Spectrafy
solar spectral sensors

User Manual:

Multi-Photodiode Pyranometer

SolarBand-C3

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User information

Spectrafy strongly recommends reading this instruction manual prior to installation and operation of your SolarBand-C3.

If you have any comments about this manual or our products, please send them to:

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CE Conformity

CE

The SolarBand-C3 is CE compliant and has been evaluated in accordance with EN IEC 61326-1:2021, Class A, for both electromagnetic emissions and immunity. It also conforms to the essential requirements of the following European Union directives:

- EMC Directive 2014/30/EU
- Machinery Directive 2006/42/EC

RoHS directive

RoHS

The Solarband-C3 complies with Directive 2011/65/EU on the restriction of certain hazardous substances in electrical and electronic equipment, as amended by Commission Delegated Directive (EU) 2015/863.

Warranty and liability

Spectrafy confirms that the SolarBand-C3 has undergone comprehensive testing to verify compliance with all specified performance standards. The product comes with a two-year warranty from the date of invoice, provided it is installed and operated correctly. Spectrafy is not responsible for any losses or damages resulting from misuse of the device.

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Introduction

Dear Customer, thank you for purchasing the SolarBand-C3 from Spectrafy. This manual provides complete guidance for the use and operation of your instrument.

The SolarBand-C3 represents a step forward in the measurement of diffuse irradiance. It combines the precision of an automated shadowband with the reliability of a fully enclosed system to provide accurate, cost-effective measurements of diffuse, global, and direct irradiance, from a single digital sensor with no external moving parts.

The instrument employs four photodiodes (two global, two diffuse) and an automated internal shadowband to measure global horizontal irradiance (GHI) and diffuse horizontal irradiance (DHI) simultaneously. The shadowband is mounted to an internal stepper motor that slowly rotates over the course of each day, ensuring that the DHI sensor remains continuously shaded, while the GHI sensors are always unshaded.

Key features include:

- RS-485 Modbus RTU communication,
- Internal diagnostics
- Built-in heating
- Over-voltage and reverse voltage protection
- Onboard GPS and automated alignment verification
- Third-party calibration support

Applications include solar resource assessment, PV plant operation, and meteorological research and monitoring networks.

For any questions, feel free to contact us at `info@spectrafy.com`.

Sincerely,
Spectrafy Team

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Specifications

Diffuse Horizontal Irradiance

Accuracy (k=2)	± 4% Daily integral ± 4% ± 5 W/m² hourly average ± 5% ± 5 W/m² individual readings
Measurement range	0 - 2000 W/m²
Response time (95%)	< 0.1 s
Non-stability (change per year)	< 0.2%
Non-linearity	< 0.5%
Zero offset A	n/a
Zero offset B	n/a
Spectral range	300–1130 nm
Temperature response (-10 °C to +40 °C)	< 0.5% (on-board temperature correction)
Latitude capability	-90 ° to +90 °

