CR10X Data Collection Program
Version 731.9
August 27, 2008

Station Type	Update Rate	Sensor Groups	Sensor Fields
Chena Snow Course	5 minutes	2	13

Revision History

CR10X data collection program version 731.9 is a MicroMet **multiple group** telemetry snow course data collection system, which requires MicroMet version 2.03 or greater.

731.9 was based on 731.2, without soil probes and storage precipitation. A snow pack temperature sensor was added, and midnight values of snow water and tipping bucket precipitation are now telemetered.

This program has a normal sensor update rate of 5 minutes, and produces one hourly data report via MicroMet as well as one hourly summary report to final logging storage.

This program requires MicroMet MBTU10X revision 2.03 or greater.

This program will produce 12 hourly telemetry reports per day. In addition, the MicroMet data modem will produce at least 1 Remote Status Report each day.

This program has several special features which will allow it to be used in multiple data sites without revision. These features, however, require some attention and manipulation by the installation and service technicians.

- SnowWater sensors are selectable by setting a pair of input location variables when setting up the site. See **Setting Snow Water Parameters**.
- An offset may be applied to the snow depth sensor to convert the height reported by the sensor to a snow depth value.
- A numeric value may be entered which will serve as a site identifier. This will help to ensure that data records are never transposed among the various sites.
- Update rate may be temporarily increased to one every ten seconds to facilitate testing and verification of data sensors.

Site and sensor variables are initialized to default values when the program first loaded into the CR10X, and whenever a new program (DLD file) is sent to the CR10X. The technician should always verify that the variables are acceptable before leaving the site.

All variables are simply CR10X Input locations, which may be modified by right clicking, then editing each variable on the NUMERIC DISPLAY of PC208W or LoggerNet.

Sensor Configuration

This version expects the following sensor configuration:

SENSOR	INPUT	EXITATION	XTROL	SENSOR MODEL
Snow Water	SE3	SW12V		
Air Temperature	SE5	E1		YSI 44211
Snow Temperature	SE6	E2		YSI 44211
Snow Depth	DIFF1	12V	C1	Judd Snow Depth sensor
Solar Radiation	DIFF4			LiCor

CONTROL	FUNCTION
C1	Judd Snow Depth control
C2	SW12V
C7	Tipping Bucket Precipitation
C8	Force a MicroMet data message

Data Reports

Hourly MicroMet report - group 1, priority 1

Sensor	Parameter	Conversion equation
1	12 volt site battery	100 * value
2	Snow Water hourly average	10 * value
3	Midnight Snow Water	10 * value
4	Snow Depth hourly average	10 * value
5	Tipping Bucket Accumulation	100 * value
6	Midnight Tipping Bucket	100 * value
7	Air Temp, current	10 * (value + 90)
8	Air Temp, maximum	10 * (value + 90)
9	Air Temp, minimum	10 * (value + 90)
10	Air Temp, average	10 * (value + 90)
11	Solar Radiation Hourly Average	1 * value
12	Solar Radiation Daily Average	1 * value
13	Snow Pack Temperature	10 * (value + 90)

Daily logging report

Field	Parameter	Units	Comment
1	Storage Area	1	This parameter is not useful to us
2	Year	YYYY	The four digit year
3	Julian Day	JJJ	Julian day of the year
4	Time of day	HHMM	
5	Site ID		A numeric ID assigned by operator to this site
6	Program ID		31.9 for this program version. Omits the leading 7
7	Battery	volts	Midnite sample
8	Snow Water	inches	Midnite sample
9	SnowMult		Snow Water multiplier – default is 0.001 (volts)
10	SnowOff	inches	Snow Water offset – default is 0
11	CurrentAirTemp	deg F	YSI44211 extended range midnite sample
12	MaxAirTemp	deg F	Daily Maximum
13	MinAirTemp	deg F	Daily Minimum
14	AvgAirTemp	deg F	Daily Average
15	SnowHeight	-inches	Midnite sample height of the snow sensor above the ground or snow pack
16	SnowDepth	inches	Midnite sample depth of the snow pack
17	SnowDOff	inches	The offset applied by the operator to snowheight to derive snow depth
18	SolRadHour	w/M2	Hourly Average Solar Radiation
19	SolRadAvg	w/M2	Daily Average Solar Radiation
20	Tipping Bucket	inches	Totalizing Accumulation (0.00” to 40.94”)
21	SnowPackTemp	deg F	Current snow pack temperature

Special Input Locations

Label	Functionality
SiteID	Numeric ID to identify the particular site
ProgID	Numeric ID of this program (31.9)
SnowMult	Snow Transducer multiplier
SnowOff	Snow Transducer offset
SnowDoff	Snow depth offset

Setting Snow Water Parameters

The Snow and Precip transducer sensors may be one of several types. When installing a new sensor, first verify that the sensor you are installing is compatible with the existing wiring scheme in use at the site. A couple of things to consider:

- What is the sensor's output? If the sensor's output is 0-5VDC, then a 2:1 voltage divider should be used. If the sensor's output is 4-20ma, then a termination resistor should be used at the CR10X.
- What is the sensor's excitation requirement? If the sensor requires an excitation voltage other than 12VDC, some voltage conversion method should be used.

