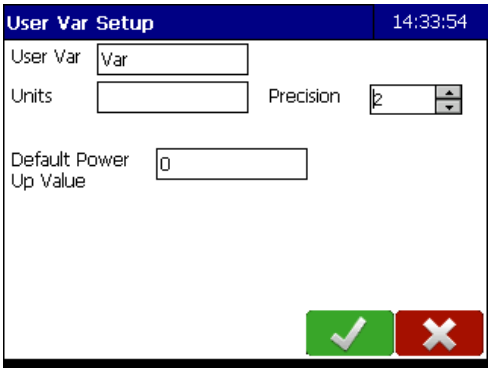


Figure 2: Snow measurement variables and calculations

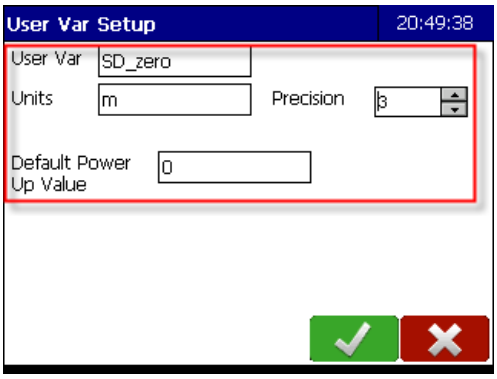
The following steps show how to create the variables and calculation required to report actual snow depth.

5a/ Create a new user variable process so that the snow depth zero offset (ground distance) can be specified.

- From the Home page, select **Processes>Add>UserVar**.

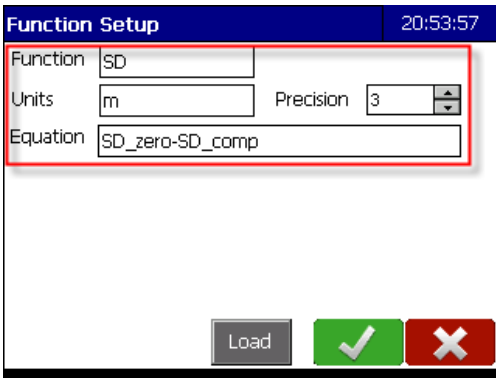


- Name the new variable SD_zero and specify units of meters and 3 decimals of precision.
- Leave the Default Power Up value at zero as this is usually site specific. The default value can be entered if the value for the specific site is known.
- Press OK.

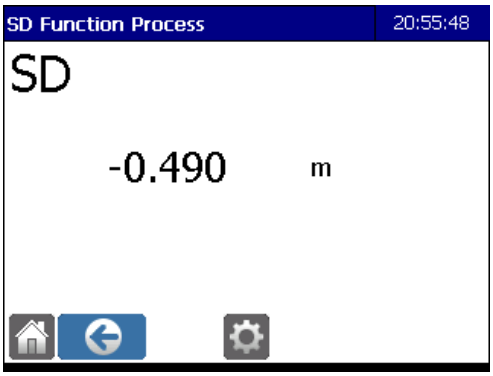


5b/ Create a new function process so that the actual snow depth can be calculated.

- From the Home page, select **Processes>Add>Function**.
- Name the new function SD (snow depth) and specify units of meters and 3 decimals of precision.
- Press OK.



- Press the SD icon to display the actual snow depth value.
- The SD value will be negative if the default value for SD_zero is zero meters

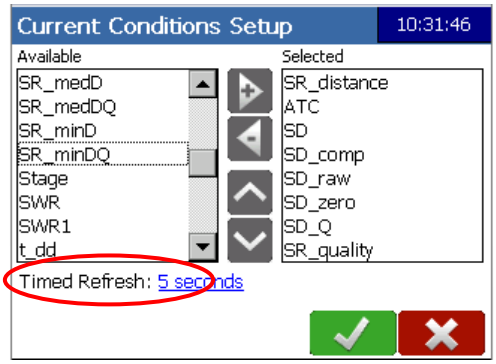


Snow Depth Calculation Set-up Process is Complete

Any of the created data points (SD_raw, SD_Q, SD_comp, SD_zero, and SD) can now be used in the Datalogger.

6/ Setup Current Conditions

- From the **Home** page select **Current Conditions** and then the **Setup** cog. Add the desired data points from the Available list to the Selected list.