Global Horizontal Irradiance

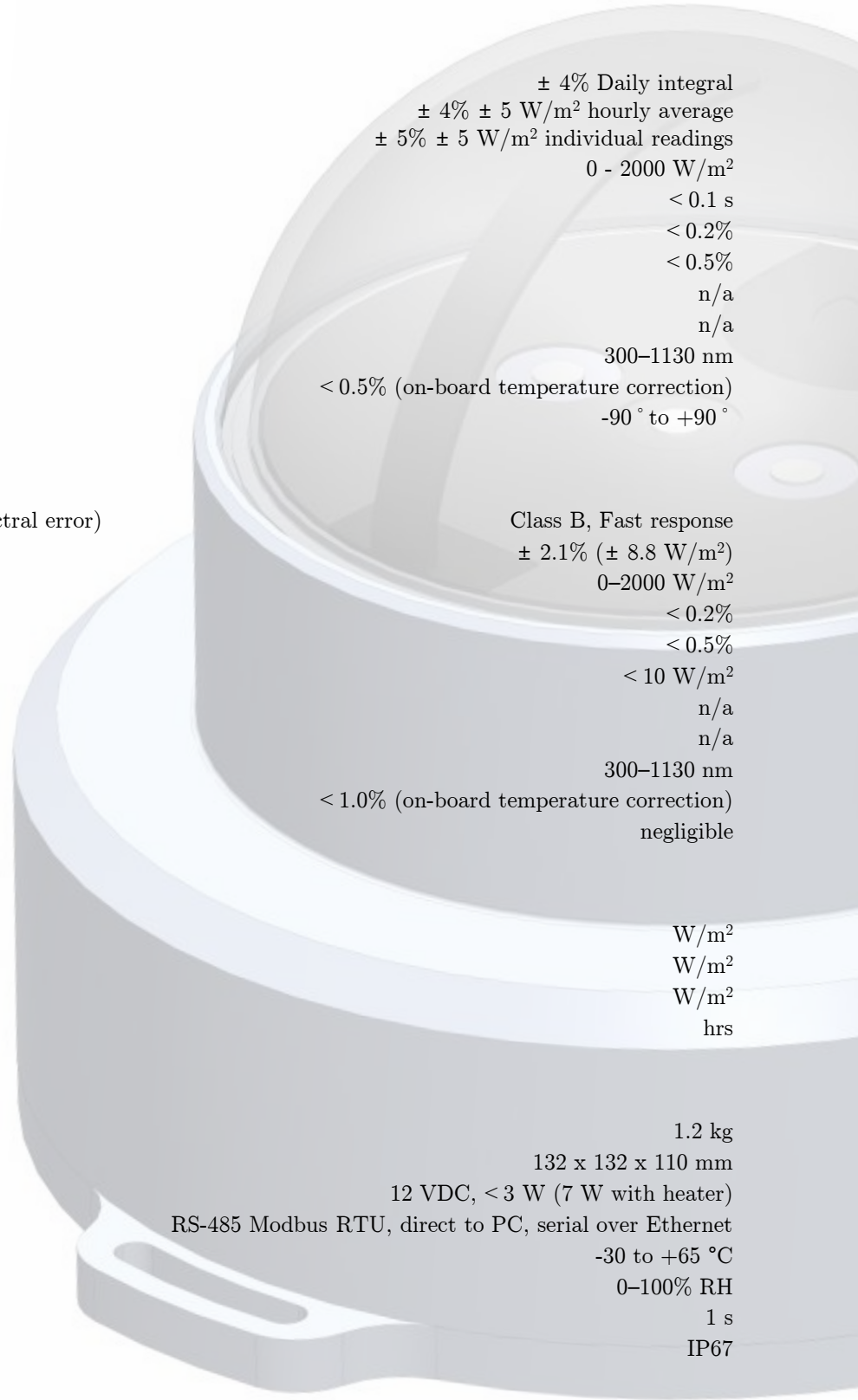
ISO 9060:2018 classification (excluding spectral error)	Class B, Fast response
Max. spectral error (per ISO9060:2018)	± 2.1% (± 8.8 W/m²)
Measurement range	0–2000 W/m²
Non-stability (change per year)	< 0.2%
Non-linearity	< 0.5%
Cosine error	< 10 W/m²
Zero offset A	n/a
Zero offset B	n/a
Spectral range	300–1130 nm
Temperature response (-10 °C to +40 °C)	< 1.0% (on-board temperature correction)
Tilt response	negligible

Measurands

Global horizontal solar irradiance	W/m²
Diffuse horizontal solar irradiance	W/m²
Direct normal solar irradiance (calculated)	W/m²
Sunshine duration	hrs

General specifications

Weight	1.2 kg
Dimensions	132 x 132 x 110 mm
Power supply	12 VDC, < 3 W (7 W with heater)
Communication	RS-485 Modbus RTU, direct to PC, serial over Ethernet
Operating temperature range	-30 to +65 °C
Humidity range	0–100% RH
Max measurement frequency	1 s
Ingress protection rating	IP67



1 Main Components

The main components of the SolarBand-C3 are shown in Figure 1 and include:

- **Glass dome** - prevents the ingress of moisture and debris.
- **Shadowband** - blocks direct sunlight, shading the DHI sensor.
- **Rotating diffuser plate** - rotates via an internal motor using the onboard GPS.
- **DHI sensor** - continuously shaded and measures the diffuse horizontal irradiance.
- **GHI sensors** - measure the global horizontal irradiance.
- **GPS cover** - shields the GPS antenna.
- **Aluminum enclosure** - provides protection from the environment.
- **Bubble level** (hidden) - ensures horizontal alignment.
- **Connector** - provides power and communication.
- **Backplate** - enables mounting via the mounting slots.

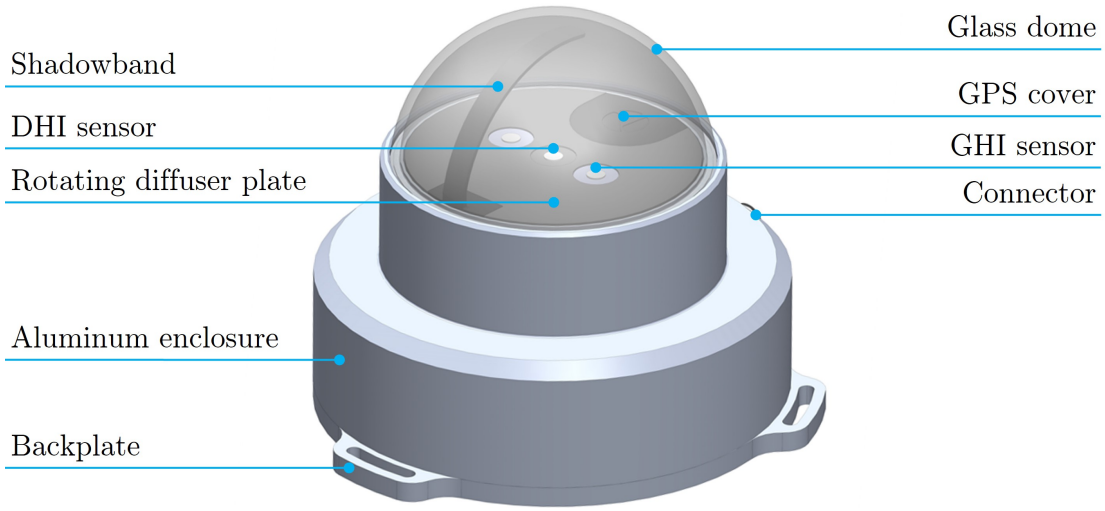


Figure 1: SolarBand-C3 components.