When changing a sensor, you must edit two input locations. For snow water, the locations are named SnowMult and SnowOff. For storage precip, the locations are named PrecMult and PrecOff. Edit the locations according to this table:

Sensor	Mult	Offset	Comment
0-50" Sensotech or Halpern	0.02	0.0	
0-100" Sensotech or Halpern	0.04	0.0	
0-200" Sensotech or Halpern	0.08	0.0	
100" Druck PMP 317 used with 2:1 divider	0.04	-1.0	Range is 0-100'
100" Druck PMP 317 used w/o 2:1 divider	0.02	-1.0	Range is 0-50"
200" Druck PMP 317 used with 2:1 divider	0.08	-2.0	Range is 0-200"
200" Druck PMP 317 used w/o 2:1 divider	0.04	-2.0	Range is 0-100"
0-69" Druck	0.0308	-7.7	

Note: The Druck PMP317 transducers are calibrated by NWCC personnel. The table above assumes 0" equals 50 millivolts, and full scale equals 5050 millivolts. If this is not the case for your transducer, you may have to calculate the multiplier and offset. Use the following general formulae:

Mult = fs / 5000

Where fs is full scale value in inches ie: 100", 200"

Offset = 50 * mult

If these variables are set correctly, the Numeric Display tab should display the actual head on the transducers at the following Input Storage Locations:

SnowWater for the snow water sensor

Note: If either the snow sensor is not used, set its multiplier and offset to 0.0. This will force the CR10X to record zero values for the non-existent sensor.

Setting the Site ID Variable

This program saves an Input Storage Location variable called **SiteID** in the data summaries to help eliminate the possibility of confusing data records among the various data sites. To adjust the SiteID, simply **right click** then edit the location on the Numeric Display. The new SiteID will then be included in all subsequent data summaries.

Setting the Snow Depth Offset Variable

The Judd snow depth sensor actually reports the distance between itself and the ground or the top surface of the snow pack. This program allows the technician to apply an offset which will convert the distance reported to actual snow depth. The snow distance (Sn_height) is made negative, then the offset (SnowDOff) is added to derive the actual snow depth. To adjust the snow depth offset simply **right click**, then edit the Input Storage Location variable named **SnowDOff**. If the snow depth sensor is sitting above bare ground, the value of SnowDOff should be set to the distance (Sn_height) reported by the sensor. **Caution**: The technician should record the height of the snow depth sensor above bare ground in case the CR10X program needs to be reloaded during the snow season.

