

Program: Shurb_2014_Soil_PAR-Temp_2020.CR1

```
1  'CR1000
2  ' Jim Laundre 2014
3  ' Wiring
4  ' Using CR1000 serial number 43615 Calibration 03Oct14
5  ' 9Aug14 GH2 AND GHF2 are switched. correting the program. JimL
6  '
7  ' HMP50/HMP60 Temperature & Relative Humidity Sensor (CT)
8  '   1H: Black
9  '   1L: White
10 '   Ground: Clear
11 '   G: Blue
12 '   12V: Brown
13 '
14 ' HMP50/HMP60 Temperature & Relative Humidity Sensor (GH)
15 '   Ground: Clear
16 '   2H: Black
17 '   2L: White
18 '   G: Blue
19 '   12V: Brown
20 '
21 ' HMP50/HMP60 Temperature & Relative Humidity Sensor (SH)
22 '   Ground: Clear
23 '   3H: Black
24 '   3L: White
25 '   G: Blue
26 '   12V: Brown
27 '
28 ' 109 Temperature Probe
29 '   Ground: Purple
30 '   Ground: Clear
31 '   4H: Red
32 '   VX1 or EX1: Black
33 '
34 ' AM416 Multiplexer
35 '   Ground: COM SHIELD
36 '   C2: COM H1   Turn CS615s On
37 '   4L: COM L1
38 '   NA: COM H2
39 '   NA: COM L2
40 '   G: GND
41 '   12V: 12V
42 '   C1: CLK      Switch to next AM416 Multiplexer channel
43 '   C3: RES      Turn AM416 Multiplexer On
44 '
45 ' AM25T Multiplexer (1) Note: using a short wire between the two AMT25 fo
46 '   that are connected to the same logger ports. I tried to use the same
47 '   for the AM416 but the AM416 did not go through the switches.
48 '   Ground: AG   (Green -> AM25T #2 AG)
49 '   5H: HI       White
50 '   5L: LO       Green
51 '   VX2 or EX2: EX Red
52 '   G: Ground    (Black -> AM25T #2 G)
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```
53 '      12V:  +12      (Red    -> AM25T #2 +12V)
54 '      C6:  CLK      (White -> AM25T #2 CLK)
55 '      C4:  RES      Black
56 '
57 '      AM25T Multiplexer (2)  Note:  using a short wire between the two AMT25 f
58 '                                  that are connected to the same logger port
59 '      Ground:  AG  wire 2 black
60 '      6H:  HI      wire 2 white
61 '      6L:  LO      wire 2 green
62 '      VX2 or EX2:  EX  wire 2 Red
63 '      G:  Ground  Black
64 '      12V:  +12      Red
65 '      C6:  CLK      White
66 '      C5:  RES      Green
67 '
68 '      BF3
69 '      7H(SE13):  BF3  PAR Radiation Signal (white)
70 '      7L(SE14):  BF3  Analog Ground (green),
71 '      jumper to Analog gnd
72 '      8H(SE15):  BF3  Diffuse Radiation Signal (grey)
73 '      8L(SE16):  BF3  jumper to  jumper to 7L(SE14)
74 '      12V:      BF3 Red
75 '      G:  BF3 violet/clear
76 '-----
77 '-----Multiplexer wiring-----
78 '-----
79 '      AM416 Multiplexer sensors
80 '      Only using H1 and L1 sets
81 '      CS616 Water Content (1)
82 '      12V:  Red
83 '      SHIELD:  Black
84 '      1 H1:  Orange
85 '      1 L1:  Green
86 '      SHIELD:  Clear
87 '      ---repeat for the other 8 sensors using only H1 & L1 ---
88 '-----
89 '
90 '      AM25T Multiplexer (1)
91 '      Type T (copper-constantan) total of 11
92 '      1H:  Blue
93 '      1L:  Red
94 '-----
95 '      AM25T Multiplexer (2)
96 '      Type T (copper-constantan) total of 25
97 '      1H:  Blue
98 '      1L:  Red
99 '
100 '      LiCor 190LA total of 4 starting at 12H
101 '      12H:  Red
102 '      12L:  Black
103 '-----
104 '      Trime TDR moisture sensor
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```
105 '      16H:  Color????
