Spectrafy
solar spectral sensors

# Application Note:

# Interfacing SolarSIM-ALB with Campbell Scientific Dataloggers

# 1. Introduction

This application note describes how to interface the SolarSIM-ALB with a Campbell Scientific CR6 series datalogger.

The provided instructions and programs can be easily adapted to other Campbell Scientific dataloggers.

# 2. Wiring to a datalogger

The SolarSIM-ALB uses the RS-485 communication protocol in half-duplex mode. The CR6 series datalogger, as shown in Figure 1, has two half-duplex RS-485 ports. Either one can be used to acquire data from the SolarSIM-ALB.

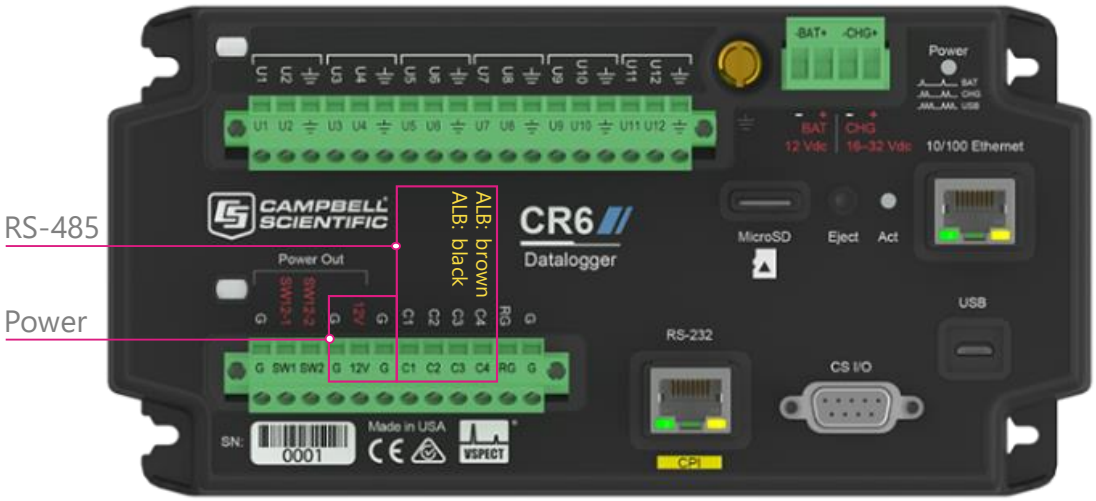


Figure 1. Interfacing with a Campbell Scientific's CR6 series datalogger

The wire colour guide for the SolarSIM-ALB is as follows:

| -ALB Wire Colour | Label | CR6 Connection | Function |
|---|---|---|---|
| Blue | $V_{in}$ | 12V | Input voltage (+12 VDC) |
| White | GND | G | Common ground |
| Black | A- | C3 | Negative RS-485 input |
| Brown | B+ | C4 | Positive RS-485 input |



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# 3. Datalogger communication

## a. Serial port configuration

The serial port for the SolarSIM-ALB should be configured as follows:

| Parameter | Value |
|---|---|
| Baud rate | 9600 |
| Parity | None |
| Data bits | 8 |
| Stop bits | 1 |

## b. Serial command for the SolarSIM-ALB

Only one serial command is needed per each SolarSIM-G to acquire raw data:

N*xxxx*_E

where *xxxx* is the serial number of either the up-facing or down-facing SolarSIM-G. Once the command is sent, the SolarSIM-G sends an ASCII string with the ambient temperature, pressure and relative humidity, the internal temperature and relative humidity, and nine channel voltages. The following ASCII string is a sample output:

N1010_2500.000,1013.120,4750.000,2600.000,1050.000,2500.032,4999.999,
0000.001,1274.004,2746.321,3291.214, 3924.385,1900.500,0500.123/r/n

This string can be parsed as:

N"serial number"_"(Tout + 50) x 75" , "$P_{out}$ x 10" , "$H_{out}$ x 100" , "($T_{in}$ + 50) × 75" , "$H_{in}$ x 100" , "V1", "V2" , "V3" , "V4" , "V5" , "V6" , "V7" , "V8" , "V9""end of line character"

where:

$T_{out}$ = ambient temperature
$P_{out}$ = ambient atmospheric pressure
$H_{out}$ = ambient relative humidity
$T_{in}$ = internal SolarSIM-G temperature
$H_{in}$ = internal SolarSIM-G relative humidity



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The aforementioned example string is parsed in the table below:

| Parameter | Symbol | Value | Units |
|---|---|---|---|
| Ambient temperature | $T_{out}$ | -16.67 | ℃ |
| Ambient pressure | $P_{out}$ | 101.312 | kPa |
| Ambient humidity | $H_{out}$ | 47.50 | % |
| Internal temperature | $T_{in}$ | -15.33 | ℃ |
| Internal humidity | $H_{in}$ | 10.50 | % |
| Voltage channel 1 | $V_1$ | 2500.032 | mV |
| Voltage channel 2 | $V_2$ | 4999.999 | mV |
| Voltage channel 3 | $V_3$ | 0.001 | mV |
| Voltage channel 4 | $V_4$ | 1274.004 | mV |
| Voltage channel 5 | $V_5$ | 2746.321 | mV |
| Voltage channel 6 | $V_6$ | 3291.214 | mV |
| Voltage channel 7 | $V_7$ | 3924.385 | mV |
| Voltage channel 8 | $V_8$ | 1900.500 | mV |
| Voltage channel 9 | $V_9$ | 500.123 | mV |

Note, the described data acquisition must be performed for both - the up-facing and down-facing SolarSIM-Gs.



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# 4. CRBasic Code

```
'Description: Acquires raw data from the SolarSIM-ALB
'Datalogger:  CR6 from Campbell Scientific
'Author:      Spectrafy Inc.
'Version:     1.0

'Defines user constants
Const Timezone     = -5 'hrs
Const DAQRate      = 60 's
Const SamplingRate = 5  's  (min. 2 s)

'Defines program constants
Const TerminationCharacter = CHR(10)
Const SerialCommand_G1 =  "N1071_E"  'Serial command for the downwelling
SolarSIM-G
Const SerialCommand_G2 = "N1072_E"   'Serial command for the upwelling
SolarSIM-G'

'Declares public variables
Public SerialData_G1 As String *256
Public SerialData_G2 As String *256
Public SerialData As String *256
Public OutputData_ALB(28)

'Declares data table column names for the SolarSIM-G1
Alias OutputData_ALB(1)  = AmbientTemperature_G1     'C
Alias OutputData_ALB(2)  = AmbientPressure_G1        'kPa
Alias OutputData_ALB(3)  = AmbientHumidity_G1        '%
Alias OutputData_ALB(4)  = InternalTemperature_G1    'C
Alias OutputData_ALB(5)  = InternalHumidity_G1       '%
Alias OutputData_ALB(6)  = ChannelVoltage1_G1        'mV
Alias OutputData_ALB(7)  = ChannelVoltage2_G1        'mV
Alias OutputData_ALB(8)  = ChannelVoltage3_G1        'mV
Alias OutputData_ALB(9)  = ChannelVoltage4_G1        'mV
Alias OutputData_ALB(10) = ChannelVoltage5_G1        'mV
Alias OutputData_ALB(11) = ChannelVoltage6_G1        'mV
Alias OutputData_ALB(12) = ChannelVoltage7_G1        'mV
Alias OutputData_ALB(13) = ChannelVoltage8_G1        'mV
Alias OutputData_ALB(14) = ChannelVoltage9_G1        'mV

'Declares data table column names for the SolarSIM-G2
Alias OutputData_ALB(15) = AmbientTemperature_G2     'C
Alias OutputData_ALB(16) = AmbientPressure_G2        'kPa
Alias OutputData_ALB(17) = AmbientHumidity_G2        '%
Alias OutputData_ALB(18) = InternalTemperature_G2    'C
Alias OutputData_ALB(19) = InternalHumidity_G2       '%
Alias OutputData_ALB(20) = ChannelVoltage1_G2        'mV
Alias OutputData_ALB(21) = ChannelVoltage2_G2        'mV
```



