UMIAT AIRPORT RAWS UPGRADE
STATION METADATA RECORDS

Edited by Austin McHugh 24 September 2007

STATION

NAME: Umiat Airport
STATION ID: 3150
PAKBUS ID: 50
LOCATION: _Umiat Airfield_____
GPS (00/00/06): 69° 22.159' N
152° 08.280' W
260 ft elevation
MAP DATUM: WGS84
INSTRUMENT: Garmin GPS V placed on top of air temperature radiation shield (2.0 m).

DATALOGGER

TYPE: CR1000
SERIAL NUMBER: 10135 *Located on bottom of datalogger; record before installation.*
WIRING PANEL SERIAL NUMBER: 9880 *Located on front of wiring panel.*
OPERATING SYSTEM (O/S): CR1000 OS 13
PROGRAM: Umiat Airfield RAWS 2007-9-22.CR1 *Name Format: Station_year_month_day*
TIME STANDARD: Alaska Standard Time *Datalogger time.*

PERSONAL

STATION MANAGER:
Name
Address Line 1
Address Line 2
GWS
Fairbanks, Alaska 99775
USA
Phone: (907)
FAX: (907)
E-mail: e-mail
Web Page Address: http://www. web page address

PROJECT PERSONNEL:
Austin McHugh
GW Scientific
P.O. Box 81538
Fairbanks, Alaska 99708
USA
Phone: (360-441-2023
FAX: (866)238-7608
E-mail: austin@gwscientific.com

PROJECT PERSONNEL:

Phone:
FAX:
E-mail:

LOCAL / OTHER PERSONNEL :

Phone :
FAX :
E-mail :

INSTRUMENTATION

Summary:

Quantity	Description	Comments
1	Campbell CR1000 datalogger sn: 10135	Installed 09/18/07.
1	Campbell CR1000 wiring panel sn: 9880	Installed 09/18/07.
1	TX312 GOES xmitter sn:1570	Installed 09/18/07.
1	Freewave FGR-115RC radio sn: 915-6747	Installed 09/18/07. actually before this date.
1	Antenna cable length- 50'	Installed 09/18/07. actually before this date.
1	Antenna make and model – Coaxial LMR-400	Installed 09/18/07. actually before this date.
4	Sun Xtender PVX-1040T 100-AH battery	Installed 09/18/07. actually before this date.
1	Morningstar SunSaver10 charger/regulator sn: SS10-12V	Installed 09/18/07. actually before this date.
1	Make & Model solar panel sn: NA—see photos	Installed 09/18/07. actually before this date.
1	enclosure- not Campbell, metal enclosure	Installed 09/18/07.
1	Campbell CM10 3-m tower	Installed 09/18/07.
1	CS105 Barometric Pressure Sensor (Vaisala PTB101B) sn:Z0740021	Installed 09/18/07. actually before this date
1	RM Young Model 05103 wind monitor – 67035, O#151374	Installed 09/18/07.
	05103 cable length 30'	
1	HMP45C sn: B4010028	Installed 09/18/07 2.0-m height in 12-plate gill radiation shield.
	HMP45C cable length 230 ft	
1	TE525 Tipping Bucket Rain Gage sn:34078-704	Installed 09/18/07.
	TE525 cable length:200 ft	
1	YSI model 4433 thermistor air temperature sensor (3 sensors/unit) (measuring 2 of 3) Labled: 07105	Installed 09/18/07. 2.0-m height in 6-plate gill radiation shield.
	YSI air temp cable length: 230'	
1	YSI model 4433 thermistor soil surface temperature sensor (3 sensors/unit) (measuring 2 of 3) Labled: 07106	Installed 09/18/07.
	YSI soil surface temp cable length: 230'	
1	YSI model 4433 thermistor -6" soil temperature sensor (3 sensors/unit) (measuring 2 of 3) Labled: 07107	Installed 09/18/07.

Quantity	Description	Comments
	YSI -6" soil temp cable length: 230'	
1	SR50A sn:C4561	Installed 09/18/07.
	SR50A cable length: 230 ft	
1	Solar panel voltage divider 10K:1K	
	Record all models and serial numbers	*Installed, replaced, location, etc. NOTE format for replacement shows old and new sensor; see Vaisala HMP45C for example.*

NOTES: *Defective sensors, reasons for replacements, re-wiring, upgrades, etc.*

STATION HISTORY

Month 09, 2007: This station was converted from a CR10X to a CR1000. A TX312 GOES transmitter was added. Sensors also added was an SR50A to measure snow depth, three GWS YSI triple thermistors to measure air temperature, soil surface temperature, and soil temperature 12 inches below the surface.

Equipment left from the previous installation includes and HMP45C air temperature and relative humidity sensor, 05103 wind monitor, TE525WS tipping bucket rain gage, CS105 barometer. Also maintained is the Freewave FGR115RC radio.

AC power charges the batteries from camp power when it is on.

The tripod was set-up with meteorological sensors and cables ran to a data logger in a near-by building. A data logger was mounted about 200' away, inside the near-by building. A Freewave FGR-115RC line-of-sight radio was mounted in the enclosure and connected to the datalogger. Power is supplied by the near-by camp and a unknown watt solar panel mounted on the south side of the building the logger panel is located. Four Concorde 100-AH batteries was placed in the building containing the data logger. Air, soil surface, and soil at -6" temperature sensors were installed and connected to the CR1000 datalogger. The air temperature sensor is an YSI thermistor, mounted in a Campbell 41303-5A 6-plate gill radiation shield and attached to the tripod at a height of 2.0 m. An RM Young wind sensor was installed at a height of 45 ft on the cross-arm of the tower. It was aligned to true north with the aid of a Brunton Pocket Transit corrected for the local magnetic declination. Datalogger time was set to Alaska Standard Time. Midnight is 0000. The datalogger program: Program scan rate is 5 seconds. Wiring diagrams were enclosed in plastic sleeves and taped to the inside of the enclosure door with black electrical tape. Photos of the completed station were taken. – *The date is the date of the installation completion. A description of the station is given as well as any problems encountered.*

Month 09, 2007: Station maintenance –

RADIO SETTINGS

List all radio settings here, along with any other relevant information.
A copy of the radio settings file from the Freewave radio would be great here.

DATA

DATA PROCESSING ALGORITHMS

TEMPERATURE °C
Steinhart & Hart equation used to convert YSI thermistor readings to °C.
T (°C) = (1/(a + b∗D + c∗D^3)) – 273.15
Where: a = 0.0014654354
b = 0.0002386780
c = 0.0000001000
D = ln(1000*Rs)
Rs = thermistor resistance (kΩ)

DATA STORAGE AND ACCESS

Where the data reside and how to access data should be here along with the name and contact information for the person responsible for the data.

QA/QC

All QA/QC procedures may be too much to enter here. A summary with a link to where the complete QA/QC documentation resides may be appropriate. The summary should document the basic rules for recognizing questionable and bad data and how they are flagged or deleted.