2 Installation

2.1 Contents of Delivery

Each SolarBand-C3 package should include:

- 1 × SolarBand-C3
- 1 × communication/power cable
- 1 × COMBOX (optional)
- 1 × mounting plate (optional)
- 3 × mounting screws and springs
- 1 × USB key loaded with the SolarBand-C3 software
- 1 × SolarBand-C3 calibration certificate

Please inspect your package upon receipt and note any damage that may have occurred during shipment. If damage is found, file a claim with the carrier and contact Spectrafy to arrange repair or replacement of the instrument and/or its accessories.

2.2 Field Installation

Installation of the SolarBand-C3 requires only a Phillips screwdriver and a digital compass. The installation procedure is detailed below:

1. Install the mounting plate at the measurement site with one threaded hole pointing toward the equator. Please refer to Figure 2 for relevant dimensions.

2. Mount the SolarBand-C3 using the supplied screws and springs, as shown in Figure 3. Orient the connector away from the equator, i.e. pointing North in Northern Hemisphere (or South in the Southern Hemisphere), as illustrated in Figure 4. Use a digital compass if needed.

3. Level the SolarBand-C3 by adjusting the mounting screws until the bubble is centered in the bubble level.

4. Power the unit by connecting the bare ends of the communication and power cable to a 12 VDC power supply. Ensure that the wiring is compliant with Table 1. Alternatively, a Spectrafy COMBOX can be used to power the SolarBand-C3 via a laptop/PC.

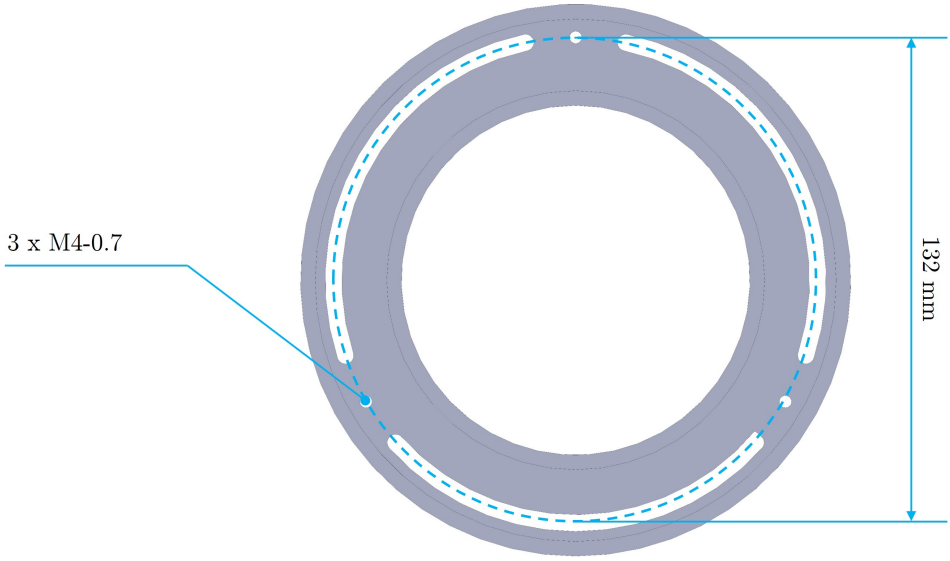


Figure 2: Dimensional drawing of a mounting plate with three M4-0.7 mounting holes spaced 120° apart on a 132 mm circle.

