INSTRUCTION MANUAL

SDMS40

Multipoint Scanning Snowfall Sensor

February 2018

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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.ca or by telephoning (780) 454-2505 (Canada). 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 personnel (e.g. 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.
- 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, 6 meters (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 CLIENT 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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SDMS40 Multipoint Scanning Snowfall Sensor

1. Introduction

The SDMS40 Multipoint Scanning Snowfall Sensor is a two dimensional (2D) multipoint scanning snow gauge, which scans its laser in a circular path on the snow's surface and measures the distance from each point on the path. Once it completes a set of measurements, the SDMS40 takes an intelligent average of the depths to provide a representative average snow depth of the target area. Communication options include SDI-12 and RS-232.

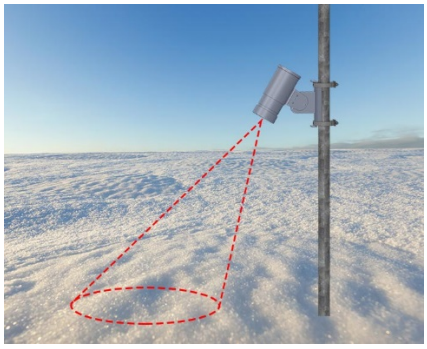


FIGURE 1-1. Circular laser area

Figure 1-1 demonstrates the circular pattern scanned by the sensor. Sophisticated filtering algorithms are implemented to provide reliable measurements in various weather and surface conditions.

The size of the target area varies depending on the height and tilt angle of the SDMS40.

1.1 Features

- Provides representative average snow depth of the target area
- Filters out erroneous measurement data caused by noise or foreign materials
- Detects new snowfall quickly and reliably
- Can operate on natural ground or snow plate
- Compact, light structure
- Simple installation process
- After mounting, the sensor performs a fully automatic calibration process to calculate install angle and height

- Output data on SDI-12 or RS-232 serial data interface

Note The SDMS40 is set with the SDI-12 or RS-232 output configuration by the manufacturer.

2. Precautions

The SDMS40 uses a Class 2 laser. Do not stare into the laser beam.

3. Initial Inspection

- Upon receipt of the SDMS40, inspect the packaging and contents for damage. File any damage claims with the shipping company. Immediately check package contents against the shipping documentation. Contact Campbell Scientific about any discrepancies.

- The model number and cable length are printed on a label at the connection end of the cable (if a cable was purchased). Check the model number information against the shipping documents to ensure the expected product and cable length are received.

- The SDMS40 is shipped with 4 screws, 2 lock washers, 2 band clamps, a mounting bracket, 4 lens wipes, a resourceUSB, and the Female DB9 terminal block.

4. Specifications

Power Supply

- 12-15 Vdc (recommended)
- 9 Vdc minimum, including cable loss

Current Draw

- Standby Current Draw: 50 mA
- Active Current Draw: 450 mA
- Heater Current Draw 1500 mA

Cable

- 3-Cond 20 AWG, 2 Pair 24 AWG
- Maximum length: 14 m (45 feet)

Sensor

- Method: Multipoint laser scanning
- Number of Scanning Points: 36
- Range: up to 3 meters
- Target Area Diameter: 30 cm – 200 cm, depending on installation height and angle
- Gauge Pointing Angle: 0 to 45° from vertical
- Half Angle: 7°

- Resolution: 1 mm
- Accuracy: ±5 mm

Communication Protocols

- SDI-12
- RS-232

General

- Operating Temperature: -40°C to 50°C*
- Weight: 1.8 kg (3.9 lb.)
- Enclosure Protection Class: IP67
- Laser Safety: Class 2

* With sensor heat on

Dimensions

- Height: 12 cm (4.72”)
- Length: 28 cm (11.02”)
- Width: 10 cm (3.94”)

5. Mounting

The SDMS40 is designed to be environmentally sealed for outdoor installations. The enclosure provides protection from moisture and high humidity. It is not intended for operation under water. All this is required is an appropriate mounting fixture.