SITE CHARACTERISTICS

LANDSCAPE
SLOPE: 00 %
ASPECT: E (00º)
ELEVATION: 80 m
LANDSCAPE POSITION: Flat tundra
Also geomorphology features, etc

SOILS
CLASSIFICATION: *If known*
ACTIVE LAYER THICKNESS: 15 cm
STONENESS: None

VEGETATION
GROUND COVER: tundra, tussak, low shrubs/woody plants nearby
CANOPY COVER: No Canopy.
If possible, list plant species and relative abundance.

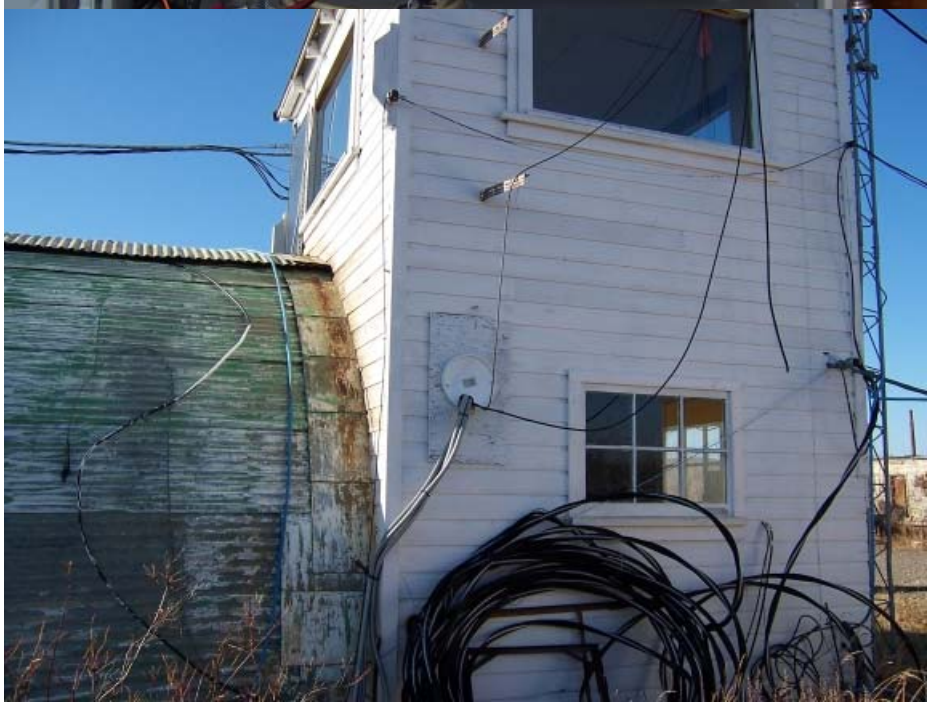
LAND USE
Near Umiat. Caribou present. Arctic fox

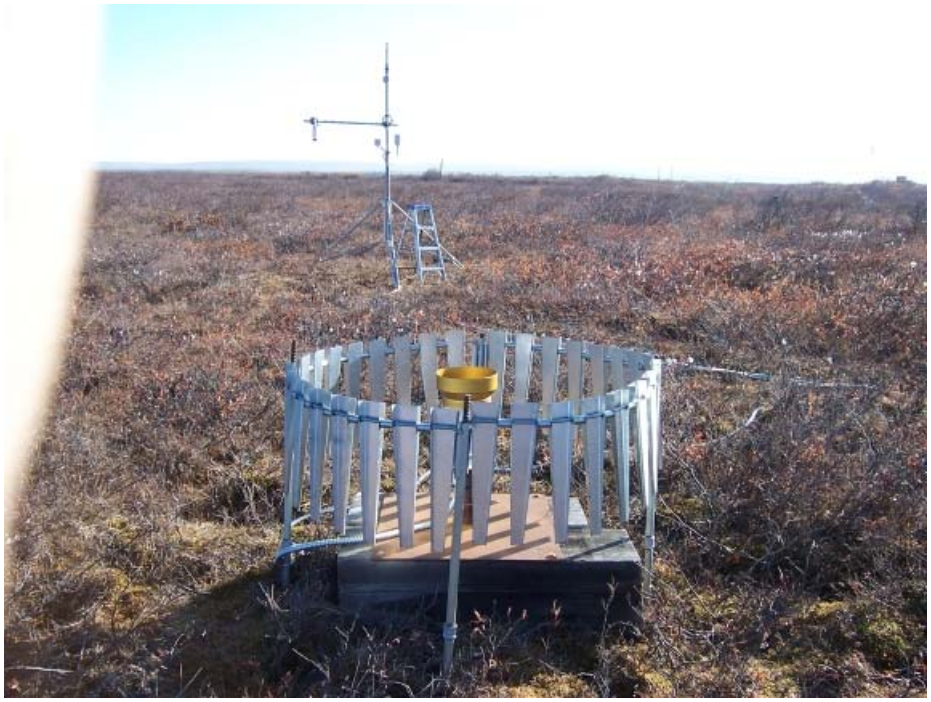
DATA NOTES
For Example: Data gap from 12/29/05 to 04/20/06 due to low battery.

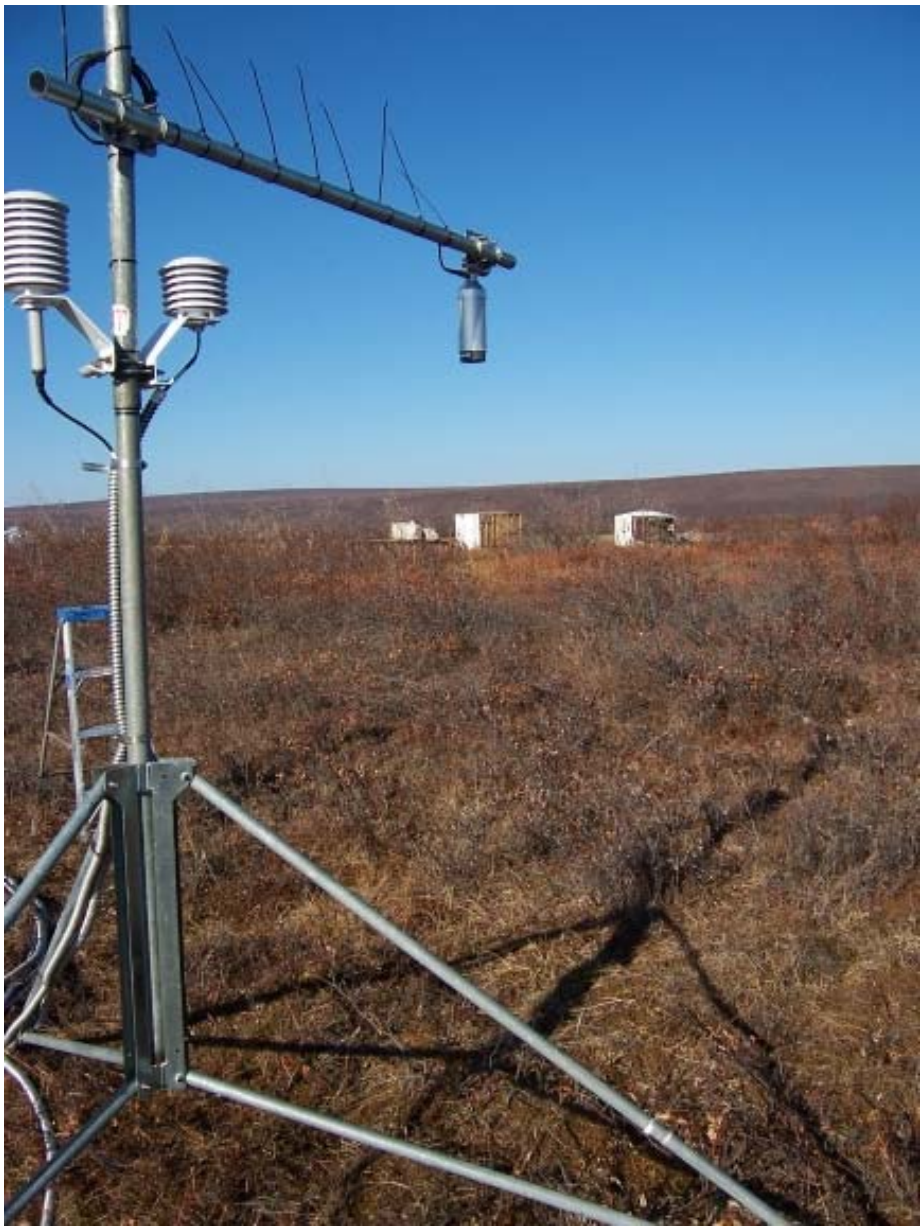
COMMENTS
Permafrost is approximately 6” below soil surface.