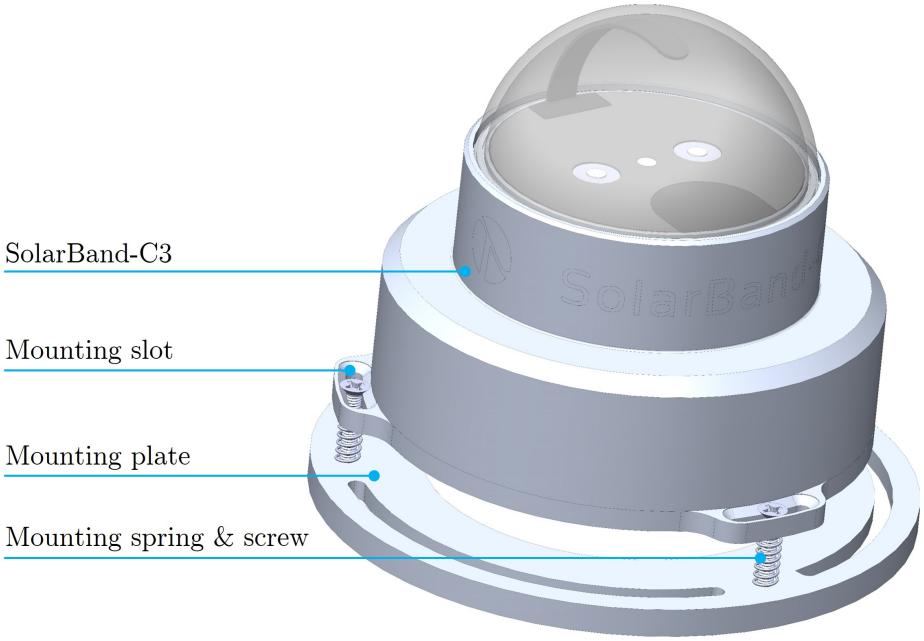
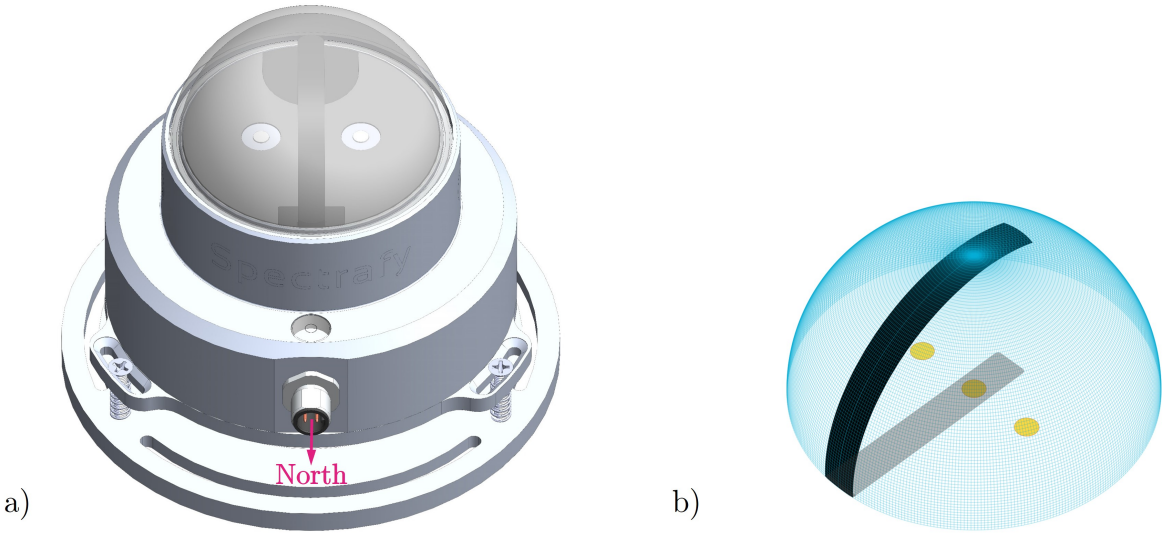


Figure 3: Assembled SolarBand-C3 on a mounting plate.



a) b)

Figure 4: a) The correct orientation of the installed SolarBand-C3 with the connector pointing North for Northern hemisphere. b) Illustration showing correct shadowband alignment.

5. Once powered, the SolarBand-C3 will automatically rotate the shadowband to the *home* position, where it aligns with the connector, as shown in Figure 4a. The onboard GPS unit will then search for nearby satellites to determine the instrument's geographic location. This process may take several minutes depending on satellite availability, horizon obstructions, and atmospheric conditions.

6. Once a GPS fix is obtained, the SolarBand-C3 will move the shadowband to the local sun's azimuth angle, i.e. directly facing the sun. The DHI sensor should be partially or fully shaded. If necessary, rotate the SolarBand-C3 through its mounting slots, so that the DHI sensor is centered within the shadow cast by the shadowband, as illustrated in Figure 4b. Note: final alignment of the SolarBand-C3 will require sufficient direct sunlight to generate the shadow cast by the shadowband.

7. Check the bubble level alignment and adjust if necessary.

Table 1: General wiring guide for the SolarBand-C3.

Colour	Label	Function
Blue	V_{in}	Input voltage (+12 VDC)
White	GND	Common ground
Black	A−	Negative RS-485 input
Brown	B+	Positive RS-485 input

3 Maintenance

The SolarBand-C3 requires minimal maintenance but for optimal performance it is important to routinely perform/verify the following:

- **Cleaning:** Clean the glass dome regularly with a dry, non-abrasive cloth.
- **Alignment:** Check the alignment of the shadowband and adjust it if necessary, as shown in Figure 4b. Note: the need for adjustments should be minimal
- **Leveling:** Check the bubble level and adjust the mounting screws if necessary.
- **Desiccant:** Regularly monitor the internal humidity of the SolarBand-C3. The desiccant typically lasts over two years and can be replaced as part of the recalibration process. The desiccant should be replaced if the internal humidity exceeds 30%.
- **Recalibration:** To maintain the SolarBand-C3's measurement accuracy, recalibration is recommended every 2 years.

