



Mountain Measure

Mountain Measure SAMS-B1
Ski Area Base Meteorological Station

User's Guide
Rafal Piersiak

The Mountain Measure SAMS-B1 Ski Area Base Meteorological Station is a three-measurement unit, capable of receiving temperature, humidity, and snow depth for numerous base and remote stations. A simple interface coupled with external measurement modules allows for easy expansion in the future.

Suitable Unit Features

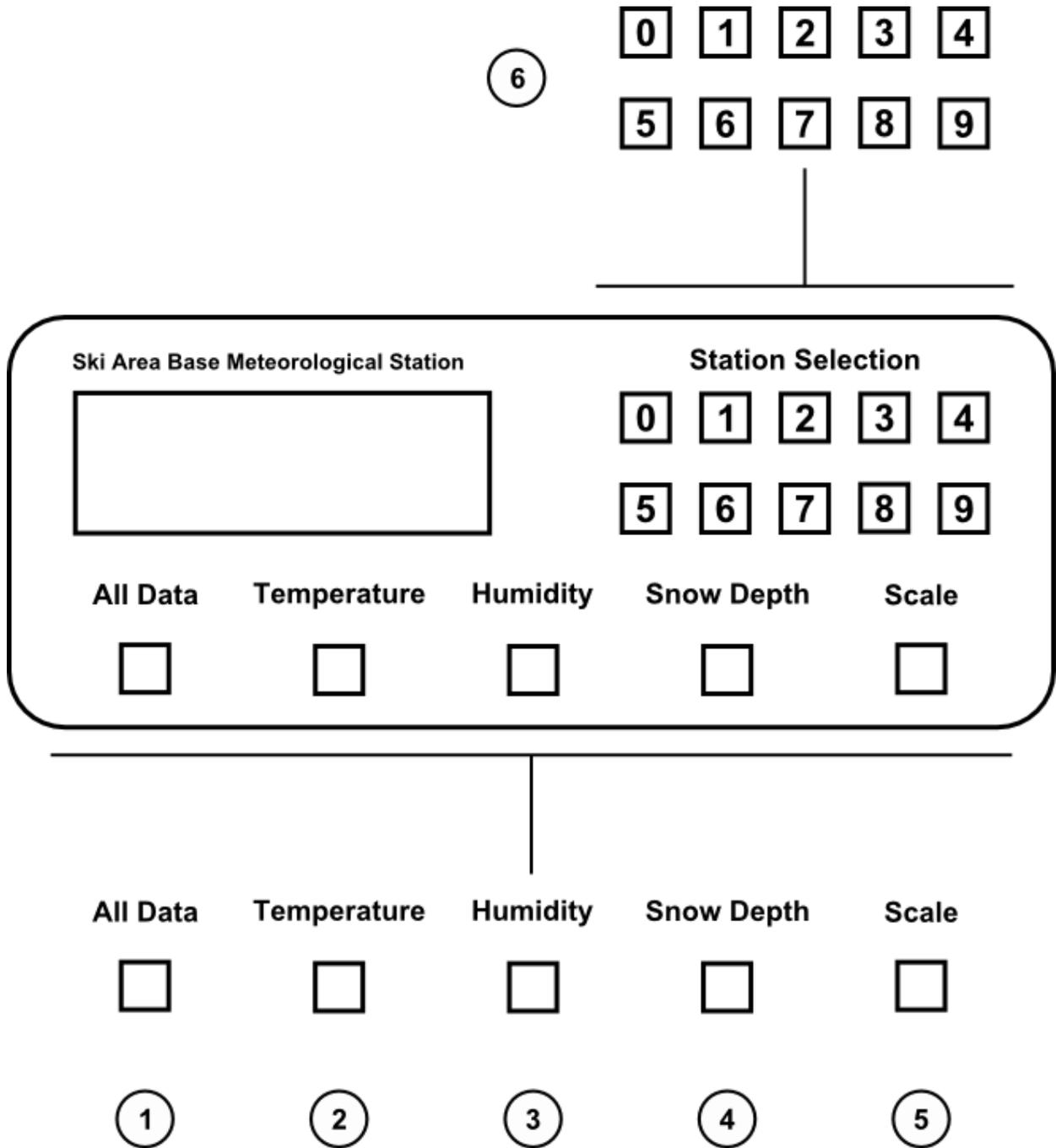
- 3 Line, 16 Character LCD (Liquid Crystal Display) with white backlight
- Temperature, humidity, and snow depth measurements
- Wireless communication with remote stations

