

E.5.1 Sample Program – Basic Wind Site

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;(CR10X)                               ;Data logger type (CR10X)
;Station Information
;   Name
;   Number or ID
;   Elevation
;   History
;
;Program History
;   Date of implementation
;   Dates of revisions
;-----Begin Wiring Diagram
;Sensor #1: CS500 Relative Humidity and Temperature Probe
;CS500 Black = 1H
;CS500 Brown = 1L
;CS500 Red = 12V
;CS500 Green = G
;CS500 Clear = G
;
;Sensor #2: 05103 Wind Monitor
;05103 SHIELD Clear = G
;05103 WSREF Black = G
;05103 WDREF Brown = AG
;05103 WDSIG Red = 2H
;05103 WDEXC Green = E1
;05103 WSSIG White = P1
;-----End Wiring Diagram
;-----Begin Program
*Table 1 Program
01: 5 Execution Interval (seconds)      ;Measurements are taken every 5 sec

1: Batt Voltage (P10)
1: 1   Loc [ Battery ]                  ;Sample Battery Voltage

2: Internal Temperature (P17)           ;Sample the internal temperature
1: 8   Loc [ IntTemp ]                  ;Note: This is recorded for diagnostic purposes and is
                                         ;not used in the program or output to the data file.

3: Volts (SE) (P1)                      ;Sample air temperature in degrees C.
1: 1   Reps
2: 25  2500 mV 60 Hz Rejection Range
3: 1   SE Channel
4: 2   Loc [ AIR_TEMP ]                  ;See section F.4.2 for conversion to Fahrenheit.
5: .1  Mult
6: -40 Offset

4: Volts (SE) (P1)                      ;Sample relative humidity in %
1: 1   Reps
2: 25  2500 mV 60 Hz Rejection Range

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3: 2   SE Channel
4: 3   Loc [ RH ]
5: .1  Mult
6: 0.0 Offset

;-----Begin RH Error Check
;
;   Note: automated error checks can mask measurement errors and hinder
;   sensor diagnostics
5: IF (X<=>F) (P89)                      ;Check to see if the relative humidity is
1: 3   X Loc [ RH ]                      ;greater than or equal to 100%. If it is, then perform
2: 3   >=                                 ;command number 6.
3: 100  F
4: 30   Then Do

6: Z=F (P30)                              ;Set the relative humidity to 100%.
1: 100  F
2: 0    Exponent of 10
3: 3    Z Loc [ RH ]

7: End (P95)                              ;End of IF statement.
;-----End of RH Error Check

8: Excite-Delay (SE) (P4)                 ;Sample wind direction in degrees.
1: 1   Reps
2: 5   2500 mV Slow Range
3: 3   SE Channel
4: 1   Excite all reps w/Exchan 1
5: 2   Delay (units 0.01 sec)
6: 2500 mV Excitation
7: 4   Loc [ WIND_DIR_ ]
8: .142 Mult
9: 0   Offset

9: Pulse (P3)                             ;Sample wind speed in meters/second.
1: 1   Reps
2: 1   Pulse Input Channel
3: 21  Low Level AC, Output Hz
4: 5   Loc [ WIND_SPD ]
5: .0980 Mult                             ;For miles/hour use a multiplier of 0.2192. Always
6: 0   Offset                             ;check instrument documentation for multiplier
                                         ;values.

;-----Begin Data Output Section
;-----15 Minute Data
10: If time is (P92)                       ;Write to output file every 15 min.
1: 0   Minutes (Seconds --) into a
2: 15  Interval (same units as above)
3: 10  Set Output Flag High

11: Set Active Storage Area (P80)         ;Place 15 min data in storage area
1: 2   Final Storage Area 2              ;number two.