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```
Alias OutputData_ALB(22) = ChannelVoltage3_G2        'mV
Alias OutputData_ALB(23) = ChannelVoltage4_G2        'mV
Alias OutputData_ALB(24) = ChannelVoltage5_G2        'mV
Alias OutputData_ALB(25) = ChannelVoltage6_G2        'mV
Alias OutputData_ALB(26) = ChannelVoltage7_G2        'mV
Alias OutputData_ALB(27) = ChannelVoltage8_G2        'mV
Alias OutputData_ALB(28) = ChannelVoltage9_G2        'mV

'Defines data table for SolarSIM-G
DataTable (Spectrafy_ALB,1,-1)        'Autoallocates table size
  DataInterval (0,DAQRate,Sec,10)     'Sets the DAQ rate
  Sample (1,Timezone,FP2)             'Stores timezone
  FieldNames("Timezone")              'Names "Timezone" column
  Average (28,OutputData_ALB,IEEE4,0) 'Stores raw data
EndTable


'Executes main program
BeginProg
  'Initializes serial port for the SolarSIM-ALB
  SerialOpen (ComC3,9600,0,0,256,4)  'RS-485 communication on port "ComC3"
                                     'Black wire (A-) to C3 terminal (from
both G1 and G2)
                                     'Brown wire (B+) to C4 terminal (from
both G1 and G2)
                                     'Baud rate: 9600 bps
                                     'Buffer size: 256 bytes
                                     'Mode: 4 (half-duplex RS485)


'-----------------------------SolarSIM-G1---------------------------------
  'Sets a 5 s scan interval
  Scan (SamplingRate,Sec,0,0)

      'Transmits the broadcast command
            SerialOut (ComC3,SerialCommand_G1,"",0,0)

            'Receives serial data with a 1000 ms timeout
            SerialIn (SerialData_G1,ComC3,100,TerminationCharacter,256)

      'Clears the serial buffer
            SerialFlush (ComC3)

      'Removes the header from the serial data
            SerialData_G1 = Mid(SerialData_G1,7,256)
```



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```
'----------------------------SolarSIM-G2--------------------------------

      'Transmits the broadcast command
            SerialOut (ComC3,SerialCommand_G2,"",0,0)

            'Receives serial data with a 1000 ms timeout
            SerialIn (SerialData_G2,ComC3,100,TerminationCharacter,256)

      'Clears the serial buffer
            SerialFlush (ComC3)

      'Removes the header from the serial data
            SerialData_G2 = Mid(SerialData_G2,7,256)

      'Combines G1 and G2 serial data

      SerialData = SerialData_G1 + "," + SerialData_G2

      'Parses the serial data into numeric values
            SplitStr (OutputData_ALB(),SerialData,"",28,0)

      'Converts raw G1 data into meteorological data
       AmbientTemperature_G1 = (AmbientTemperature_G1 / 75.0) - 50.0
       AmbientPressure_G1 = AmbientPressure_G1 / 10.0
       AmbientHumidity_G1 = AmbientHumidity_G1 / 100.0
       InternalTemperature_G1 = (InternalTemperature_G1 / 75.0) - 50.0
       InternalHumidity_G1 = InternalHumidity_G1 / 100.0

      'Converts raw G2 data into meteorological data
       AmbientTemperature_G2 = (AmbientTemperature_G2 / 75.0) - 50.0
       AmbientPressure_G2 = AmbientPressure_G2 / 10.0
       AmbientHumidity_G2 = AmbientHumidity_G2 / 100.0
       InternalTemperature_G2 = (InternalTemperature_G2 / 75.0) - 50.0
       InternalHumidity_G2 = InternalHumidity_G2 / 100.0

      'Passes raw SolarSIM-ALB data to "Spectrafy" table
        CallTable Spectrafy_ALB

      NextScan

EndProg
```

## 5. Support

If you have any questions regarding your specific application, don't hesitate to contact Spectrafy at info@spectrafy.com.



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