System Features

- Base station: RS-232 serial transmission
- Remote station: ZigBee wireless transmission
- 10 snow depth readings per second
- 1 temperature/humidity reading per second
- Display Metric and US customary units

Mountain Measure SAMS-B1 Ski Area Base Meteorological Station

Front Panel Overview

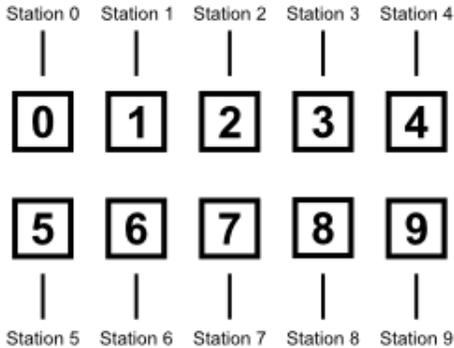


Key Legend

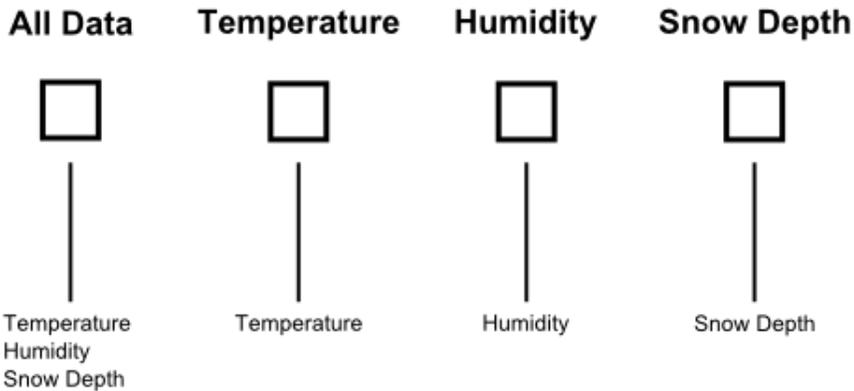
- | | | | |
|---|------------------------------|---|------------------------------|
| 1 | Display all measurements key | 4 | Display snow depth key |
| 2 | Display temperature key | 5 | Toggle measurement scale key |
| 3 | Display humidity key | 6 | Select station number key |

Front Panel Commands

To select a station, press:



To display measurement, press:

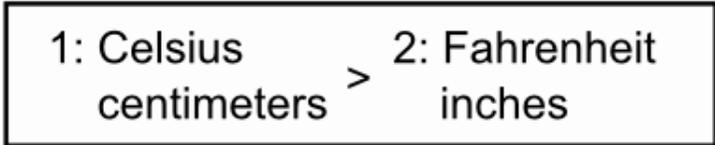


To toggle scale, press:

Scale



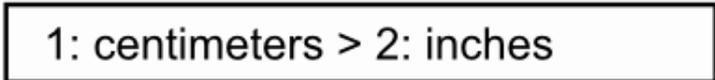
If All Data is selected:



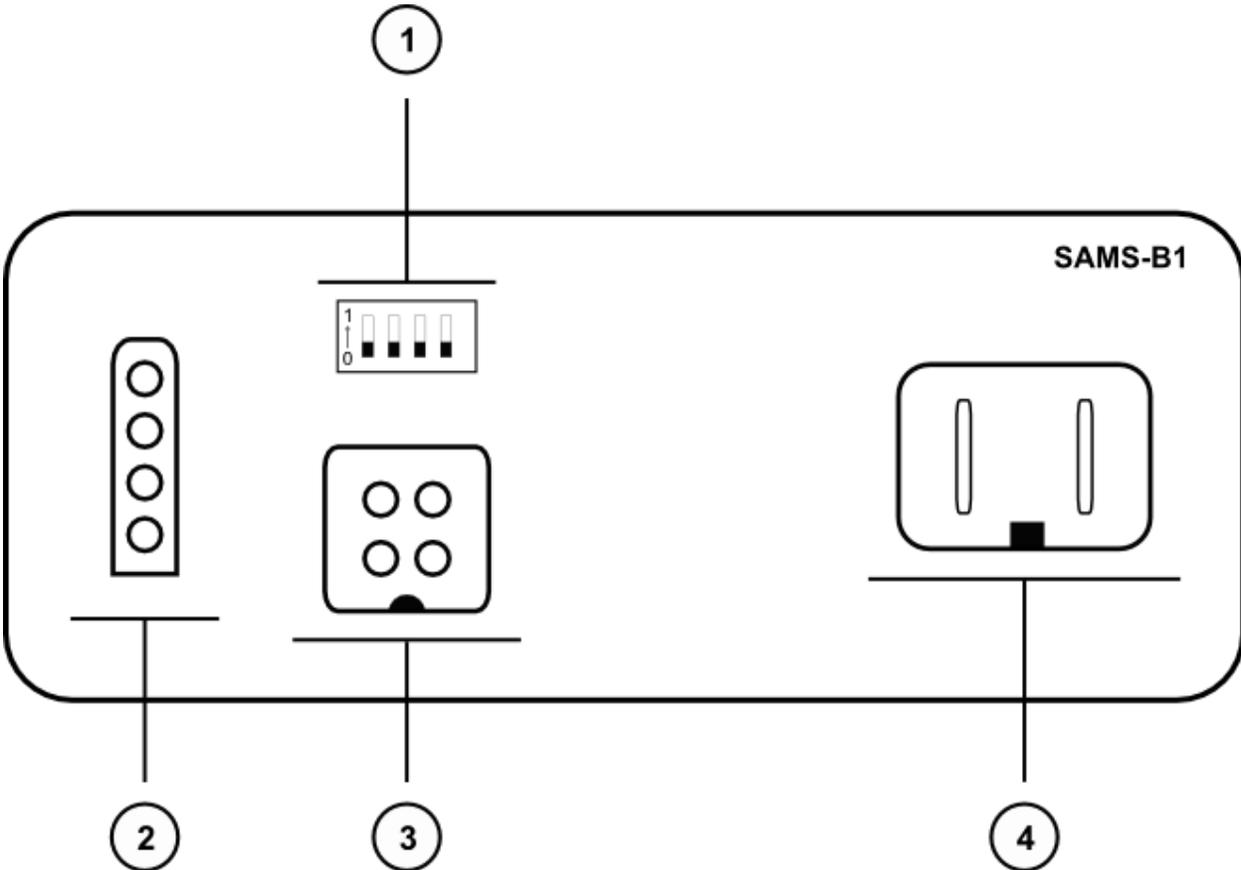
If Temperature is selected:



If Snow Depth is selected:



Rear Panel Overview



Key Legend

- 1 Station Address DIP Switch
- 2 Sonar Module Connector
- 3 Temperature/Humidity Module Connector
- 4 AC Power Connector

In this Manual

Quick Start Chapter 1 provides installation instructions and helps the user become acquainted with the station.

Front Panel Key Operation Chapter 2 reveals the format of the LCD display, provides an operational flow diagram, and explains how to perform various measurements.

Remote Station Interface Chapter 3 goes over the commands the base and remote stations use to communicate and transfer data for processing and displaying.

Troubleshooting Chapter 4 provides systematic instructions for resolving issues, such as incorrect measurements, or no measurements are received at all.

Specifications Chapter 5 contains information on the performance of the system, including measurement resolution and frequency.

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Chapter 1

Quick Start

This guide will help you prepare your base station to make and request measurements from remote location. Simple instructions are given to properly configure the base station and verify its ability to display a measurement on the LCD display.