NOTES FOR NEXT STATION VISIT
Standard maintenance.

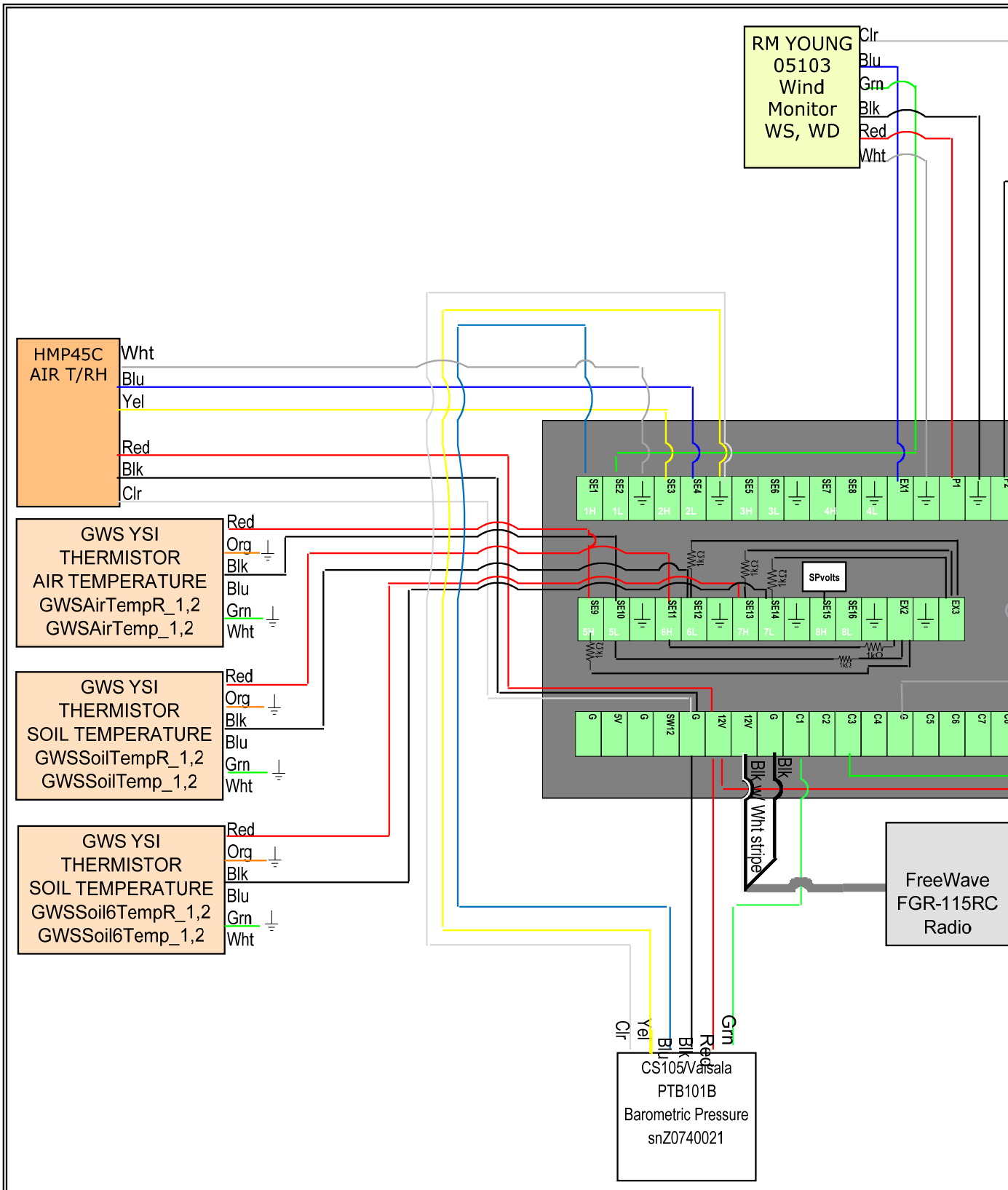
APPENDIX A
Site Photos

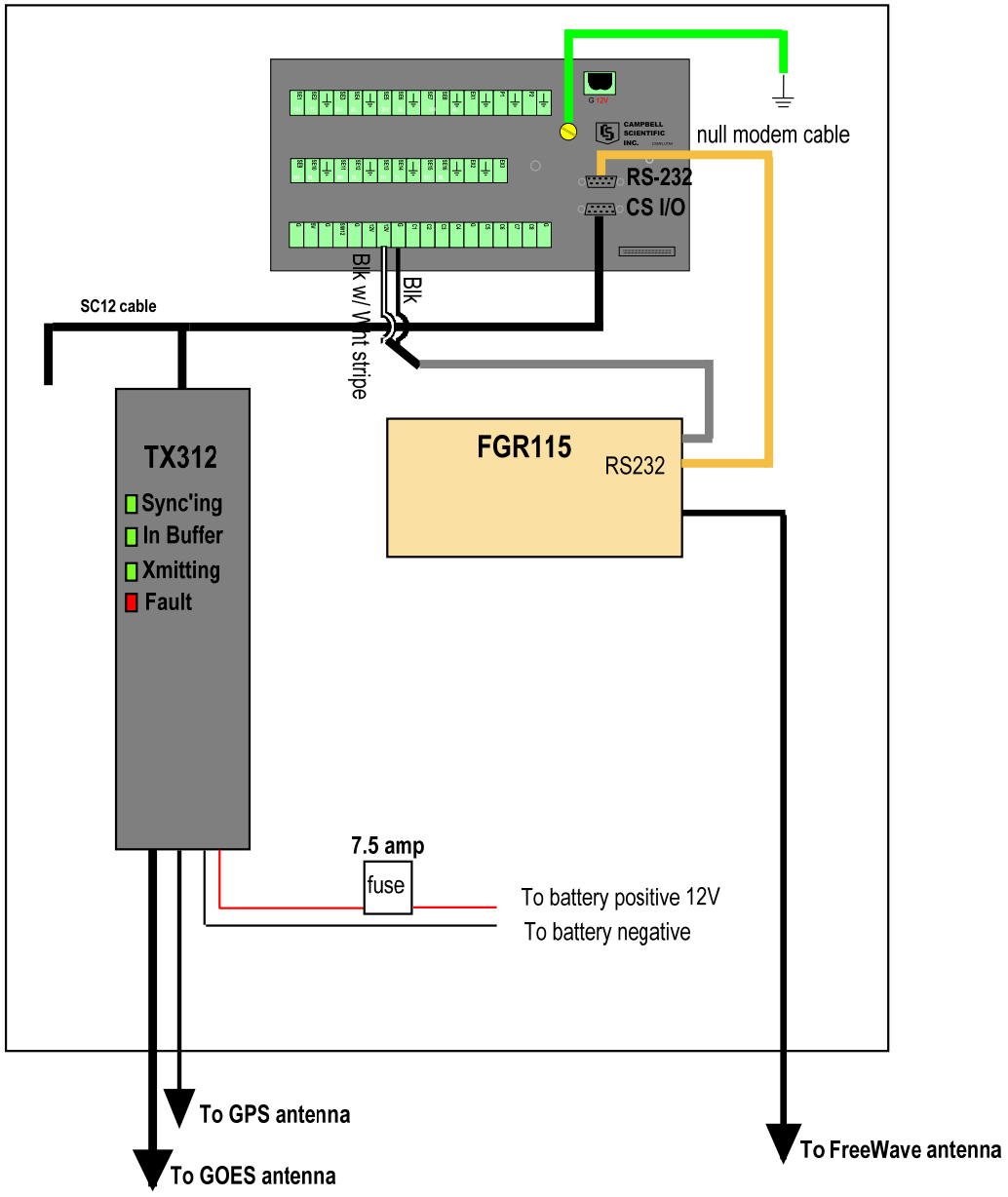


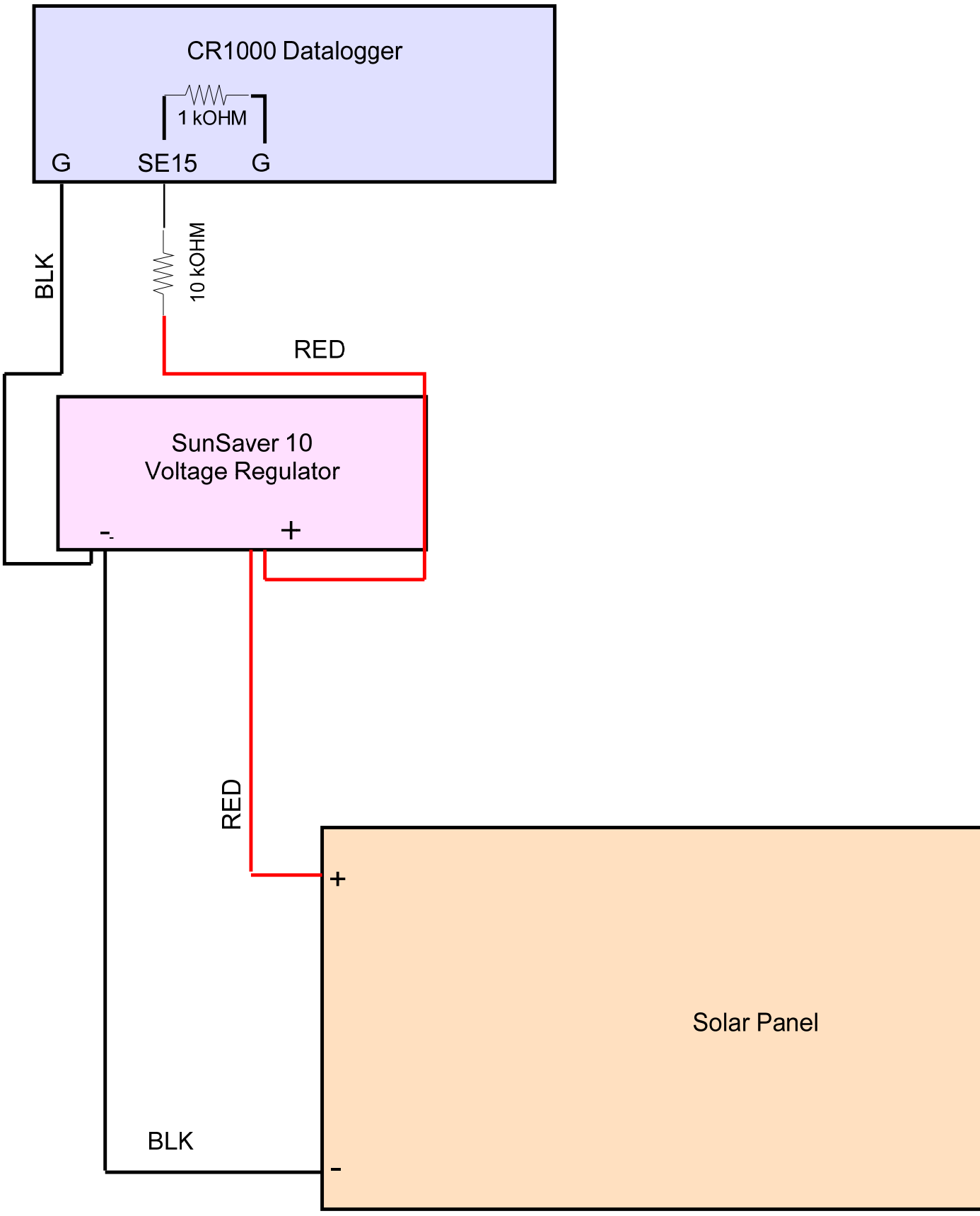




APPENDIX B
Wiring Diagrams


RM YOUNG
05103
Wind
Monitor
WS, WD
Clr
Blu
Grn
Blk
Red
Wht
HMP45C
AIR T/RH
Wht
Blu
Yel
Red
Blk
Clr
GWS YSI
THERMISTOR
AIR TEMPERATURE
GWSAirTempR_1,2
GWSAirTemp_1,2
Red
Org
Blk
Blu
Grn
Wht
GWS YSI
THERMISTOR
SOIL TEMPERATURE
GWSSoilTempR_1,2
GWSSoilTemp_1,2
Red
Org
Blk
Blu
Grn
Wht
GWS YSI
THERMISTOR
SOIL TEMPERATURE
GWSSoil6TempR_1,2
GWSSoil6Temp_1,2
Red
Org
Blk
Blu
Grn
Wht
SE1
SE2
SE3
SE4
SE5
SE6
SE7
SE8
EX1
P1
SE9
SE10
SE11
SE12
SE13
SE14
SE15
SE16
EX2
EX3
SPvolts
G
5V
G
SW12
G
12V
12V
G
C1
C2
C3
C4
C5
C6
C7
Blk
Blk
Blk w/ Wht stripe
FreeWave
FGR-115RC
Radio
Clr
Yel
Blu
Blk
Red
Grn
CS105/Vaisala
PTB101B
Barometric Pressure
snZ0740021