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2: 100 Array ID
12: Real Time (P7) 1: 1110 Year, Day, Hour/Minute
Time format: 2003,1,0950
Year, Day of year, Hour min
Lines containing 15 min data will
begin with the array ID 100.
13: Sample (P70) 1: 1 Reps
2: 1 Loc [ Battery ]
Output instantaneous battery
voltage.
23: Average (P71) 1: 1 Reps
2: 2 Loc [ AIRTEMP ]
Output hourly average of air temperature.
24: Average (P71) 1: 1 Reps
2: 3 Loc [ RH ]
Output hourly average of relative
humidity.
25: Wind Vector (P69) 1: 1 Reps
2: 0 Samples per Sub-Interval
3: 1 S, 01 Polar
4: 5 Wind Speed/East Loc [ WIND_SPD ]
5: 4 Wind Direction/North Loc [ WIND_DIR_ ]
Output hourly average of wind
speed and vector averaged wind
direction.
15: Average (P71) 1: 1 Reps
2: 3 Loc [ RH ]
Output 15 min average of relative
humidity.
16: Wind Vector (P69) 1: 1 Reps
2: 0 Samples per Sub-Interval
3: 1 S, 01 Polar
4: 5 Wind Speed/East Loc [ WIND_SPD ]
5: 4 Wind Direction/North Loc [ WIND_DIR_ ]
Output 15 min average of wind
speed and vector averaged wind
direction.
17: Maximize (P73) 1: 1 Reps
2: 0 Value Only
3: 5 Loc [ WIND_SPD ]
Output maximum wind speed in
the 15 minute period.
18: Serial Out (P96) 1: 71 SM192/SM716/CSM1
Store data to storage module.
-----Hourly Data
19: If time is (P92) 1: 0 Minutes (Seconds --) into a
2: 60 Interval (same units as above)
3: 10 Set Output Flag High
20: Set Active Storage Area (P80)
1: 1 Final Storage Area 1
21: 101 Array ID
22: Real Time (P77)
Time format: 2003,1,0950
Year, Day of year, hour min
Lines containing 15 min data will
begin with the array ID 100.
13: Sample (P70) 1: 1 Reps
2: 1 Loc [ Battery ]
Output instantaneous battery
voltage.
23: Average (P71) 1: 1 Reps
2: 2 Loc [ AIRTEMP ]
Output hourly average of air temperature.
24: Average (P71) 1: 1 Reps
2: 3 Loc [ RH ]
Output hourly average of relative
humidity.
25: Wind Vector (P69) 1: 1 Reps
2: 0 Samples per Sub-Interval
3: 1 S, 01 Polar
4: 5 Wind Speed/East Loc [ WIND_SPD ]
5: 4 Wind Direction/North Loc [ WIND_DIR_ ]
Output maximum wind speed in
the 1 hour period.
26: Maximize (P73) 1: 1 Reps
2: 0 Value Only
3: 5 Loc [ WIND_SPD ]
Output maximum wind speed in
the 15 minute period.
27: Serial Out (P96) 1: 71 SM192/SM716/CSM1
Store data to storage module.
End Program
Program Output
Final Storage Location 1
101,2003,1,0800,12,42,5,24,68,45,8,34,270,15,93
Final Storage Location 2
101,2003,1,0900,12,40,7,45,60,34,4,72,275,8,30
100,2003,1,0800,12,42,5,69,68,23,8,46,270,14,35
100,2003,1,0815,12,41,5,94,66,57,7,20,272,12,30
19: If time is (P92)
1: 0 Minutes (Seconds --) into a
2: 60 Interval (same units as above)
3: 10 Set Output Flag High
20: Set Active Storage Area (P80)
1: 1 Final Storage Area 1
21: 101 Array ID
22: Real Time (P77)
Time format: 2003,1,0950
Year, Day of year, hour min
Lines containing 15 min data will
begin with the array ID 100.

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E.5.2 Sample Program – Basic Precipitation Site

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;{CR10X}
;Station Information
;   Name
;   Number or ID
;   Elevation
;   History
;
;Program History
;   Date of implementation
;   Dates of revisions
;-----Begin Wiring Diagram

;Sensor #1 Judd Communication Depth Sensor, Interval
;Clear = G
;Black = G
;Red = 12V
;Green = C1
;White = 1H
;Brown = G
;
;Sensor #2 Judd Communication Depth Sensor, Total
;Clear = G
;Black = G
;Red = 12V
;Green = C1
;White = 1L
;Brown = G
;
;Sensor #3: ETI Precipitation Gauge
;Red = 12V
;Black = G
;Green = P2
;
;-----End Wiring Diagram

*Table 1 Program
01: 5   Execution Interval (seconds)      ;Measurements are taken every 5 seconds.