You will find two sections of keys. The first section contains the station selection keys, which allows the user to select one station to receive measurements from. The second section of keys allows the user to select a variety of measurements, along with various measurements scales for those measurements.

Now that we know the basic layout of the base station, let us begin.

Chapter 1 Quick Start

Prepare Base Station

The following steps will verify that the base station is fully operational.

1 Check contents of box for supplied parts

- Base Station
- Power Cord
- Sonar Module
- Temperature/Humidity Module

2 Connect the sonar and temperature/humidity module

Connect the sonar module and the temperature/humidity module to the proper sockets located on the rear panel. They will only fit in one direction.

3 Connect the base station power cord and turn on power switch

The front panel LCD display should light up and display a message requesting the user to enter a station number and what type of data the user would like to see. The annunciator LED's will turn on for half a second as well. This allows the user to confirm the functionality of the LED's.

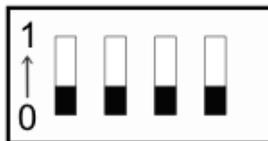
4 Set the address of the base station using the DIP switch

The DIP switch located on the rear panel allows the user to set the address of the base station. The default address for the base station is "0." The following diagram explains how the address is set.

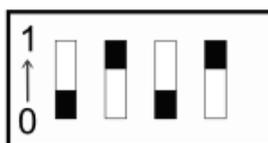
To set address, move all four switches based on the following template

Switches represent a value of 0 or 1. The legend to the left of the switches shows which position is 0 and 1.

The following pattern provides an address of 0



The following pattern provides an address of 5



Address Pattern Template

Move the switches to the 0 or 1 position based on the provided pattern.

An address of zero is represented as 0000.

Address Patterns:

0: 0000	5: 0101
1: 0001	6: 0110
2: 0010	7: 0111
3: 0011	8: 1000
4: 0100	9: 1001

5 Verify functionality of base stations keys and related functions

Pressing station number 0 and a measurement key should reveal 1-3 measurements simultaneously on the LCD display, depending on which measurement key was selected.

Please proceed to the troubleshooting section if no measurements are displayed on the LCD display.

If a remote station is operational:

Pressing a remote station number and a measurement key should reveal 1-3 measurements simultaneously on the LCD display, depending on which measurement key was selected

If Base Station Does Not Turn On

The following steps will help to resolve issues causing the base station to not turn on. Check the troubleshooting for more assistance if necessary.

1 Check power cord connection

Make sure the power switch is turned on. Verify that the power cord is firmly placed into the ac outlet and into the rear panel of the base station. Check for any cuts on the cord, which may inhibit power flow. Check that the ac outlet is receiving power.

2 Check the ac outlet

If the previous steps did not resolve the problem, check the ac outlet for proper load conditions and voltage levels.

Chapter 2

Front Panel Key Operation

You should be familiar with the product, after reviewing the Quick Start. This chapter will focus on the operation of the base station. You will learn about the display formats of the LCD display for the various measurements, the flow of the command sequences, and how to perform every measurement the base station can perform.

Front Panel LCD Display Formats

The following figure will show the user how measurements will be displayed on the LCD display.

Display All Measurements LCD Format

Temp: t^ot^ot^oX
Humidity: hh.h%
Snow: dd.d Y

t = digit of temperature
X = C (Celsius)/F (Fahrenheit)
h = digit of humidity
d = digit of snow depth
Y = cm (centimeters)/in (inches)