Position the SDMS40 about one meter above the maximum seasonal snow depth height. This provides adequate height for required accuracy and resolution.

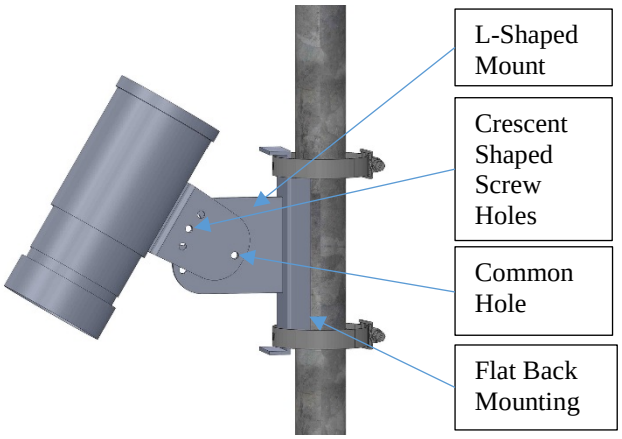


FIGURE 5-1. SDMS40

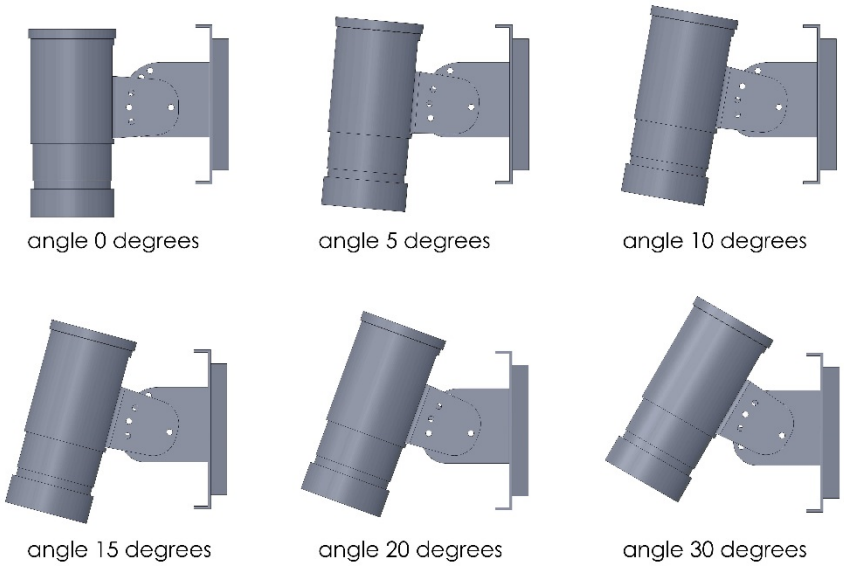


FIGURE 5-2. SDMS40 mounting angles

TABLE 5-1. SDMS40 Mounting Procedure	
Step	**Procedure**
1	Attach the L-shaped mount to the flat back mount using the common hole and crescent shaped screw holes.
2	Using Figure 5-2 *SDMS40 Mounting angles*, decide which angle your sensor is to be mounted at.
3	Bolt the L-shaped mounting piece to the underside of the sensor. The big middle circle should line up with the cable connector.
4	Install sensor and mount 1 m above the maximum seasonal snow depth height. For mounting to poles, use thin hose clamps.
5	Line up the connector end of the cable to the cable connector on the sensor. Lightly push the connector into place and screw the connector to secure.

5.1 Adjusting Inclination Angle or Direction of the SDMS40

The SDMS40 can be installed at any angle between 0 and 45 degrees from the pole. After loosely tightening the screw on the common hole (see Figure 5-1 *SDMS40*), the inclination angle can be adjusted in 5 degree increments by matching one of the six holes on the flat backed mount attached to the pole (see Figure 5-2 *SDMS40 Mounting angles*). Use the second screw to fix the inclination angle by tightening the screw through the SDMS40 part and the bracket. Lastly, completely tighten the common hole screw. See Figure 5-2 *Mounting angles* for mounting angle options.