1: Batt Voltage (P10)                    ;Sample battery voltage.
1: 1   Loc [ Battery ]

2: Pulse (P3)                             ;Sample precipitation from ETI gauge.
1: 1   Reps
2: 2   Pulse Input Channel
3: 2   Switch Closure
4: 8   Loc [ PRECIP ]
5: .01 Mult
6: 0   Offset

;-----Begin Depth Sensor Call
;-----Begin Depth Sensor Status Check
3: If time is (P92)                        ;Perform command every 15 minutes.
1: 0   Minutes (Seconds --) into a
2: 15   Interval (same units as above)
3: 30   Then Do

4: If Flag/Port (P91)                      ;If the depth sensor is on, turn it off.
1: 11   Do if Flag 1 is High
2: 21   Set Flag 1 Low

5: End (P95)
;-----End Depth Sensor Status Check

6: If Flag/Port (P91)                      ;This command allows for an instantaneous
1: 11   Do if Flag 1 is High                ;measurement of the snow depth from a PC
2: 1    Call Subroutine 1                   ;that is connected to the data logger (press F1).

7: If time is (P92)                        ;Call subroutine that measures snow depth
1: 0    Minutes (Seconds --) into a
2: 15   Interval (same units as above)
3: 1    Call Subroutine 1

;-----Begin Data Output Section
;-----15 Minute Data
8: If time is (P92)                        ;Specify 15 minute output interval.
1: 0    Minutes (Seconds --) into a
2: 15   Interval (same units as above)
3: 10   Set Output Flag High

9: Set Active Storage Area (P80)           ;Place 15 min data in storage area number two.
1: 2    Final Storage Area 2
2: 100  Array ID                           ;Lines containing 15 min data will begin with the
                                           ;array ID 100.

10: Real Time (P77)                        ;Time format: 2003,1,0950
1: 1110 Year, Day, Hour/Minute            ;Year, Day of year, hour min

11: Sample (P70)                           ;Output instantaneous battery voltage
1: 1    Reps
2: 1    Loc [ Battery ]

12: Sample (P70)                           ;Output instantaneous air temperature from
1: 1    Reps                                ;the interval depth sensor.
2: 2    Loc [ DSTemp1 ]