Display Temperature LCD Format

4 digits — **Temperature**
t^ot^ot^oX

t = digit of temperature
X = Celsius/Fahrenheit

Display Humidity LCD Format

3 digits — **Humidity**
hh.h%

h = digit of humidity

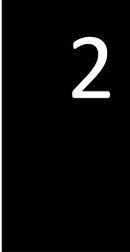
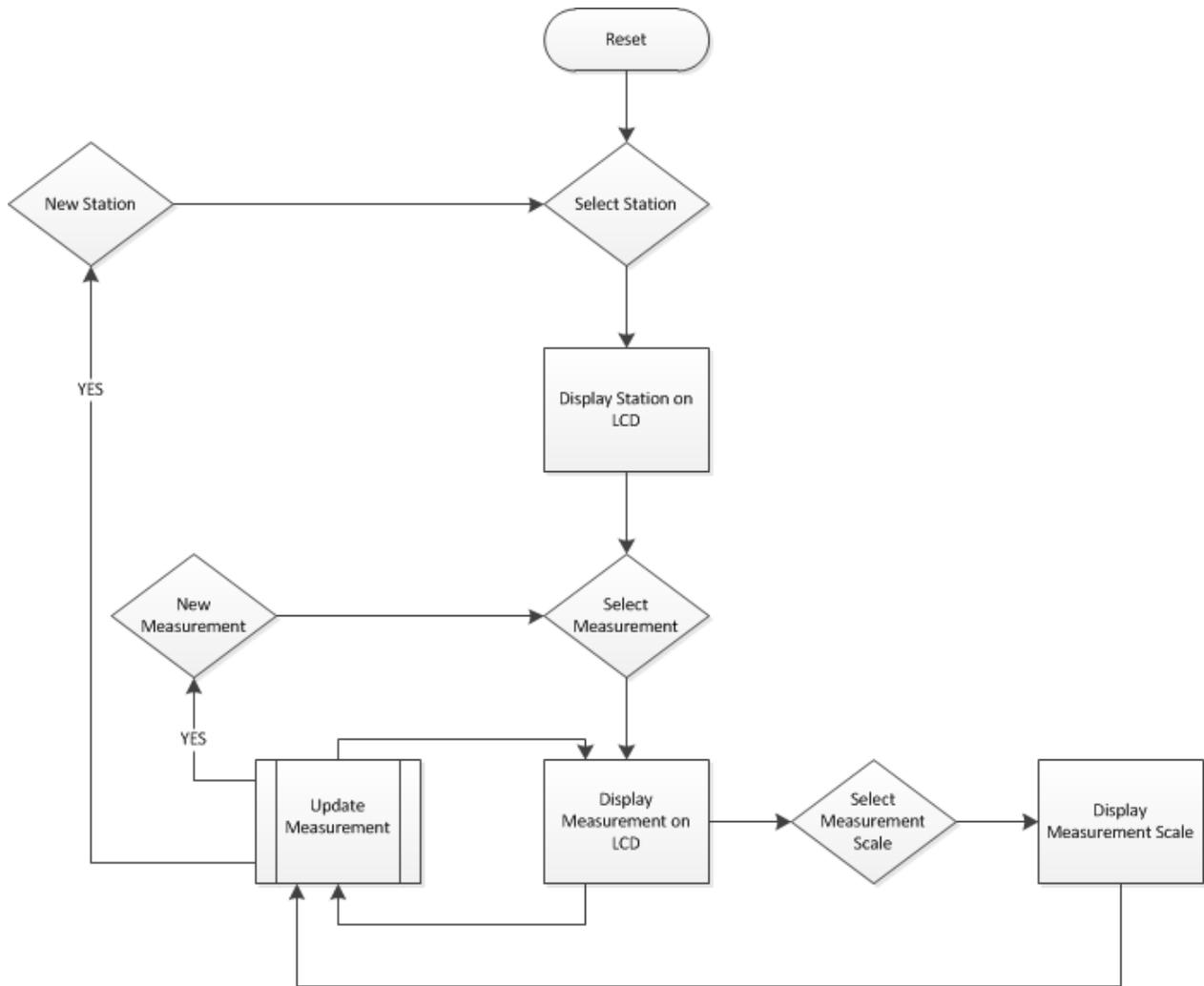
Display Snow Depth LCD Format

3 digits — **Snow Depth**
dd.d Y

d = digit of snow depth
Y = centimeters/inches

Operating Flow Diagram

The following diagram explains the typical operation of the base station.



Using The Front Panel Keys To Display Measurements

The following steps will show the user how to receive various measurements using the front panel keys.

The unit must be powered on and functioning properly.

Display Temperature

- 1 Press a **STATION NUMBER** key
- 2 Press the **TEMPERATURE** key

The LCD display should display the temperature in Fahrenheit or Celsius.