null modem cable
RS-232
CS I/O
Blk w/ Wht stripe
Blk
SC12 cable
TX312
Sync'ing
In Buffer
Xmitting
Fault
FGR115
RS232
7.5 amp
fuse
To battery positive 12V
To battery negative
To GPS antenna
To GOES antenna
To FreeWave antenna


CR1000 Datalogger
1 kOHM
G
SE15
G
BLK
10 kOHM
RED
SunSaver 10
Voltage Regulator
-
+
RED
+
Solar Panel
BLK
-

APPENDIX C
Current Datalogger Program
Umiat Airfield RAWS 2007-9-22.CR1

```
'Umiat Airfield RAWS 2007-09-22.cr

' Program modified: Umiat Airfield RAWS 2007-09-20.cr1
' Modified By: Austin McHugh
' Modifications: changed Daily table to get max of wind speed in m/s not
mph


' Program modified: Umiat Airfield RAWS 2007-09-19.cr1
' Modified By: Austin McHugh
' Modifications:  Changed soil temps from xxx to xxx.x, added a daily
table, added WSpd_ms and changed the label of the Daily
' wind vector to WindSpeedAvg_ms.  added WindSpeedAvg_ms to the end of the
Atmospherics table.

' Program modified: Umiat Airfield RAWS 2007-09-18.cr1
' Modified By: Austin McHugh
' Modifications: Deleted several of the update comments below to make
program shorter. Changed GOES WD to hourly from 10 minutes.
' Deleted SlrMj. Changed xmitted GOES precip to accumulated from hourly.
Changed HMP45C to Sample from Average.  Changed 12inch soil to 6inch soil.

' Program modified: Umiat Airfield RAWS 2007-09-17.cr1
' Modified By: Austin McHugh
' Modifications: Corrected spelling of HourlyAtmospherics table.
Corrected error reading the rain gage was on C6, now P2.
' measure BP Not corrected every 1 minute.

' Program modified: Umiat Airfield RAWS 2007-09-14.cr1
' Modified By: Austin McHugh
' Modifications: Added code to compute YSI Air Temp in F.  Swapped to send
the GWS YSI Air Temperature in F with the GOES 7 values and HMP45C temp in
F in the upper.


''-----------------------------------------------------------------------
-----------------------------------------------------------------------
--
' GOES Data Output                                        Format
Units
' 01    Rain cumulative total                             XX.XX     inches
' 02    WS 10 min avg                                     XXX       mph
' 03    WD 10 min avg                                     XXX       degrees
' 04    GWS YSI Air Temperature F sample                  XXX       F
' 05    Fuel Temp Sample                                  XXX       F  (set
to 0)
' 06    RH 10 min avg                                     XXX       Percent
' 07    Battery Voltage Sample                            XX.X      Volts

' 08    Barometric Pressure  Sample                       XX.XX     In of Hg
' 09    Hourly Dir of Peak Wind                           XXX       Dir
' 10    Hourly Peak WS                                    XXX       mph
```

```
'     11       Snow Depth Hourly "cleaned" average
           XXX                    cm
'     12       Air Temp (HMP45C) sample
                      XXX                    F
'     13       GWS Soil Temperature Hourly average
           XXX.X             C
'     14       GWS Soil Temperature at -6 average
           XXX.X             C



'Note: Do NOT apply power to the TX312 until the antenna is connected
'Note: GOES can NOT transmit w/o a GPS fix.


'CRBasic angle units are in Radians by default.
AngleDegrees

Const SensorHt=195   'ENTER HEIGHT OF SNOW DEPTH SENSOR ABOVE GROUND 195
(cm) HERE <-----

'  For YSI thermistors -- conversion of kOHM to deg C
Const a = 0.0014654354
Const b = 0.0002386780
Const c = 0.0000001000

Dim j
Dim D(12)

'Sensor Variables ----------------------------------------------------------
------------------------------------------------------------------------
Public Batt_Volt,  Panel_TempF, AirTempF, RH
Public SolarPnlV
Public Rain_in
Public BP_inHg_C, BP_mBar_NC ' C = Corrected to sea level, NC = Not
Corrected to sea level
Public FuelT_F
Public BPElev_ft
Public Raintot

Public MaxWS, MaxWD
Public Panel_TempC, AirTempC, TdewC, TdewF
Public setup_rc, msg_window

Public StationID
Public WDir
Public WSpd_knots, Wspd_ms
Public WSpd_mph

Public SR50(2), TCDT, SR50_Bad, Snowdepth,
Alias SR50(1)=DT
Alias SR50(2)=SR50_quality
Public GWSAirTemp(2), GWSSoilTemp(2), GWSSoil6Temp(2)
Public GWSAirTempR(2), GWSSoilTempR(2), GWSSoil6TempR(2)
Public GWSAirTempF(2)
```

```
Public RC_Data, ClearError
Public SetupFlag
Public Status(13), location(6), time(7)

public i, TimeToXmit, PortState
Public CountDwn As Boolean, TwlvMinFlag As Boolean, TwoMinFlag As Boolean
public ClockGood as boolean, SetClock as boolean,  DataTrigger as boolean


Alias Location(1)=GPSdataRC
Alias Location(2)=GPSSeconds
Alias Location(3)=Latitude
Alias Location(4)=Longitude
Alias Location(5)=Elevation
Alias Location(6)=MagDec

Alias Time(1)=Year
Alias Time(2)=Month
Alias Time(3)=Days
Alias Time(4)=Hours
Alias Time(5)=Minutes
Alias Time(6)=Seconds
Alias Time(7)=MicroSeconds

Alias Status(1)=RC_Status
Alias Status(2)=ST_Bytes
Alias Status(3)=ST_Days
Alias Status(4)=ST_Hour
Alias Status(5)=ST_Minute
Alias Status(6)=ST_Second
Alias Status(7)=Rdm_Bytes
Alias Status(8)=Rdm_Hour
Alias Status(9)=Rdm_Minute
Alias Status(10)=Rdm_Second
Alias Status(11)=FailSafe
Alias Status(12)=ST_BattVolt
Alias Status(13)=Ave_GPS

Const LASTRECORD=1
Const ST_APPEND = 0
Const ST_OVERWRITE = 1
Const RAWS7 = 3
Const XXX_X = 4
Const XX_XX = 5
Const X_XXX = 6
Const XXX = 7
Const XXXXX = 8


Const High = True
Const Low = False
Const ScanInterval = 5

Const PlatformID = &H326B17F6   'NESDIS ID as 8 hex characters ' 326B17F6
Const MsgWindow = 10            'Message window in Seconds ' 10
Const STChannel = 158           'Self-Timed channel number ' 158
```

```
Const STBaud = 300              'Self-Timed Baud Rate ' 300
Const RChannel = 151            'Random Channel number, not = zero ' leave
at 151
Const RBaud = 100               'Random Channel Baud Rate ' leave at 100