4 Connectivity

The SolarBand-C3 offers several connectivity options to accommodate most use-case scenarios. These options include:

1. Spectrafy Communication Box (COMBOX)
2. Serial-over-Ethernet converter (SoE)
3. Datalogger

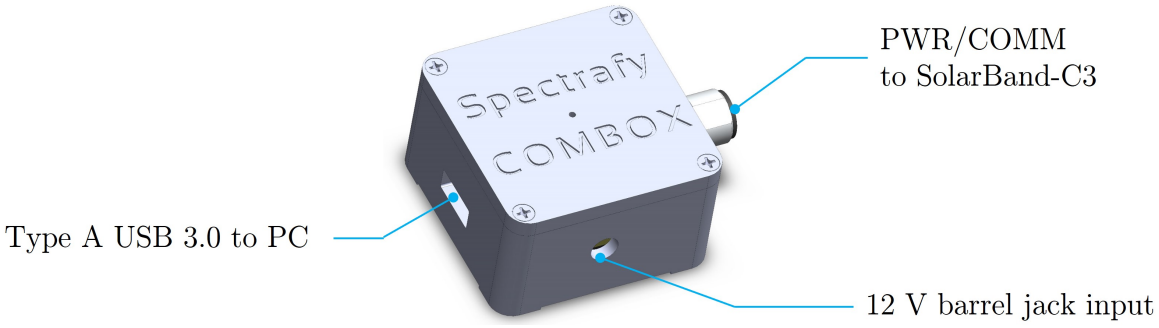


Figure 5: The COMBOX connects the SolarBand-C3 to a PC.

4.1 Spectrafy COMBOX

The COMBOX, as pictured in Figure 5, provides the fastest and most convenient way to retrieve data from the SolarBand-C3. Follow the steps below to install the COMBOX, then see Section 5 regarding the SolarBand-C3 DAQ application:

1. Connect one end of the communication cable to the SolarBand-C3.
2. Connect the opposite end of the cable to the COMBOX.
3. Connect the 12 V barrel jack connector from the power supply to the COMBOX. A blue LED confirms that power is being supplied to the SolarBand-C3.
4. Connect one end of a male-to-male USB 3.0 cable to the COMBOX.
5. Connect the other end of the USB 3.0 cable to a PC.
6. Allow the PC to install the required FTDI drivers; this process may take several minutes and it may require to restart the PC.

4.2 Serial-over-Ethernet Converter

For locations with a suitable local area network, the SolarBand-C3 can be connected to a networked PC using a suitable serial-over-Ethernet (SoE) converter, such as the ICP DAS I-7188-E2[1]. The user must connect the SolarBand-C3 communication cable wires as per Table 1. Specifically, the B+ and A− lines (brown and black wires, respectively) should be connected to the corresponding input/output (I/O) terminals on the SoE device. The blue and white wires must be connected to the positive and common ground terminals of a 12 V power supply, respectively. The SoE converter and the power supply must share a common ground.

A static IP address must be assigned to the SoE converter by the network administrator. Once assigned, a virtual communication link can be established using VxComm software[2]. After proper configuration as per Figures 6 and 7, the VxComm software creates a virtual serial port on the networked PC, which is then used by the SolarBand-C3 DAQ application to communicate with the instrument. More information on the SolarBand-C3 DAQ application is presented in Section 5.

4.3 Datalogger

The SolarBand-C3 can be connected to any datalogger that possesses an available RS-485 port and supports the Modbus RTU communication protocol. The SolarBand-C3 communication cable must be wired to the appropriate datalogger I/O terminals. Additional details are provided in Section 6.

[1] `https://www.icpdas-usa.com/i_7188e2.html`
[2] `http://ftp.icpdas.com/pub/cd/8000cd/napdos/driver/vxcomm_driver/windows/`

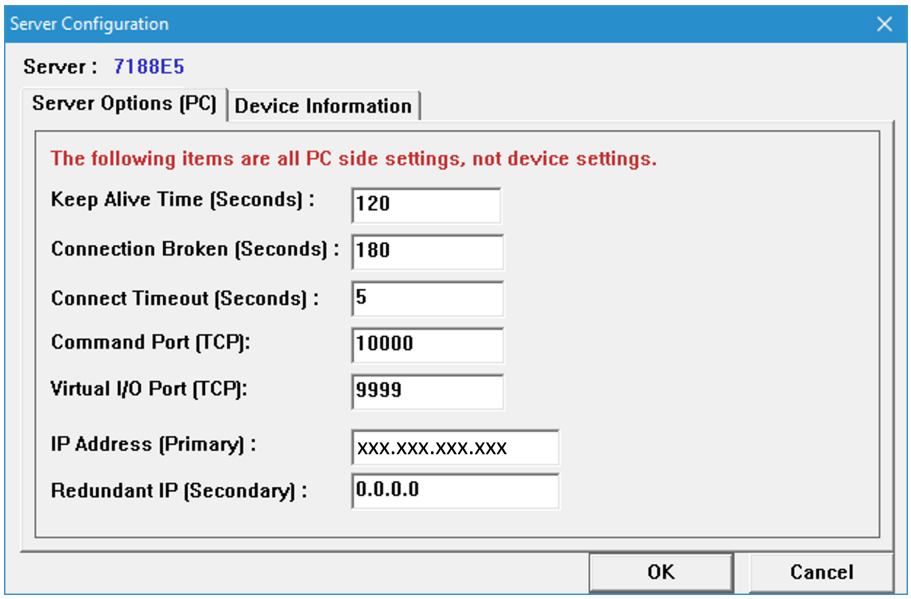


Figure 6: Server configuration with VxComm software.