To change the temperature scale:

While a temperature is displayed, press the **SCALE** key. The LCD display will display the temperature in Fahrenheit or Celsius. Pressing the **SCALE** key again will cycle between displaying the temperature in Fahrenheit or Celsius.

To read a different measurement for the selected station:

Press any other measurement key to display other measurements on the LCD display for the previously selected station.

Display Humidity

- 1 Press a **STATION NUMBER** key
- 2 Press the **HUMIDITY** key

The LCD display should display the Humidity in percent. The **SCALE** key has no operation for humidity.

To read a different measurement for the selected station:

Press any other measurement key to display other measurements on the LCD display for the previously selected station.

Display Snow Depth

- 1 Press a **STATION NUMBER** key
- 2 Press the **SNOW DEPTH** key

The LCD display should display the snow depth in inches or centimeters.

To change the snow depth scale:

While a snow depth is displayed, press the **SCALE** key. The LCD display will display the snow depth in inches or centimeters. Pressing the **SCALE** key again will cycle between displaying the snow depth in inches or centimeters.

To read a different measurement for the selected station:

Press any other measurement key to display other measurements on the LCD display for the previously selected station.

Display All Measurements

- 3 Press a **STATION NUMBER** key
- 4 Press the **ALL DATA** key

The LCD display should display the:

- Temperature in Fahrenheit or Celsius
- Humidity in percent
- Snow depth in inches or centimeters

To change the measurement scale of the temperature and snow depth:

While all the measurements are displayed, press the **SCALE** key. The LCD display will display all the measurements in Fahrenheit/inches or Celsius/centimeters. Pressing the **SCALE** key again will cycle between displaying all the measurements in Fahrenheit/inches or Celsius/centimeters.

Note: The user cannot display the following measurement scale combinations: Fahrenheit/centimeters or Celsius/inches.

Chapter 3

Remote Station Interface

The base station can request measurements from remote stations using wireless technology. The following commands explain how the base station and remote station communicate. The commands are sent using the RS232 serial protocol. You will also be given the opportunity to see the resolution of the remote stations data.

Remote Station Commands

The following commands provide an overview of how the base station communicates with the remote station to receive various measurements.

Remote Station Receive Command

When the user performs the following key presses, the base station translated these key presses to the following command found in the box. This command is transmitted wirelessly to the corresponding remote station. The remote station will parse this command and send back the requested measurements.

- 1 Press a **STATION NUMBER** key
- 2 Press a measurement key

Ux M<CR><LF>

U	=	Remote Station Prefix
x	=	Address from DIP switch (1-9)
M	=	Selects which measurement is returned to the base station
<CR>	=	Enter (Carriage Return)
<LF>	=	Ctrl + Enter key (Line Feed)

Note: M can be the following values:

A	=	Return all measurements
T	=	Return temperature
H	=	Return humidity
D	=	Return snow depth

The remote station will send the most recent measurements.

Remote Station Transmit Command

The base station will receive this command after it has requested data. If only one measurement was requested, the base station will ignore the other two measurements during parsing of the command.

All measurements are sent in the default measurement scales:

Temperature is sent in: Celsius
Humidity is sent in: percent
Snow Depth is sent in: centimeters

The base station does the conversion to Fahrenheit and inches.

Ux Tttt.t Hhh Ddd.d <CR><LF>

U	=	Remote Station Prefix
x	=	Address from DIP switch on remote station (1-9)
T	=	Specifies temperature
t	=	Digit of the temperature (4 digits)
H	=	Specifies humidity
h	=	Digit of the humidity (3 digits)
D	=	Specifies snow depth
d	=	Digit of the snow depth (3 digits)
<CR>	=	Enter (Carriage Return)
<LF>	=	Ctrl + Enter key (Line Feed)

The base station will continually request for new measurements and update them on the LCD display.

Chapter 4

Troubleshooting

There may be times when the base station is not functioning properly, due to improper setup, damage, or interference. This troubleshooting guide provides systematic instructions for resolving several common issues with power-up, measurement transmission, and measurement inaccuracies.