6. Powering Up

The SDMS40 requires a 12-15 Vdc power supply capable of providing up to 2 Amps continuously.

Note **To avoid shock or damage to the instrument, never apply power while working on wiring and connections. Never open the sensor when the power is turned on.**

Once mounting and wiring of the SDMS40 are complete, (see Section 5 *Mounting* and Section 7.3 *SDI-12 Wiring* or Section 8.3 *RS-232 Wiring*), apply power to the SDMS40.

7. SDI-12 Output

Note The SDI-12 output option is only available if the sensor was ordered with this configuration. A sticker on the sensor will indicate which output option the sensor is configured with.

7.1 SDI-12 Quick Start

Use Table 7-1 *Set up wiring for SDI-12* when setting up an SDMS40 to communicate to a Campbell Scientific datalogger via SDI-12.

TABLE 7-1. Set up wiring for SDI-12

Step	Procedure
1	Connect the Black cable wire from the sensor to 12-15 Vdc, 2 Amp power supply's ground.
2	Connect the Red cable wire from the sensor to 12-15 Vdc, 2 Amp power supply.
3	Connect the Green wire to the SDI-12 channel of the datalogger.
4	Connect the Brown wire to the SDI-12 ground. **Note:** Leave any unused wires disconnected and isolate them individually with electric tape.
5	Apply power to your sensor.
6	Send sample SDI-12 datalogger program.
7	Set *Calibrate Now* flag to *True* to initiate automatic calibration (will begin with 1 minute). The sensor will begin measuring and storing values each minute.
For a full list of SDI-12 commands, see Section 7.2.1 *SDI-12 Command List.*	

7.2 SDI-12 Operation

The SDMS40 measures the current snow depth at user-programmable intervals (minutes) and transmits data on its SDI-12 data lines to an external device, such as a datalogger. By default, the sensor is in polling mode, where measurements are triggered by request from a datalogger.

7.2.1 SDI-12 Command List

The SDMS40 supports many of the SDI-12 features and specifications. Table 7-2 *SDI-12 Command List* is a list of current SDI-12 commands and responses to commands, where 'a' is the address of the sensor.

TABLE 7-2. SDI-12 Command List

Commands	Responses	Remarks
a!	a⏎	Acknowledge active.
al!	"system info" ⏎	SDI012 version, manufacturer, model, firmware version (e.g. 013wtherpiaSDMS40v6.111-24-2016).
aV	"test result" ⏎	System verification details.
aAB!	B⏎	Change address.
A?!	a⏎	Query sensor address.
aM!	0501⏎	Start measurement. Average depth value will be provided by "aD0!" following a service request.
aC1!	05041⏎	Start concurrent measurement. Average depth and individual depth data at each sample point will be provided by "aD0!" through "aD8!".
aD0!	depth⏎	Average depth.
aD1! thru aD8!	36 individual sample data	Grouped in 8 packets.
aR0!	+depth⏎	Similar to aD0 for continuous measurement mode.
aXA!	0601	Preform automatic calibration to determine installation angle and height.
aXTxx! Where xx is the desired threshold	xx⏎	Set the heater threshold value (default is 0°C). The heater will turn on when the internal temperature drops below this value and will remain on until the temperature climbs above the threshold. The allowed values range from -40°C to 10°C.
aXHxx! Where xx is the height in mm	xx⏎	Manually set the current sensor height in mm. This option would only be used if the automatic calibration fails due to problems in the target area.

aXGxx!	0501	Reset the sensor ground level. This command would be used with the offset if there is existing snow on the ground when the sensor is installed.
* "a" refers to the address of the sensor.		