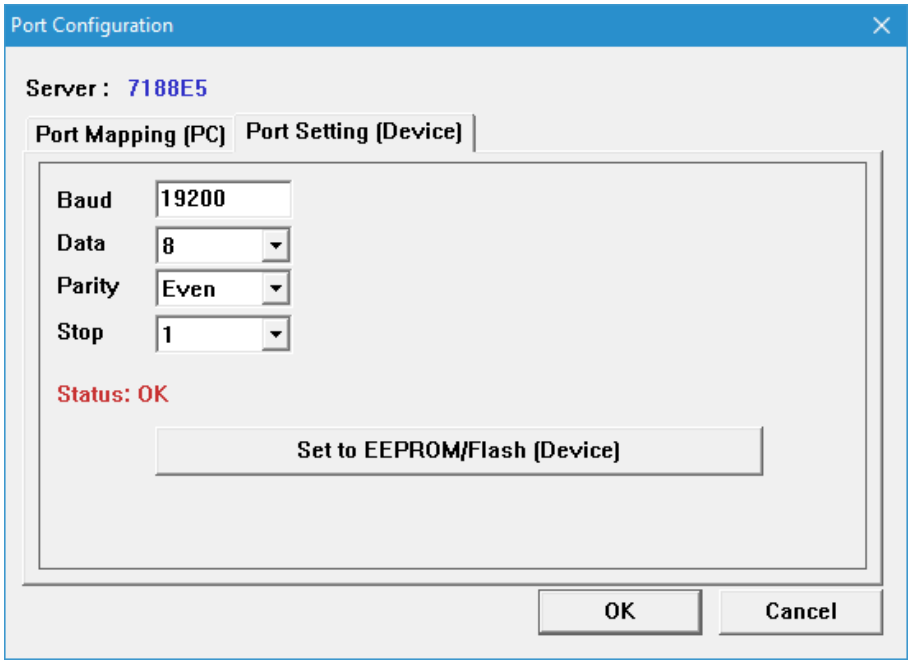


Figure 7: Serial port configuration with VxComm software.

5 SolarBand-C3 DAQ Application

The SolarBand-C3 DAQ application provides real-time visibility on instrument status, manages data acquisition and storage, and generates daily plots for multiple measurement parameters. Communication with the SolarBand-C3 is handled via a serial interface using the Modbus RTU protocol, enabling compatibility with either the COMBOX or a SOE converter. This section outlines the software installation procedure, configuration options, and general operation of the application.

5.1 Software Installation

The software is installed by running the setup executable located in the SolarBand-C3 DAQ SNxxxx Installer\Volume folder on the supplied USB drive, as shown in Figure 8. Please note, xxxx is a four-digit serial number of the SolarBand-C3. Follow the on-screen installation instructions to complete the installation process.

5.2 Software Settings

After installation, the user can configure the data acquisition (DAQ) and sampling rates by editing the user_settings.conf file located in the SolarBand-C3 DAQ SNxxxx\Settings folder of the installation directory, as shown in Figure 9. The DAQ timer defines the overall data acquisition interval for the SolarBand-C3, while the Sampling rate determines how frequently measurements are polled within each acquisition interval. The DAQ rate can also be adjusted directly through the SolarBand-C3 DAQ application. Other parameters, such as the Modbus address and Serial number, should generally remain unchanged.

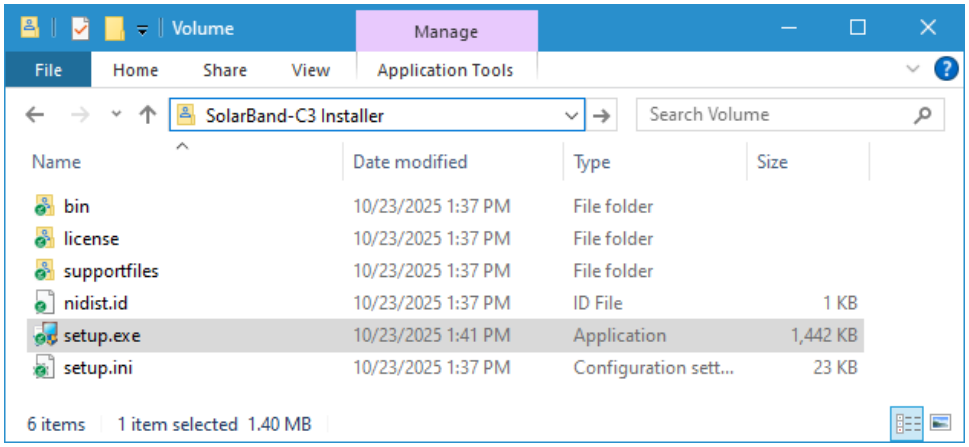


Figure 8: Installation of the SolarBand-C3 DAQ software.