Const STinterval = "00_01_00_00" 'Self-Timed
interval:"day_hour_minute_second", as string ' as hourly
Const STOffset = "00_23_50"      'Self-Timed offset:"Hour_Minute_Second" '
as "00_23_50"
Const RInterval = "00_30_00"     'Random Interval:"Hour_minute_second" '
leave as is
'-------------------------------------------------------------------------
------


Units WSpd_mph=miles/hour
Units WSpd_ms=m/s
Units WDir=Degrees
Units Batt_Volt=Volts
Units SolarPnlV=Volts
Units AirTempF=Deg F
Units RH=%

Units BPElev_Ft=feet
Units Rain_in=inch
Units Raintot=inch
Units FuelT_F=Deg F

Units AirTempC=Deg C

Units TdewF=Deg F
Units TdewC = Deg C
Units Panel_TempC=Deg C
Units Panel_TempF = Deg F

Units WSpd_knots=knots
Units SnowDepth=cm

Units GWSAirTemp(2)=DegC
Units GWSSoilTemp(2)=DegC
Units GWSSoil6Temp(2)=DegC
Units GWSAirTempF(2)=DegF



DataTable(RAWS,TwoMinFlag,100)        ' RAWS7 data table -----------------
-----------------------------------------------------
      Sample (1,Raintot,fp2)
      WindVector (1,WSpd_mph,WDir,FP2,False,0,0,1)
      Sample (1,GWSAirTempF(1),FP2)   ' <<<<<<<<<<<<<<<<< we are using the
GWS YSI thermistor in DegF for the RAWS air temperature sensor
      Sample (1,FuelT_F,FP2)
      Average (1,RH,FP2,False)
      Sample (1,Batt_Volt,FP2)
EndTable


DataTable(RawsXd8,TwoMinFlag,100)       ' Sample BP xx.xx
```

```
      Sample(1,BP_inHg_C,fp2)
EndTable


DataTable (RawsXd9,TwoMinFlag,100)      ' Dir of Peak WS: XXX
      Sample(1,MaxWD,fp2)
EndTable


DataTable (RawsXd10,TwoMinFlag,100)     ' Peak WS: XXX
      Sample(1,MaxWS,fp2)
EndTable


DataTable (RawsXd11,TwoMinFlag,100)     ' Average Snow Depth: XXX
      Average(1,Snowdepth, fp2,SR50_Bad)
EndTable


DataTable (RawsXd12,TwoMinFlag,100)     ' Average GWS Air Temp XXX
      Sample (1,AirTempF,FP2)  '<<<<<<<<<<<<<< this is the HMP45C in F.
EndTable


DataTable (RawsXd13,TwoMinFlag,100)     ' Average GWS Soil Temp XXX
      Average(1,GWSSoilTemp(1), fp2,false)
EndTable


DataTable (RawsXd14,TwoMinFlag,100)     ' Average GWS Soil at -12 Temp XXX
      Average(1,GWSSoil6Temp(1), fp2,false)
EndTable


' Original 2-minute wind table
DataTable(TwoMinWind,true,-1)
      DataInterval(0,2,Min,10)
      Sample(1, STATIONID, FP2)
      WindVector(1,WSpd_knots,WDir, FP2, 0, 0, 0, 0)
      FieldNames("MeanWindSpeed:knots,VectorWindDir:deg,WindDirStdDev")
      Maximum(1,WSpd_knots, FP2, 0, False)
EndTable

DataTable(Hourly_Data,true,-1)
      DataInterval(0,60,Min,10)
      Sample(1, STATIONID, FP2)
      WindVector(1,WSpd_knots,WDir, FP2, 0, 0, 0, 0)
      FieldNames("MeanWindSpeed:knots,VectorWindDir:deg,WindDirStdDev")
      Maximum(1,WSpd_knots, FP2, 0, False)
      Average(1,AirTempC, FP2, 0)
      Average(1,TdewC, FP2, 0)
      Minimum(1,AirTempC, FP2, 0, False)
      Sample(1,BP_mBar_NC, FP2)
      Totalize(1,Rain_in, FP2, 0)
EndTable

' a new table for new met sensors
```

```
DataTable(HourlyAtmospherics, true, -1)
      DataInterval(0,60,Min,10)
      Sample(1, STATIONID, FP2)
      average(1,AirTempC,fp2,SR50_Bad)
      maximum (1,AirTempC,FP2,False,False)
      minimum (1,AirTempC,FP2,False,False)
      Sample(1,RH, FP2)
      Maximum(1,RH, FP2, 0, False)
      Minimum(1,RH, FP2, 0, False)
      Average(2,GWSAirTemp(),FP2,False)
      Average(1,snowdepth,fp2,SR50_Bad)' this is a "cleaned" value
      maximum (1,snowdepth,FP2,False,False)
      Minimum (1,snowdepth,FP2,False,False)
      sample (1,snowdepth,FP2)
      Sample (1,SR50_quality,FP2)
      WindVector (1,Wspd_ms,WDir,FP2,False,0,0,0)
      FieldNames("WindSpeedAvg_ms:ms,VectorWindDir:deg,WindDirStdDev")
EndTable



' a new table for sub surface measurements
DataTable(HourlySubSurface, true, -1)
      DataInterval(0,60,Min,10)
      Sample(1, STATIONID, FP2)
      Average(2,GWSSoilTemp(),FP2,False)
      Average(2,GWSSoil6Temp(),FP2,False)
EndTable

DataTable(HourlyRaw, true, -1)
      DataInterval(0,60,Min,10)
      Sample(1, STATIONID, FP2)
      Average (2,GWSAirTempR(),FP2,False)
      Average (2,GWSSoilTempR(),FP2,False)
      Average (2,GWSSoil6TempR(),FP2,False)
EndTable

DataTable(HourlyDiag, true, -1)
      DataInterval(0,60,Min,10)
      Sample(1, STATIONID, FP2)
      Average(1,Batt_Volt, FP2,False)
      Average(1,Panel_TempC, FP2, False)
      Average (1,SolarPnlV,FP2,False)
EndTable

DataTable (Daily, 1,-1)
      DataInterval(0,1440,Min,0)
      Sample(1,StationID,fp2)
      Average (1,AirTempC,FP2,False)
      Maximum (1,AirTempC,FP2,False,False)
      Minimum (1,AirTempC,FP2,False,False)
      Average (2,GWSAirTemp(),FP2,False)
      Maximum (2,GWSAirTemp(),FP2,False,False)
      Minimum (2,GWSAirTemp(),FP2,False,False)
      Average (2,GWSSoilTemp(),FP2,False)
      Maximum (2,GWSSoilTemp(),FP2,False,False)
      Minimum (2,GWSSoilTemp(),FP2,False,False)
```

```
      Average (2,GWSSoil6Temp(),FP2,False)
      Maximum (2,GWSSoil6Temp(),FP2,False,False)
      Minimum (2,GWSSoil6Temp(),FP2,False,False)
      Maximum (1,RH,FP2,False,False)
      Minimum (1,RH,FP2,False,False)
      WindVector (1,Wspd_ms,WDir,FP2,False,0,0,0)
      FieldNames("WindSpeedAvg_ms:ms,VectorWindDir:deg,WindDirStdDev")
      Maximum (1,Wspd_ms,FP2,False,False)
      Totalize (1,Rain_in,FP2,False)
      Average(1,snowdepth,fp2,SR50_Bad)  ' this is a "cleaned" value
EndTable


' ***************** Subroutine Setupsub ************************
sub setupsub                              'Uses Constants for GoesSetup(),
June 18, 2007
      goessetup(SEtup_RC,PlatformID,MsgWindow,STChannel,STBaud,RChannel,RB
aud,STInterval,STOffset,RInterval)
endsub


' ********************** TimeSet ************************************
sub TimeSet               'Set CR1000 clock to GMT time via TX312
      if  SetClock then
            GOESGPS(Location(),time())
            ' convert elevation in cm to BPelev_ft in feet once after it