106 '      16L:  Color for single ground
107 '      12volt switch
108
109 'Declare Variables and Units
110 Public BattV
111 Public AirTC_3M
112 Public RH_3Meter
113 Public GH_AirTC
114 Public GH_RH
115 Public SH_AirTC
116 Public SH_RH
117 Public T109_3M
118 Public PAR_Den(3)
119 Public LCount
120 Public BF3_Direct_PAR
121 Public BF3_Diffuse_PAR
122 Public RTempC
123 Public SoilTemp_C(11)
124 Public RTempC_2
125 Public SoilTemp_C_2(25)
126 Public VW(8)
127 Public PA_mS(8)
128
129 Alias PAR_Den(1) = CT_PAR_Den
130 Alias PAR_Den(2) = GH_PAR_Den
131 Alias PAR_Den(3) = SH_PAR_Den
132 Alias SoilTemp_C_2(1) = CT1sur_AVG
133 Alias SoilTemp_C_2(2) = CT1_5cm_AVG
134 Alias SoilTemp_C_2(3) = CT1_10cm_AVG
135 Alias SoilTemp_C_2(4) = CT1_20cm_AVG
136 Alias SoilTemp_C_2(5) = CT1_40cm_AVG
137 Alias SoilTemp_C_2(6) = CT1_100cm_AVG
138 Alias SoilTemp_C_2(7) = CT2sur_AVG
139 Alias SoilTemp_C_2(8) = CT2_5cm_AVG
140 Alias SoilTemp_C_2(9) = CT2_10cm_AVG
141 Alias SoilTemp_C_2(10) = CT2_20cm_AVG
142 Alias SoilTemp_C_2(11) = CT2_40cm_AVG
143 Alias SoilTemp_C_2(12) = CT2_100cm_AVG
144 Alias SoilTemp_C_2(13) = NP1Sur_AVG
145 Alias SoilTemp_C_2(14) = NP1_10cm_AVG
146 Alias SoilTemp_C_2(15) = NP1_20cm_AVG
147 Alias SoilTemp_C_2(16) = NP1_40cm_AVG
148 Alias SoilTemp_C_2(17) = GHF1sur_AVG
149 Alias SoilTemp_C_2(18) = GHF1_10cm_AVG
150 Alias SoilTemp_C_2(19) = GHF1_20cm_AVG
151 Alias SoilTemp_C_2(20) = GHF1_40cm_AVG
152 Alias SoilTemp_C_2(21) = GH1sur_AVG
153 Alias SoilTemp_C_2(22) = GH1_10cm_AVG
154 Alias SoilTemp_C_2(23) = GH1_20cm_AVG
155 Alias SoilTemp_C_2(24) = GH1_40cm_AVG
156 Alias SoilTemp_C_2(25) = GHF2sur_AVG
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```
157 Alias SoilTemp_C(1) = GHF2_10cm_AVG
158 Alias SoilTemp_C(2) = GHF2_20cm_AVG
159 Alias SoilTemp_C(3) = GHF2_40cm_AVG
160 Alias SoilTemp_C(4) = GH2sur_AVG
161 Alias SoilTemp_C(5) = GH2_10cm_AVG
162 Alias SoilTemp_C(6) = GH2_20cm_AVG
163 Alias SoilTemp_C(7) = GH2_40cm_AVG
164 Alias SoilTemp_C(8) = NP2sur_AVG
165 Alias SoilTemp_C(9) = NP2_10cm_AVG
166 Alias SoilTemp_C(10) = NP2_20cm_AVG
167 Alias SoilTemp_C(11) = NP2_40cm_AVG
168
169 Units BattV=Volts
170 Units AirTC_3M=Deg C
171 Units RH_3Meter=%
172 Units GH_AirTC=Deg C
173 Units GH_RH=%
174 Units SH_AirTC=Deg C
175 Units SH_RH=%
176 Units T109_3M=Deg C
177 Units PAR_Den=umol/s/m^2
178 Units RTempC=Deg C
179 Units SoilTemp_C=Deg C
180 Units RTempC_2=Deg C
181 Units SoilTemp_C_2=Deg C
182 Units PA_mS=mSec
183 Units BF3_Direct_PAR = umol/m2/s
184 Units BF3_Diffuse_PAR = umol/m2/s
185
186 'FGR115 radion modem control
187 Dim RTime(9)
188 Public NowMin_5
189 Public NowSec_4
190 Public RadioCon
191
192 'Define Data Tables
193 DataTable(Hourly,True,-1)
194   DataInterval(0,60,Min,10)
195   CardOut(0,-1)
196   Average(1,BattV,FP2,False)
197   Average(1,AirTC_3M,FP2,False)
198   Sample(1,RH_3Meter,FP2)
199   Average(1,GH_AirTC,FP2,False)
200   Sample(1,GH_RH,FP2)
201   Average(1,SH_AirTC,FP2,False)
202   Sample(1,SH_RH,FP2)
203   Average(1,T109_3M,FP2,False)
204   Average(3,PAR_Den(),FP2,False)
205   Average(1,BF3_Direct_PAR,FP2,False)
206   Average(1,BF3_Diffuse_PAR,FP2,False)
207   Average(4,VW(),FP2,False)
208   Average(4,PA_mS(),IEEE4,False)
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```
209 Average(1,RTempC,FP2,False)
210 Average(1,RTempC_2,FP2,False)
211 Average(11,SoilTemp_C(),FP2,False)
212 Average(25,SoilTemp_C_2(),FP2,False)
213
214 EndTable
215
216 DataTable(Daily,True,-1)
217   DataInterval(0,1440,Min,10)
218   CardOut(0,-1)
219   Minimum(1,BattV,FP2,False,False)
220   Maximum(1,BattV,FP2,False,False)