7.3 SDI-12 Wiring

The cable/connector assembly provides the SDI-12 connections outlined below:

- 12-15 Vdc, 2 Amp power supply
- SDI-12 interface for external loggers

Align markers on the male and female connectors to plug in and fasten the cable to the sensor.

Tables 7-3 *Power Wiring* and 7-4 *SDI-12 Wiring* outline connecting cable wire assignments. Use proper tools to connect the wires to the datalogger and other devices.

TABLE 7-3. Power Wiring

Color	Function	Connection
Red	Power	12 V
Black	Power Ground	G

TABLE 7-4. SDI-12 Wiring

Color	Function	Connection
Green	SDI-12 Signal	C1/C3/…
Brown	Signal Ground	G

Note Leave any unused wires disconnected and isolate them individually with electrical tape.

7.4 SDI-12 Sample CRBasic Program

Use this sample program when setting up the sensor to communicate with a datalogger via SDI-12.

CRBasic Example 7-1. SDI-12

```
'*******************************************************************************
'SDMS40 SDI-12 Sample Program (CR6)
'*******************************************************************************

SequentialMode


'*******************************************************************************
'  Wiring Guide
'*******************************************************************************

'SDI12 Communication
'  Sensor 1
'    Green (SDI12 Signal) = C1
'    Red   (Power)        = 12V
'    Black and Brown (GND)= G

'*******************************************************************************
'  Constants
'*******************************************************************************
Const SDMS40_Interval = 1 'in minutes
Const SDI12_PORT1 = 1 ' C1 is the Communications port used for connection to SDMS40


'*******************************************************************************
'  Diagnostic variables
'*******************************************************************************
Public PTemp, batt_volt
Units PTemp = deg C
Units batt_volt = volts







'*******************************************************************************
'  Sensor Variables
'*******************************************************************************
Public SDI_Snow_Depth_Avg_1 As Float
Units SDI_Snow_Depth_Avg_1 = mm
Dim SDI_Calibrate_Return
Public Calibrate_Flag As Boolean


'*******************************************************************************
'  Diagnostic Data Table
'*******************************************************************************
'Daily diagnostic data table for troubleshooting purposes
DataTable (Diagnostic,True,-1)
  DataInterval (0,1,day,10)
  Sample (1,status.OSversion,String)
  Sample (1,status.ProgName,String)
  Sample (1,status.LithiumBattery,FP2)
  Sample (1,status.PakBusAddress,UINT2)
  Sample (1,status.Low12VCount,UINT2)
  Maximum (1,status.Battery,FP2,False,False)
  Minimum (1,status.Battery,FP2,False,False)
  Sample (1,status.CompileResults,String)
  Maximum (1,status.PanelTemp,FP2,False,False)
  Minimum (1,status.PanelTemp,FP2,False,False)
  Sample (1,status.ProgSignature,UINT4)
  Sample (1,status.StartTime,String)
  Sample (1,status.SkippedScan,UINT2)
  Sample (1,status.SkippedSystemScan,UINT2)
  Sample (1,status.VarOutOfBound,UINT2)
```

```
  Sample (1,status.WatchdogErrors,UINT2)
EndTable

'*******************************************************************************
'  Snow Depth Data Table
'*******************************************************************************
DataTable(SnowDepth,1,-1)
  DataInterval (0,SDMS40_Interval,min,10)
  Sample(1,SDI_Snow_Depth_Avg_1,FP2)
EndTable


'*******************************************************************************
'  Subroutine: CalibrateSensors
'  Description: Sends an auto-calibration command to the SDMS40.
'*******************************************************************************
Sub CalibrateSensors
  SDI12Recorder(SDI_Calibrate_Return,SDI12_PORT1,0,"XA!",1,0,-1,1)
  Delay (1,10,Sec)
EndSub


'*******************************************************************************
'  Main Program
'*******************************************************************************
BeginProg

  Scan (10,Sec,5,0)
    PanelTemp (PTemp,_60Hz)
    Battery (batt_volt)
    CallTable Diagnostic

      'The user's programming for other sensors would go here in the main scan

  NextScan


  SlowSequence
  Scan (1,min,5,0)


    If Calibrate_Flag = true
      Calibrate_Flag = false
      Call CalibrateSensors

    Else
      SDI12Recorder (SDI_Snow_Depth_Avg_1,SDI12_PORT1,0,"M!",1.0,0,-1,1)
    EndIf

    CallTable(SnowDepth)

  NextScan
EndProg
```