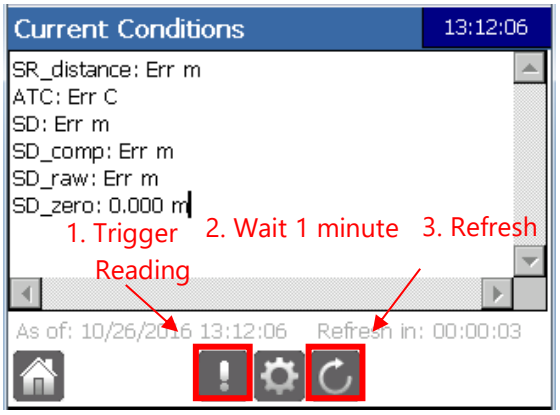
IMPORTANT! SR-Distance MUST be selected for any data points from the Calculations tab {D(Min), D(Max) etc.} or Processes {SD_raw, SD-comp, etc.} to be

7/ Site Installation

When installing the sensor at the site, it is critical to set the SD_zero value so that the correct snow depth is reported. Ideally, this should be done prior to any snowfall so that an SD_comp value can be determined based on the distance to the bare ground.

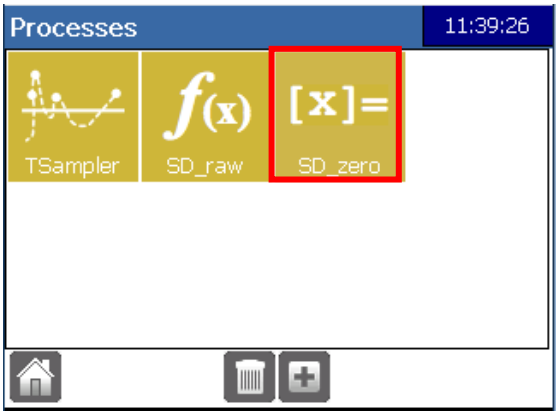
Once the Datalogger and sensors are set up and operating, the following steps outline the procedure to be followed prior to snowfall:

- From the Datalogger's Home screen, select Current Conditions and trigger a reading



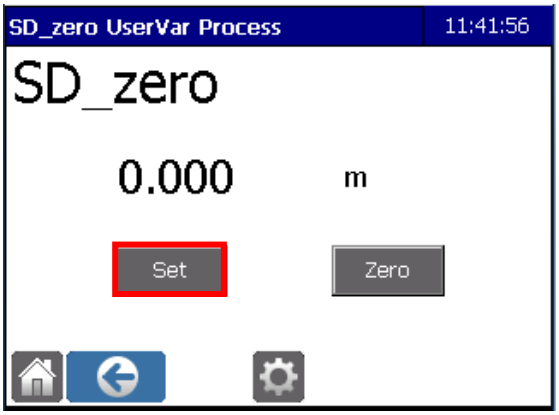
- Wait for the SR50A to complete its command cycle (approximately 1 minute - you will hear it cycle through a series of clicks). Once completed, refresh the screen.
- The Current Conditions data points will be updated. **Note the value for SD_Comp**.

- From Home select Processes, and then select the **SD_zero** icon to display the **SD_zero** UserVar process screen.

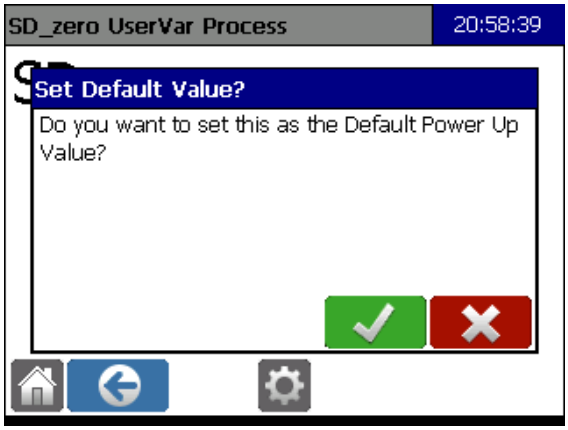


- Press on the Set button and enter the **SD_comp** value noted previously

IMPORTANT: The SD value will be negative if the default value for SD_zero is zero meters



- When asked if the entered value should be saved as the Default Power Up Value, select Yes so that the entered **SD_zero** value is not lost due to an inadvertent Datalogger power cycle or reset



Configuration is complete, return to the home page.

Contact Information

If you have any questions or would like further information please contact FTS.

CONTACT:

FTS FOREST TECHNOLOGY SYSTEMS, LTD.
1065 Henry Eng Place
Victoria, B.C. V9B 6B2

PH: (250) 478-5561 or 1-800-548-4264
FAX: (250) 478-8579 or 1-800-905-7004

ON THE INTERNET:

Web Page:	www.ftsinc.com
E-mail:	info@ftsinc.com
Technical Support:	service@ftsinc.com.com

Revision History

Revision	Date	Description
1	2012-Aug-3	Original release
2	2013-Apr-24	Updated screenshots for Axiom App 3.0.0.48
3	2015-Jan-22	Updated with SRSnow sensor extension Axiom App Ver 3.1.5.9
4	2017 Feb 9	Inserted additional functions (SD_DQ) and information in sections 6/7 on triggering a read for accurate SD_comp/SD_zero values