221   Maximum(1,AirTC_3M,FP2,False,False)
222   Minimum(1,AirTC_3M,FP2,False,False)
223   Maximum(1,GH_AirTC,FP2,False,False)
224   Minimum(1,GH_AirTC,FP2,False,False)
225   Maximum(1,SH_AirTC,FP2,False,False)
226   Minimum(1,SH_AirTC,FP2,False,False)
227 EndTable
228
229 'Main Program
230 BeginProg
231   Scan(60,Sec,1,0)
232     'Default Datalogger Battery Voltage measurement BattV
233     Battery(BattV)
234     'FGR115 radio Control: This will turn the radio on each hour from :30 t
235     ' use the switched 12 volt SW12-1
236     RealTime(RTime(1))
237     '1=year, 2=month, 3=day of month, 4=hour of day, 5=minutes,
238     '6=seconds, 7=microseconds, 8=day of week, 9=day of year
239     NowMin_5=RTime(5)
240     If NowMin_5>=40 AND NowMin_5<59 Then
241       RadioCon=1
242       PortSet(9,RadioCon)
243     Else
244       RadioCon=0
245       PortSet(9,RadioCon)
246     EndIf
247     If BattV<11.5 Then
248       RadioCon=0
249     EndIf
250     'HMP50 Temperature & Relative Humidity Sensor measurements AirTC_3M and
251     VoltSe(AirTC_3M,1,mV2500,1,0,0,_60Hz,0.1,-40)
252     VoltSe(RH_3Meter,1,mV2500,2,0,0,_60Hz,0.1,0)
253     If (RH_3Meter>100) AND (RH_3Meter<108) Then RH_3Meter=100
254     'HMP50 Temperature & Relative Humidity Sensor measurements GH_AirTC and
255     VoltSe(GH_AirTC,1,mV2500,3,0,0,_60Hz,0.1,-40)
256     VoltSe(GH_RH,1,mV2500,4,0,0,_60Hz,0.1,0)
257     If (GH_RH>100) AND (GH_RH<108) Then GH_RH=100
258     'HMP50 Temperature & Relative Humidity Sensor measurements SH_AirTC and
259     VoltSe(SH_AirTC,1,mV2500,5,0,0,_60Hz,0.1,-40)
260     VoltSe(SH_RH,1,mV2500,6,0,0,_60Hz,0.1,0)
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```
261   If (SH_RH>100) AND (SH_RH<108) Then SH_RH=100
262   '109 Temperature Probe measurement 'T109_3M'
263   Therm109(T109_3M,1,7,1,0,_60Hz,1,0)
264   'Only measure the soil moisttture probes once and hour;test with 5 minut
265   If IfTime(0,30,Min) Then
266   'Turn AM416 Multiplexer On
267   PortSet(3,1)
268   'Turn CS615s On
269   PortSet(2,1)
270   LCount=1
271   'Do 4 scans of reading only the H1 and L1. We only have one diff channe
272   ' the CR1000 so ignoring the H2 & L2 channels.
273   SubScan(0,uSec,4)
274   'Switch to next AM416 Multiplexer channel
275   PulsePort(1,10000)
276   'CS615 Water Content Reflectometer measurements 'VW()' and 'PA_mS()'
277   PeriodAvg(PA_mS(LCount),1,mV2500,8,0,0,10,50,0.001,0)
278   LCount=LCount+1
279   NextSubScan
280   'Convert to soil water volume
281   For LCount=1 To 4
282     VW(LCount)=-0.187+(0.037*PA_mS(LCount))+(0.335*PA_mS(LCount)^2)
283   Next
284   'Turn CS615s Off
285   PortSet(2,0)
286   'Turn AM416 Multiplexer Off
287   PortSet(3,0)
288   EndIf
289   'Type T (copper-constantan) Thermocouple measurements 'Temp_C_2()' on the
290   AM25T(SoilTemp_C(),11,mV2_5C,1,5,TypeT,RTempC,6,4,Vx2,True,0,250,1,0)
291   'Type T (copper-constantan) Thermocouple measurements 'Temp_C()' on the A
292   AM25T(SoilTemp_C_2(),25,mV2_5C,1,6,TypeT,RTempC_2,6,5,Vx2,True,0,250,1,0)
293   'LI190SB Quantum Sensor measurements PAR_Den on AM25T No. 1; Start at cha
294   AM25T(PAR_Den(),3,mV25,12,5,-1,RTempC,6,4,0,True,0,250,1,0)
295   For LCount=1 To 3
296     PAR_Den(LCount)=PAR_Den(LCount)*200
297     If PAR_Den(LCount)<0 Then PAR_Den(LCount)=0
298   Next
299   'BF3 diffiuse and direct
300   VoltDiff(BF3_Direct_PAR,1,mV2500,7,True,0,250,1,0)
301   VoltDiff(BF3_Diffuse_PAR,1,mV2500,8,True,0,250,1,0)
302   'Call Data Tables and Store Data
303   CallTable(Hourly)
304   CallTable(Daily)
305   NextScan
306   EndProg
```