8. RS-232 Output

Note The RS-232 output option is only available if the sensor was ordered with this configuration. A sticker on the sensor will indicate which output option the sensor is configured with.

8.1 RS-232 Quick Start

Use Table 8-1 *Setup Wiring for RS-232* when setting up the SDMS40 to communicate to a Campbell Scientific datalogger via RS-232.

TABLE 8-1. Setup Wiring for RS-232

Step	Procedure
1	Connect the Black cable wire from the sensor to a 12-15 Vdc, 2 Amp power supply's ground.
2	Connect the Red cable wire from the sensor to a 12-15 Vdc, 2 Amp power supply.
3	Connect the Blue wire to a datalogger TX (C1).
4	Connect the Yellow wire to a datalogger RX (C2).
5	Connect the Brown wire to ground (G). Note: Leave any unused wires disconnected and isolate them individually with electrical tape.
6	Apply power to your sensor.
7	Send sample RS-232 datalogger program, as seen in Section 8-4 *RS-232 Sample CRBasic Program.*
8	Set *Calibrate Now* to *True* to initiate automatic calibration (will begin with 1 minute). The sensor will begin measuring and storing values each minute.
For a full list of RS-232 commands, see Section 8.2.1 *RS-232 Command List.*	

8.2 RS-232 Operation

The SDMS40 measures the current snow depth at a user-programmable interval (minutes) and transmits data on its RS-232 serial data lines to an external device, such as a datalogger. By default, the sensor is in polling mode, where measurements are triggered by request from a datalogger.

8.2.1 RS-232 Command List

Table 8-2 *RS-232 Command List* is a list of current RS-232 commands in the command mode.

TABLE 8-2. RS-232 Command List

Command Usage	Default Value	Function
@v (x) ⏎	1	Set the verbose level: 0 – none/1 – show information.
@i (x) ⏎	0 (polling mode)	Set measurement interval in minutes. The sensor should be kept in polling mode for use with the sample RS-232 datalogger program. Allowed values: 1, 2, 3, 4, 5, 6, 10, 20, 30, and 60.
@h (x)⏎	2000 mm	Manually set the current gauge height in millimeters. Use this command if automatic calibration fails.
@g (x)⏎ Where (x) is the existing snow depth	n/a	Reset the sensor ground level. This command would be used with the offset if there is existing snow on the ground when the sensor is installed.
@m⏎	n/a	Run a round of measurements immediately.
@s⏎	n/a	SDMS40 status. This shows various system information such as current firmware version and installation angle and height.
@ac⏎	n/a	Perform automatic calibration to determine installation height and angle.
@history⏎	n/a	Show measurement data from the last 24 hours.
@lowtempx⏎ Where x is the desired threshold	0°C	To check the current threshold value, type "@lowtemp" ⏎. To modify the heater threshold value, include the value x. The heater will turn on when the internal temperature drops below this value and will remain on until the temperature climbs above the threshold. Allowed values range from -40°C to 10°C.
@b (x)⏎ Where x is an index for the desired baud rate	3 (9,600bps)	Check or modify the baud rate of the serial port. To check current baud rate, type "@b"⏎. To modify the baud rate, include the desired index seen below. 0: 57600, 1: 38400, 2: 19200, 3: 9600, 4: 4800, 5: 2400, 6: 1200.