Increasing the Sensor Update Rate

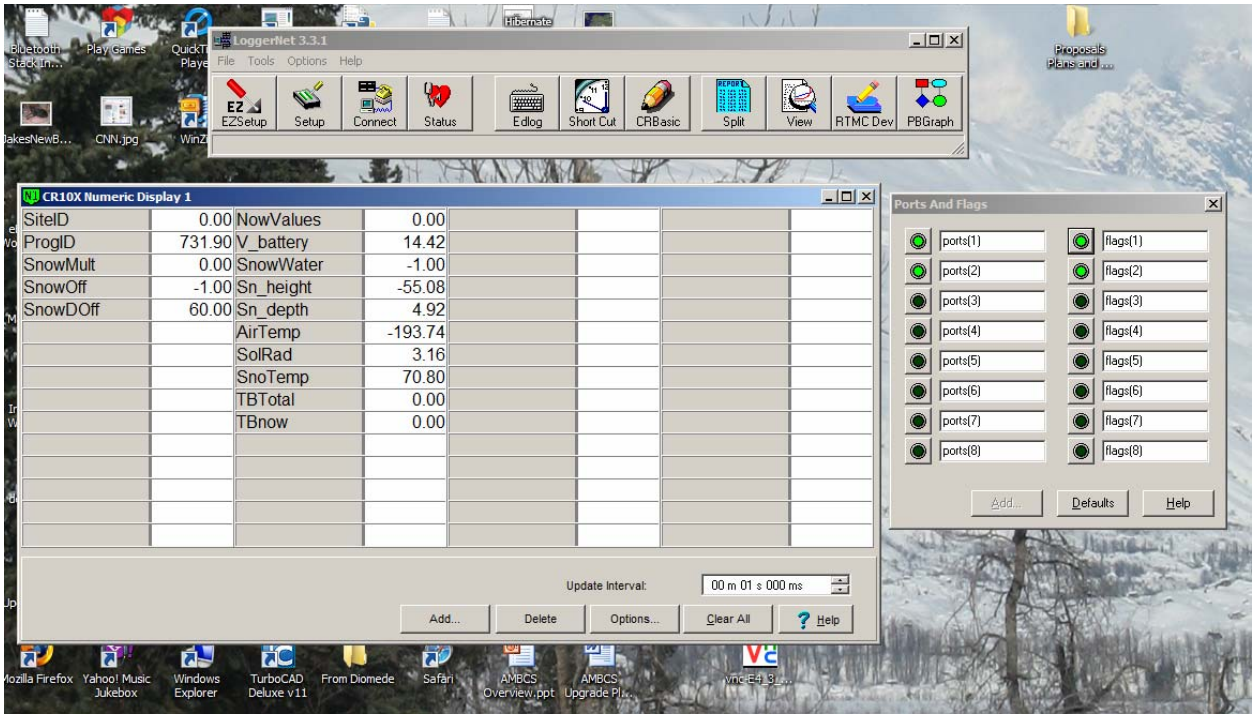
The normal sensor update rate for this program is one update every five minutes. This update rate is good for the site's power budget, but is cumbersome when testing sensor operation. The sensor update rate may be temporarily increased by the technician to a rate of one update every ten seconds. There is no hazard in increasing the update rate, as it will automatically reset to the normal rate at the end of the hour. To increase the update rate, click the **Ports/Flags button** on the Numeric Display tab, then click the **Flag#1 button** on the Ports/Flags window.

Sensor Sanity Check

The following Input Storage Location variables represent what should be reasonable sensor values. The technician should verify that these sensor values make sense before departing the site.

V_battery	The site's 12V battery supply
SnowWater	The final product of the snow water sensor and its multiplier (SnowMult)
Sn_height	The distance from the snow depth sensor to ground or snow pack.
Sn_Depth	The final product – should be actual snow depth.
AirTemp	The current air temperature
SolRad	The current Solar radiation value.
SnoTemp	The current Snow pack temperature
TBTotal	The tipping bucket precipitation accumulation in inches
TBnow	The tips captured in the most recent sensor update

Important: If these or other Input Storage Location variables are not displayed on the Numeric Display tab, they may be added to the Numeric display by clicking the **Add** button, then dragging them from the **Inloc List** window to the Numeric Display.



Utilizing Special Operator Features

Rapid Sensor Update Feature

This program normally reads its sensors once every five minutes. When installing new sensors, or troubleshooting sensor related problems, it is advantageous to have the program read the sensors more frequently. From within PC208, the technician may temporarily increase the sensor update rate to once very ten seconds. This is accomplished by opening the **PORTS/FLAGS** window, then clicking the button named **F1.** While **F1** is set (darkened), the program will complete a sensor update once every ten seconds. There is no power budget risk in enabling this feature, as the update rate returns five minutes at the end of the hour or when a data message is generated by the CR10X.

Forcing a Data Message

This program normally generates one data message at the end of each hour. This data message is sent to the ***MicroMet*** data modem. Usually it is highly inconvenient to wait for the end of the hour when one wishes to observe a data message being delivered to the ***MicroMet*** data modem. By temporarily connecting **5V** to **C8** on the CR10X wiring panel, the technician can force the CR10X to immediately send a data message to the ***MicroMet*** data modem.

Use the following procedure to force a new data message, and observe it at the ***MicroMet*** operator's console.

1. After completing sensor validation with PC208, exit PC208.
2. Disconnect the PC from the CR10X and connect the PC to the ***MicroMet*** operator's console port.
3. Connect the data cable between the CR10X and the ***MicroMet*** data modem.
4. Open the communications program with which you normally communicate with the ***MicroMet*** data modem.
5. Command the ***MicroMet*** to show level five advisories (verbose 5).
6. On the CR10X Wiring Panel, connect a jumper wire between **5V** and **C8**. This will initiate a new data message from the CR10X within 10 seconds.

7. Observe the data message advisory on the ***MicroMet*** console. The message format should be correct, and the number of sensors should be correct for the application.
8. Disconnect the temporary jumper from between **5V** and **C8** on the CR10X Wiring Panel.

If it is desired to generate a second data message, the jumper must be disconnected for at least ten seconds, the reconnected. The CR10X will generate on one data message per jumper connection. If you forget to remove the jumper, the program will continue to operate normally.