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13: Sample (P70)	1: 1 Reps	2: 3 Loc [IntSnow]	13: Sample (P70)	1: 1 Reps	2: 3 Loc [IntSnow]	25: Serial Out (P96)	1: 71 SM192/SM716/CSM1	Store data to storage module.
14: Sample (P70)	1: 1 Reps	2: 4 Loc [TotalSnow]	14: Sample (P70)	1: 1 Reps	2: 4 Loc [TotalSnow]	2: Do (P86)	1: 41 Set Port 1 High	Turn on both snow depth sensors (see wiring diagram).
15: Totalize (P72)	1: 1 Reps	2: 8 Loc [PRECIP]	15: Totalize (P72)	1: 1 Reps	2: 8 Loc [PRECIP]	3: Excitation with Delay (P22)	1: 1 Ex Channel	Wait 0.6 seconds for the sensor to measure the air temperature
16: Serial Out (P96)	1: 71 SM192/SM716/CSM1		16: Serial Out (P96)	1: 71 SM192/SM716/CSM1		2: 60 Delay W/Ex (units = 0.01 sec)	1: 1 Ex Channel	Wait 0.6 seconds for the sensor to measure the air temperature
17: If time is (P92)	1: 0 Minutes (Seconds --) into a	2: 60 Interval (same units as above)	17: If time is (P92)	1: 0 Minutes (Seconds --) into a	2: 60 Interval (same units as above)	3: 0 Delay After Ex (units = 0.01 sec)	4: 0 mV Excitation	
18: Set Active Storage Area (P80)	21: 101 Array ID		18: Set Active Storage Area (P80)	21: 101 Array ID		4: Excite-Delay (SB) (P4)	1: 1 Reps	Sample air temperature in degrees C from the interval snow depth sensor.
19: Real Time (P77)	1: 1110 Year, Day, Hour/Minute		19: Real Time (P77)	1: 1110 Year, Day, Hour/Minute		2: 5 n 2500 mV Slow Range	3: 2 SE Channel	
20: Sample (P70)	1: 1 Reps	2: 1 Loc [Battery]	20: Sample (P70)	1: 1 Reps	2: 1 Loc [Battery]	4: 1 Excite all reps w/Exchan 1	3: 1 SE Channel	
21: Sample (P70)	1: 1 Reps	2: 2 Loc [DSTemp1]	21: Sample (P70)	1: 1 Reps	2: 2 Loc [DSTemp1]	5: 0 Delay (units 0.01 sec)	4: 1 Excite all reps w/Exchan 1	
22: Sample (P70)	1: 1 Reps	2: 3 Loc [IntSnow]	22: Sample (P70)	1: 1 Reps	2: 3 Loc [IntSnow]	6: 0 mV Excitation	5: 0 Delay (units 0.01 sec)	
23: Sample (P70)	1: 1 Reps	2: 4 Loc [TotalSnow]	23: Sample (P70)	1: 1 Reps	2: 4 Loc [TotalSnow]	7: 2 Loc [DSTemp1]	6: 0 mV Excitation	
24: Totalize (P72)	1: 1 Reps	2: 8 Loc [PRECIP]	24: Totalize (P72)	1: 1 Reps	2: 8 Loc [PRECIP]	8: 2 Mult	7: 2 Loc [DSTemp2]	
25: Serial Out (P96)	1: 71 SM192/SM716/CSM1		25: Serial Out (P96)	1: 71 SM192/SM716/CSM1		9: -273 Offset	8: 2 Mult	
Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	9: -273 Offset	9: -273 Offset	
Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	1: 1 Ex Channel	1: 1 Ex Channel	Wait 1.8 seconds for the sensor to make 10 measurements and perform air temperature compensation.
Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	2: 180 Delay W/Ex (units = 0.01 sec)	2: 180 Delay W/Ex (units = 0.01 sec)	
Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	Output instantaneous snow depth from the interval depth sensor.	1: 1 Reps	2: 3 Loc [IntSnow]	3: 0 Delay After Ex (units = 0.01 sec)	3: 0 Delay After Ex (units = 0.01 sec)	
Output the total liquid precipitation from the ETI gauge.	1: 1 Reps	2: 5 2500 mV Slow Range	Output the total liquid precipitation from the ETI gauge.	1: 1 Reps	2: 5 2500 mV Slow Range	4: 0 mV Excitation	4: 0 mV Excitation	Sample interval snow depth in centimeters.

```

3: 1   SE Channel
4: 1   Excite all reps w/Exchan 1
5: 0   Delay (units 0.01 sec)
6: 0   mV Excitation
7: 3   Loc [ IntSnow ]
8: -0.5 Mult           ;This value outputs snow depth in centimeters
                       ;Use -0.19685 for inches.
9: 100 Offset         ;This number is the distance between the sensor
                       ;and the ground surface in centimeters.

8: Excite-Delay (SE) (P4) ;Sample total snow depth in centimeters.
1: 1   Reps
2: 5   2500 mV Slow Range
3: 2   SE Channel
4: 1   Excite all reps w/Exchan 1
5: 0   Delay (units 0.01 sec)
6: 0   mV Excitation
7: 4   Loc [ TotalSnow ]
8: -0.5 Mult           ;This value outputs snow depth in centimeters
                       ;Use -0.19685 for inches.
9: 1000 Offset        ;This number is the distance between the sensor
                       ;and the ground surface in centimeters.

9: Do (P86)           ;Turn off snow depth sensors.
1: 51   Set Port 1 Low

10: End (P95)         ;End of snow depth subroutine

End Program           ;End of program

```

Program Output

```

Final Storage Location 1
101,2003,1,0800,12.42,5.24,8.30,140.34,0.59
101,2003,1,0900,12.40,7.45,9.53,141.83,0.63
Final Storage Location 2
100,2003,1,0800,12.42,5.26,8.30,140.36,0.58
100,2003,1,0815,12.41,5.94,8.34,140.7,0.59

```

E.5.2 Sample Program – Temperature Conversion

The air temperature measurements in the program examples are output in degrees kelvin. Within the sampling commands the temperatures are converted from degrees kelvin to degrees Celsius. The commands listed below can be added to any Campbell Scientific program to convert a temperature in degrees Celsius to degrees Fahrenheit.

```

#: Z=X*F (P37)           ;Multiply the air temperature in degrees
1: 2   X Loc [ AIRTEMPF ] ;C by 1.8 and store it in the same location.
2: 1.8   F
3: 2   Z Loc [ AIRTEMPF ]

#: Z=X+F (P34)          ;Add 32 to the new value to complete
1: 2   X Loc [ AIRTEMPF ] ;the conversion. The temperature
2: 32   F                ;in degrees F is stored in the same
3: 2   Z Loc [ AIRTEMPF ] ;location.

```