8.3 RS-232 Wiring

The cable/connector assembly provides the RS-232 connections outlined below:

- 12-15 Vdc, 2 Amp power supply
- Full duplex RS-232 interface for external loggers

Align markers on the male and female connectors to plug in and fasten the cable to the sensor.

Tables 8-3 *Power Wiring* and 8-4 *RS-232 Wiring* outline connecting cable wire assignments. Use proper tools to connect the wires to the datalogger and other devices.

TABLE 8-3. Power Wiring

Color	Function	Connection
Red	Power	12 V
Black	Power Ground	G

TABLE 8-4. RS-232 Wiring

Color	Function	Connection
Brown	Signal Ground RS-232	G
Blue	RX	C1/C3/…
Yellow	TX	C2/C4/…

Note Leave any unused wires disconnected and isolate them individually with electrical tape.

8.4 RS-232 Sample CRBasic Program

Use this sample program when setting up the sensor to communicate with a datalogger via SDI-12.

CRBasic Example 8-1. RS-232

```
'*******************************************************************************
'SDMS40 RS232 Sample Program (CR1000)
'*******************************************************************************

SequentialMode

'*******************************************************************************
'User entered constants
```

```
'*********************************************************************************

Const SDMS40_Interval = 1 'measurement and data output interval (in minutes)
Const SDMS40_COMport = COM1 'Communications port used for connection to SDMS40
Const SDMS40_baud_rate = 57600

'*********************************************************************************
'Wiring for SDMS40
'*********************************************************************************'
'The sensor measurement takes about 30 seconds and it is done in the program's slow
sequence

'Blue ------------------------> C1 (RS232 RX) -- if using COM1 as your port
'Yellow ----------------------> C2 (RS232 TX) -- if using COM1 as your port
'Brown -----------------------> G (digital ground)
'Red -------------------------> +12V
'Black -----------------------> G (Power Ground)

'*********************************************************************************'
'Diagnostic variables
'*********************************************************************************
Public PTemp, batt_volt
Units PTemp = deg C
Units batt_volt = volts

'*********************************************************************************
'Variables for WeatherPia SDMS40 Scanning Laser Sensor
'*********************************************************************************
Public SDMS40_Measure_Now As Boolean 'the user can set this to TRUE to request a
measurement
Public SDMS40_Calibrate_Now As Boolean 'the user can set this to TRUE to calibrate the
sensor
Public SDMS40_Install_Height
Units SDMS40_Install_Height = mm
ReadOnly SDMS40_Install_Height
Public SDMS40_Install_Angle
Units SDMS40_Install_Angle = degrees
ReadOnly SDMS40_Install_Angle
Public SDMS40_Depth_Avg
Units SDMS40_Depth_Avg = mm
Public SDMS40_Temperature(2)
Units SDMS40_Temperature = deg C
Alias SDMS40_Temperature(1) = SDMS40_Board_Temperature
Alias SDMS40_Temperature(2) = SDMS40_Laser_Temperature
Public SDMS40_Depth_Points(36)
Units SDMS40_Depth_Points() = mm
Public SDMS40_Distance_Points(36)
Units SDMS40_Distance_Points() = mm
Dim SDMS40_string As String * 2000 'string to hold data string received from SDMS40