is optained from TX312, added AMcHugh
            BPelev_ft = (elevation/100) * 3.281
            if GPSdataRC < 1 then
                  if Hours>=0and Hours<24and Minutes>=0and Minutes<60and
Seconds>=0and Seconds<60 then
                        '     ClockSet (Time())  'ClockSet is dissabled
AMcHugh  The datalogger clock is not used to transmit data.
                        ClockGood = true
                        SetClock = false
                  endif
            endif
      EndIf
EndSub

' ***************** subroutine Stats ************************
Sub Stats
      GOESStatus (Status(),1)
endsub

'****************** Subroutine CountDown ************************
sub CountDown
      If ClockGood then
            If not CountDwn then
                  If ST_Hour < 1 and St_Minute < 59 and ST_Minute > 15
then
                        TimeToXmit = (ST_Minute * 60) + ST_Second
                        Countdwn = true
                  endif
            EndIf
      endif
endsub
```

```
'*****************Subroutine Counting ***********************
Sub Counting
      if ClockGood then
            if countDwn then
                  TimeToXmit = TimeToXmit - ScanInterval          ' june
18, 2007
                  If TimeToXmit <= 720 Then TwlvMinFlag = True
                  If TimeToXmit <= 120 then
                        TwoMinFlag = True
                        CountDwn = false
                  EndIf
            endif
      endif
Endsub

'Main Program ---------------------------------------------------------
------------------------------------------------------------------------
BeginProg
      SetClock = True
      ClockGood = False
      CountDwn = False
      setup_RC=1
      msg_window=-1
      MaxWS = -20000  'initialize Max ws and wd, june 18
      MaxWD = 0

      Scan (ScanInterval,Sec,0,0)     'Const ScanInterval in seconds june
18, 2007

            if SEtup_RC > 0 then
                  call setupsub
            endif

            STATIONID = 3150

            Battery(Batt_Volt)
            PanelTemp(Panel_TempC,250)
            Panel_TempF=Panel_TempC*1.8+32
            VoltSe (SolarPnlV,1,mV2500,15,1,0,250,0.011,0)


            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure HMP45C               ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''

            ' this sensor is currently wired to 12v and ON always.
            PortSet(2, 1)
            Delay(0,150,MSEC)
            VoltSe(AirTempC, 1, mV2500, 3, False, 0, 250, 0.1, -40)
            VoltSe(RH, 1, mV2500, 4, False, 0, 250, 0.1, 0)
            PortSet(2, 0)
            If RH>100 AND RH<108 Then RH=100
            AirTempF=AirTempC*1.8+32
```

```
            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure Wind Monitor         ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''

            BrHalf(WDir, 1, mV2500, 2, VX1, 1, 2500, False, 20000, 250,
355, 0)
            ' 05103 uses a multiplier of 0.2192 to get mph
            PulseCount(WSpd_mph, 1, 1, 1, 1, 0.2192, 0)
            ' 1mph = 0.869knots
            WSpd_knots = WSpd_mph * 0.869
            ' 1 mile/hour (mph) = 0.447 meter/second
            WSpd_ms = WSpd_mph * 0.447

            If WSpd_mph > MaxWS Then          ' Track max Wind Speed and
Dir, these are zeroed at two min flag.
                  MaxWS = WSpd_mph
                  MaxWD = WDir
            EndIf

            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure TE525WS              ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''

            'TE525/TE525WS Rain Gauge measurement Rain_in 0.01"/tip:
            PulseCount(Rain_in,1,2,2,0,0.01,0)
            Raintot = Raintot + rain_in

            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure GWSAirTemp Thermistors ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''

            '     USE HALF BRIDGE TO MEASURE RATIO OF Vse TO Vex
            '       FOR 2 YSI AIR TEMPERATURE THERMISTORS

            BrHalf (GWSAirTempR(),2,mV2500,9,Vx2,2,2500,True,0,250,1,0)

            '     CONVERT VOLTAGE RATIO TO RESISTANCE (kOHM) FOR 2 SENSORS
            '     FIXED RESISTANCE = 1.0 kOHM

            GWSAirTempR(1) = 1 * GWSAirTempR(1) / (1 - GWSAirTempR(1))
            GWSAirTempR(2) = 1 * GWSAirTempR(2) / (1 - GWSAirTempR(2))

            For j=1 To 2
                  D(j) = LN (1000*GWSAirTempR(j))
'ln resistance (ohm)
                  GWSAirTemp(j) = (1/(a + b*D(j) + c*(D(j))^3)) - 273.15
'Steinhart & Hart Equation
                  GWSAirTempF(j) = (GWSAirTemp(j)*1.8)+32
                        ' compute GWS Air Temperature in F
            Next j
```

```
            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure GWSSoilTemp Thermistors ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''
            ' first one on EX2

            BrHalf (GWSSoilTempR(1),1,mV2500,11,Vx2,2,2500,True,0,250,1,0)
            GWSSoilTempR(1) = 1 * GWSSoilTempR(1) / (1 - GWSSoilTempR(1))

            D(1) = LN (1000*GWSSoilTempR(1))
'ln resistance (ohm)
            GWSSoilTemp(1) = (1/(a + b*D(1) + c*(D(1))^3)) - 273.15
'Steinhart & Hart Equation


            ' second one on EX3
            BrHalf (GWSSoilTempR(2),1,mV2500,12,Vx3,1,2500,True,0,250,1,0)
            GWSSoilTempR(2) = 1 * GWSSoilTempR(2) / (1 - GWSSoilTempR(2))

            D(2) = LN (1000*GWSSoilTempR(2))
'ln resistance (ohm)
            GWSSoilTemp(2) = (1/(a + b*D(2) + c*(D(2))^3)) - 273.15
'Steinhart & Hart Equation

            ''''''''''''''''''''''''''''''''''
            ''                              ''
            '' Measure GWSSoil6Temp Thermistors ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''
            ' both on EX3
            BrHalf (GWSSoil6TempR(),2,mV2500,13,Vx3,2,2500,True,0,250,1,0)

            '     CONVERT VOLTAGE RATIO TO RESISTANCE (kOHM) FOR 2 SENSORS