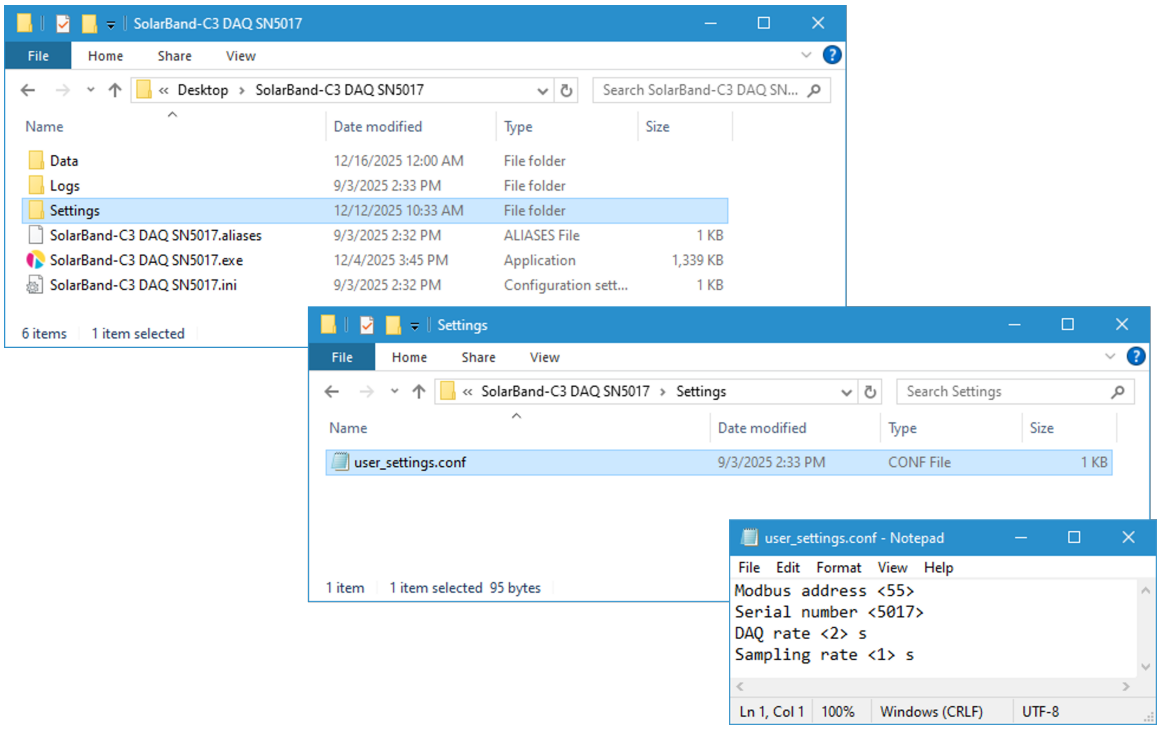


Figure 9: Accessing the SolarBand-C3 DAQ user settings file.

Figure 10: Failing to detect the SolarBand-C3.

5.3 Using the Software

The SolarBand-C3 DAQ software is launched by opening the executable file named SolarBand-C3 DAQ SNxxxx.exe file. The application must be run in administrator mode to allow data to be saved in the Program files directory.

Upon startup, the software automatically searches for the serial port connected to the SolarBand-C3. If the instrument is not detected, an error message is displayed, as shown in Figure 10, and the application closes. In this case, verify that the correct serial or COM port is visible in the Device Manager. If the issue occurs when using the SoE converter, verify the configuration and wiring as specified in Section 4.2.

Once the serial connection is established, the main window of the application will open,