Dim SDMS40_string_temp As String * 2000
Dim SDMS40_Serial_Check

'*********************************************************************************
'Snow depth data table
'*********************************************************************************
DataTable(SnowDepth,1,-1)
  DataInterval (0,SDMS40_Interval,Min,10)
  Sample(1,SDMS40_Depth_Avg,FP2)
  Sample(2,SDMS40_Temperature(),FP2)
  Sample(36,SDMS40_Depth_Points(),FP2)
  Sample(36,SDMS40_Distance_Points(),FP2)
EndTable

'Main Program
BeginProg

  'Open COM port for SDMS40
  SerialOpen (SDMS40_COMport,SDMS40_baud_rate,0,10,2000)
  SerialFlush (SDMS40_COMport)
```

```
  'Retrieve install angle and height from the sensor
  SerialOut (SDMS40_COMport,"@s" + CHR(13),"",0,0)
  SerialIn (SDMS40_string,SDMS40_COMport,1000,"",2000)
  SplitStr(SDMS40_string_temp,SDMS40_string,"angle:",1,4)
  SplitStr(SDMS40_Install_Angle,SDMS40_string_temp,"",1,0)
  SplitStr(SDMS40_string_temp,SDMS40_string,"Height:",1,4)
  SplitStr(SDMS40_Install_Height,SDMS40_string_temp,"",1,0)

  Scan (10,Sec,5,0)
    PanelTemp (PTemp,_60Hz)
    Battery (batt_volt)

    'The user's programming for other sensors would go here in the main scan

  NextScan

  SlowSequence
  Scan (1,min,5,0)

    If SDMS40_Calibrate_Now = true
      'Calibration process
      SDMS40_Calibrate_Now = false

      SerialFlush (SDMS40_COMport)

      SDMS40_Serial_Check = SerialOut (SDMS40_COMport,"@ac" + CHR(13),"are you
sure?",2,50)

      If SDMS40_Serial_Check = 13 Then
        SDMS40_Serial_Check = SerialOut (SDMS40_COMport,"y" + CHR(13),"confirmed.",2,50)
        SerialIn (SDMS40_string,SDMS40_COMport,1000,"",2000)
        SplitStr(SDMS40_string_temp,SDMS40_string,"Angle:",1,4)
        SplitStr(SDMS40_Install_Angle,SDMS40_string_temp,"",1,0)
        SplitStr(SDMS40_string_temp,SDMS40_string,"Height:",1,4)
        SplitStr(SDMS40_Install_Height,SDMS40_string_temp,"",1,0)
      EndIf

    Else
      If TimeIntoInterval(0,SDMS40_Interval,min)
        SDMS40_Measure_Now = true
      EndIf

      If SDMS40_Measure_Now = true Then
        SDMS40_Measure_Now = false

        SerialFlush (SDMS40_COMport)

        'Send the measurement command
        SDMS40_Serial_Check = SerialOut (SDMS40_COMport,"@m" +
CHR(13),"measurements",2,50)



        'Receive and parse the response from the sensor
        SerialIn (SDMS40_string,SDMS40_COMport,1000,"",2000)
        SplitStr (SDMS40_Depth_Avg,SDMS40_string,"[M]",1,4)
        SplitStr (SDMS40_string_temp,SDMS40_string,"[t]",1,4)
        SplitStr(SDMS40_Temperature(),SDMS40_string_temp,"",2,0)
        SplitStr(SDMS40_string_temp,SDMS40_string,"[P]",1,4)
        SplitStr(SDMS40_Depth_Points(),SDMS40_string_temp,"",36,0)
        SplitStr(SDMS40_string_temp,SDMS40_string,"[R]",1,4)
        SplitStr(SDMS40_Distance_Points(),SDMS40_string_temp,"",36,0)
      EndIf
    EndIf


    CallTable SnowDepth
```

```
  NextScan
EndProg
```

9. Maintenance

Regular cleaning and inspection is required; this includes:

- Checking to make sure the target area is free from any obstacles or foreign material.
- Removing any dust or foreign deposits from the window of the SDMS40. Clean the window glass with soft cleaning fabric or tissues, water, and soft cleaning detergents.
- Inspect the bracket and other mounting clamps for loosened screws or clamps.