            '     FIXED RESISTANCE = 1.0 kOHM

            GWSSoil6TempR(1) = 1 * GWSSoil6TempR(1) / (1 -
GWSSoil6TempR(1))
            GWSSoil6TempR(2) = 1 * GWSSoil6TempR(2) / (1 -
GWSSoil6TempR(2))

            For j=1 To 2
                  D(j) = LN (1000*GWSSoil6TempR(j))
'ln resistance (ohm)
                  GWSSoil6Temp(j) = (1/(a + b*D(j) + c*(D(j))^3)) - 273.15
'Steinhart & Hart Equation
            Next j

            ''''''''''''''''''''''''''''''''''
            ''                              ''
            ''  Measure Snow Depth and Not-Corrected BP every minute ''
            ''                              ''
            ''''''''''''''''''''''''''''''''''

            If IfTime(0,1,Min) Then
                  'SR50 Sonic Ranging Sensor (SDI-12 Output) measurements
DT, TCDT, and DBTCDT:
```

```
                  SDI12Recorder(DT,3,0,"M1!",100.0,0)    'MEASURE DISTANCE
TO SNOW (cm), changed to M1! to get the quaulity number too.
                  TCDT=DT*SQR((GWSAirTemp(1)+273.15)/273.15)  'CORRECT
DISTANCE FOR AIR TEMPERATURE (cm)
                  Snowdepth=SensorHt-TCDT               'CALCULATE SNOW
DEPTH (cm)
                  ' create a variable to not process out-of-range
snowdepth values
                  If Snowdepth < -25 OR Snowdepth > 100 Then SR50_Bad = 1
Else SR50_Bad = 0
                  ' remove the multiplier from the quality number
                  SR50_quality=SR50_quality/100

                  ' Turn on and read CS105 BP Not Corrected, then turn it
off.
                  PortSet(1,1)    'turn on CS105
                  Delay(1,1000,mSec)      'pause after applying power
                  'measure CS105 (Vaisala PTB101) BP in mBar uncorrected.
Multipler = 0.184 mBar/mv
                  VoltSe(BP_mBar_NC, 1, mV2500, 1,1, 0, 250, 0.184, 600)
                  PortSet(1,0)
            EndIf

            ' set Fuel Temperature to 0 as a place holder per Richard
Kemnitz request
            FuelT_F = 0

            'The equation used to calculate dew point is:
            'Td=(241.88*ln(Vp/0.61078))/(17.558-ln(Vp/0.61078))
            DewPoint(TdewC,AirTempC,RH)
            If TdewC>AirTempC OR TdewC=NAN Then TdewC=AirTempC
            TdewF=1.8*TdewC+32



            '--- GOES Satellite code setup ----------------------------
----------------------------------------------------------------------
-
            If msg_window Then              ' run when GOES setup
parameters have been entered
                  'Time interval for read stats.
                  If IfTime(0,1,min) Then
                        If SetClock Then
                              Call timeset
                        EndIf
                        Call Stats
                  EndIf

                  Call CountDown
                  Call Counting

                  If TwoMinFlag Then 'Measure  BP
                        PortSet(1,1)    'turn on CS100
                        Delay(1,1000,mSec)      'pause after applying
power
                        'measure CS105 (Vaisala PTB101) BP in mBar
corrected. Multipler = 0.184 mBar/mv
```

```
                        VoltSe(BP_inHg_C,1,mV2500,1,1,0,250,0.184,600.0)
'measure Barometric sensor in mBar
                        BP_inHg_C=BP_inHg_C+(1013.25*(1-(1-
((BPElev_Ft/3.281)/44307.69231))^5.25328)) ' compute offset in mBar
                        BP_inHg_C=BP_inHg_C*0.02953 'convert mBar to inHg
                        PortSet(1,0)
                  EndIf

                  ' call the 10-minute outputs only when the 12-minute
flag is high
                  If TwlvMinFlag Then
                        CallTable (RAWS)        ' Rain, WS, WD, AT, FT,
RH, BV: RAWS7
                        CallTable (RawsXd8)     ' BP_inHg_C=In of Hg
                  EndIf

                  ' call these tables every time because we want complete
hourly averages.
                  ' These must be called before the TwoMinFlag is set to
0.
                  CallTable (RawsXd9)     ' Sample Peak WD: XXX
                  CallTable (RawsXd10)    ' Sample Pead WS: XXX
                  CallTable (RawsXd11)     ' Average Snow Depth: XXX
                  CallTable (RawsXd12)     ' Sample GWS Air Temp XXX
                  CallTable (RawsXd13)     ' Average GWS Soil Temp XXX
                  CallTable (RawsXd14)     ' Average GWS Soil at -12 Temp
XXX


                  If TwoMinFlag Then      'Shut down data taking until
next hour
                        CountDwn = False
                        TwlvMinFlag = False
                        TwoMinFlag = False
                        MaxWS = 0
                        MaxWD = 0
                        '     raintot = 0  ' commmented out the 0 of
raintot so that a cumulative precipitation would be transmitted.

      GOESData(RC_data,RAWS,LASTRECORD,ST_OVERWRITE,RAWS7)

      GOESData(RC_Data,RawsXd8,LASTRECORD,ST_APPEND,XX_XX)
                        GOESData(RC_data,RawsXd9,LASTRECORD,ST_APPEND,XXX)

      GOESData(RC_data,RawsXd10,LASTRECORD,ST_APPEND,XXX)

      GOESData(RC_data,RawsXd11,LASTRECORD,ST_APPEND,XXX)

      GOESData(RC_data,RawsXd12,LASTRECORD,ST_APPEND,XXX)

      GOESData(RC_data,RawsXd13,LASTRECORD,ST_APPEND,XXX_X) ' xxx.x

      GOESData(RC_data,RawsXd14,LASTRECORD,ST_APPEND,XXX_X) ' xxx.x
                  EndIf
                  If IfTime(0,30,5) Then SetClock = True                '
set the clock from GPS every 30 days
            EndIf   ' end of GOES code
```

```
            'Call Data Tables and Store Data ----------------------------
---------------
            CallTable (TwoMinWind)
            CallTable (Hourly_Data)
            CallTable (HourlyAtmospherics)
            CallTable (HourlySubSurface)
            CallTable (HourlyRaw)
            CallTable (HourlyDiag)
            CallTable (Daily)

      NextScan
EndProg
```