If you are having trouble with turning the base station on, please visit the Quick Start section, Chapter 1.

If no measurements are received

The following steps will help to resolve issues causing the base station to not receive measurements.

1 Check sonar and temperature/humidity connections

Verify that the wires leading from the sonar and temperature/humidity modules are intact. Ensure the modules are seated correctly in their respective sockets on the rear panel.

2 Check if power is applied to the system

A quick way to verify if power is applied is to check if the LCD backlight is on and the LCD is displaying text during power-up.

3 Verify the base station address is zero

Verify the address of the DIP switch found on the base station is zero. To learn how to set the address, visit **Chapter 1 Quick Start**.

4 Verify the remote station address is correct

Verify the address of the DIP switch found on the remote station is in the range (1-9). Values greater than 9 will not be read correctly. Zero is reserved for the base station and should not be used as an address on a remote station. To learn how to set the address, visit **Chapter 1 Quick Start**.

5 Perform the proper key press sequence for requesting measurements

- I. Press a **STATION NUMBER** key
- II. Press a measurement key

The LCD display should display a measurement.

If base station measurements seem incorrect

The following steps will help to resolve issues causing the base station to receive incorrect measurements.

1 Verify the sonar and temperature/humidity module is not directly subjected to interference.

Temperature/Humidity Module

- Do not place this module near heat sources.
- Keep away from snow making equipment, which may artificially raise the humidity during snowmaking

Sonar Module

- The sensor should be pointed at a relatively flat surface.
- The surrounded perimeter should be free from debris, which may modify the signal.
- Do not place the sensor near walls. Distance measurements will be incorrect.

2 Cycle power to the base station

Unpress the power switch and wait a few second. Turn on the base station.

3 Perform a measurement key sequence

- I. Press a **STATION NUMBER** key
- II. Press a measurement key

Verify that the measurements are within the expected range.

If remote station measurements seem incorrect

The following steps will help to resolve issues causing the base station to receive incorrect measurements.

1 Verify the sonar and temperature/humidity module is not directly subjected to interference.

Temperature/Humidity Module

- Do not place this module near heat sources.
- Keep away from snow making equipment, which may artificially raise the humidity during snowmaking

Sonar Module

- The sensor should be pointed at a relatively flat surface.
- The surrounded perimeter should be free from debris, which may modify the signal.
- Do not place the sensor near walls. Distance measurements will be incorrect.

2 Cycle power to the remote station

Unpress the power switch and wait a few second. Turn on the remote station.

3 Perform a measurement key sequence

- III. Press a **STATION NUMBER** key on the base station
- IV. Press a measurement key on the base station

Verify that the measurements are within the expected range.

Chapter 5

Specifications

Hopefully, you have not experienced issues with preparing and utilizing the base station. This last section provides some performance details about the unit. You will find that this system transmits data at a very low data rate, due to the relatively low refresh rate of the sensors. Considering that we are dealing with weather, performance will not be affected due to slow measurement refresh rates.

Measurement Resolution

The following section will reveal the resolution of the various measurements the base station can make and the remote station can transmit.

Temperature Resolution

Minimum Measurement: -50.0°C

Maximum Measurement: +150.0°C

Humidity Resolution

Minimum Measurement: 0%

Maximum Measurement: 100%

Snow Depth Resolution

Minimum Measurement: 20.0cm

Maximum Measurement: 99.9cm

Note: Minimum measurement is 20cm due to constraint imposed by sonar sensor. It can assess distances starting at 20cm. Anything smaller will be registered as 20cm.

Measurement Frequency

The following section will reveal the frequency of the various measurements the base and remote station will process in one second.

Sonar Sensor

Maximum Frequency of Measurements: 10 Readings/Second

Although the base station will request many more measurements in one second, the remote station will only be able to provide 10 measurements per second.

Temperature/Humidity Sensor

Maximum Frequency of Measurements: 1 Reading/Second

Although the base station will request many more measurements in one second, the remote station will only be able to provide 1 measurement per second.