10. Calibration

Once the SDMS40 is fully installed, calibrate it for proper operation. Calibration sets the height and angle of the sensor to ensure accurate measurements. This occurs automatically (Section 10.1 *Automatic Calibration)* or manually (Section 10.2 *Manual Calibration).*

10.1 Automatic Calibration

SDMS40 supports a fully automatic calibration process, which automatically calculates the height and inclination angle of the SDMS40. If the sensor is moved, it requires recalibration. This is done by issuing a calibration request command (SDI-12 “aXA!” or RS-232 “@a”). When using the RS-232 command, the sensor will ask to confirm the request. Enter *y* to proceed.

10.2 Manual Calibration

Manual calibration is only required if automatic calibration fails. After installation, enter the height of the sensor and run a ground level resetting procedure.

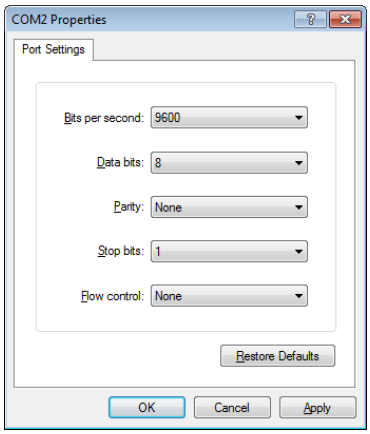
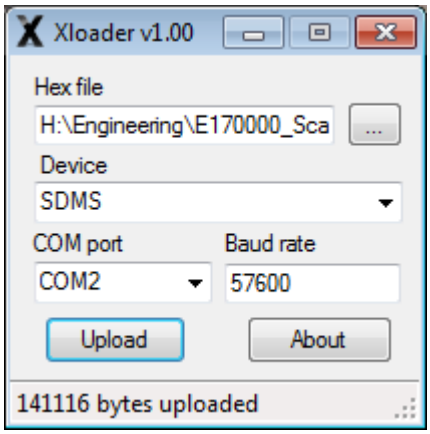
Entering the height can be done by sending the appropriate command (SDI-12 “aXHxxxx!” or RS-232 “@h xxxx”, where xxxx is the sensor height). When using the RS-232 command, the sensor will ask to confirm the height. Enter *y* to proceed.

After entering the sensor height, initiate a ground level reset (SDI-12 “aXG!” or RS-232 “@g”). When using the RS-232 command, the sensor will ask to confirm the request. Enter *y* to proceed.

11. Updating Firmware

To update the sensor firmware, download the firmware available from: http://www.campbellsci.ca/sdms40.

TABLE 11-1. Updating Firmware Procedure

Step	Procedure
1	Wire the SDMS40 sensor to the DB9 female terminal block (see Table XXX).
2	Connect the DB9 female to your computer's RS-232 port using a standard serial cable or to a USB port using a serial-to-USB adapter.
3	Apply power to the sensor.
4	Open a connection to the sensor using Terminal Emulator software (e.g. HyperTerminal), using the following communication options. Ensure the correct COM port is selected. 
5	Change the sensor baud rate to 57,600 by sending the command "@b0" through the Terminal software.
6	Extract the firmware .zip file downloaded from the website.
7	Run the Xloader.exe program from the folder. 
8	Browse the files on the PC using the "…" button. Select the *.cpp.hex firmware file from the folder.
9	From the *Device* dropdown, select *SDMS.*
10	From the *COM Port* dropdown, select the COM port connecting the sensor to your computer.
11	Click *Upload.* The message *Uploading …* will appear at the bottom of Xloader.

The firmware update may take a few minutes. Upon successful completion, an *XXXXXX bytes uploaded* message will appear.

TABLE 11-2. Firmware Update Wiring

Color	Function	Connection
White*	Firmware reset	Pin 4
Blue	RX	Pin 3
Yellow	TX	Pin 2
Brown	Ground	Pin 5
*Only use when resetting the firmware.		

TABLE 11-3. Power Wiring

Color	Function	Connection
Red	Power	12 V
Black	Power Ground	G

Note Leave any unused wires disconnected and isolate them individually with electrical tape.

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