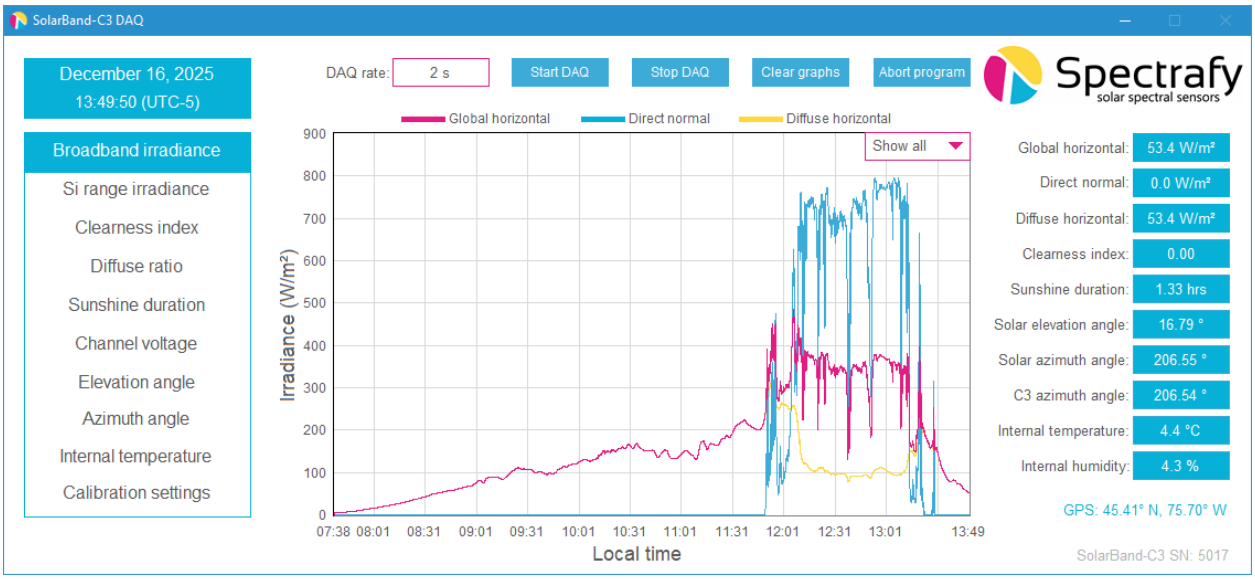


Figure 11: Main window of the SolarBand-C3 DAQ application

as shown in Figure 11. The SolarBand-C3 will then start searching for a GPS fix, as indicated in the lower right corner of the main window. Once a GPS fix is obtained, the detected latitude and longitude will be displayed. Data acquisition will then begin automatically.

The software displays real-time measurements of global horizontal, diffuse horizontal, and direct normal irradiance in both the broadband (280–4000 nm) and silicon (280–1200 nm) ranges. Additional time-series parameters include clearness index, diffuse ratio, sun duration (as defined by the World Meteorological Organization), channel voltages, sun elevation and azimuth angles, and internal temperature and humidity. With the exception of internal temperature and humidity, data is recorded for all solar elevations above -5°.

The data acquisition rate can be set between 1 second and 3600 seconds using the control located next to the Start DAQ button. To change the DAQ rate, first press the Stop DAQ button, enter the desired interval in seconds, and then press the Start DAQ button. Note that in the event that the software is restarted, the default DAQ rate will be the value specified in the user_settings.conf file.

5.4 Data Storage

The SolarBand-C3 DAQ stores measurement data in daily summary CSV files within the Data folder of the the installation directory. An example of the SolarBand-C3 data file is presented in Figure 12. At a data acquisition rate of two seconds, the daily summary file size is approximately 4 MB.

Timestamp	Time zone (hr)	SPA elevation (deg)	SPA azimuth (deg)	C3 azimuth (deg)	Internal temperature (C)	Internal humidity (%)	GHI (W/m2)	DHI (W/m2)	DNI (W/m2)
2025-12-16 13:00:00	-5	19.88	194.96	194.84	8.77	4.4	368.45	107.15	768.35
2025-12-16 13:00:02	-5	19.88	194.96	194.84	8.77	4.4	368.4	107.03	768.53
2025-12-16 13:00:04	-5	19.88	194.97	194.84	8.77	4.4	368.95	106.95	770.4
2025-12-16 13:00:06	-5	19.88	194.97	194.84	8.77	4.4	368.57	106.83	769.53
2025-12-16 13:00:08	-5	19.875	194.985	194.955	8.78	4.4	367.75	106.75	767.65
2025-12-16 13:00:10	-5	19.87	195	195.07	8.78	4.4	367.5	106.65	767.4
2025-12-16 13:00:12	-5	19.87	195	195.07	8.79	4.4	367.13	106.53	766.77
2025-12-16 13:00:14	-5	19.87	195.01	195.07	8.78	4.4	367.4	106.4	768.1
2025-12-16 13:00:16	-5	19.87	195.01	195.07	8.78	4.4	367.33	106.3	767.9
2025-12-16 13:00:18	-5	19.87	195.02	195.07	8.79	4.4	367.1	106.2	767.6

GHI SI (W/m2)	DHI SI (W/m2)	Sunshine duration (hr)	Diffuse ratio	Clearness index	CH1 (mV)	CH2 (mV)	CH3 (mV)	CH4 (mV)
299.75	101.2	1.054	0.29	1.008	882.9	887.95	525.4	352.65
299.73	101.07	1.055	0.29	1.009	882.83	888.2	524.87	352.33
300.15	101	1.055	0.289	1.011	887.45	886.3	524.35	352.1
299.87	100.93	1.056	0.29	1.01	885.6	886.33	523.9	351.83
299.15	100.85	1.056	0.29	1.007	880.95	887.4	523.25	351.45
298.95	100.8	1.057	0.29	1.007	882.45	885.45	522.55	351.2
298.7	100.63	1.057	0.289	1.007	876.8	886.6	522.07	350.77
298.9	100.5	1.058	0.289	1.008	880.5	886.2	521.2	350.3
298.8	100.43	1.059	0.289	1.008	880.17	886.13	520.8	350.03
298.7	100.4	1.059	0.289	1.007	879.75	885.55	520.35	349.8

Figure 12: An example of the SolarBand-C3 daily summary file.

5.5 Changing Default Language for Non-Unicode Characters

On computers using non-Latin languages, such as Mandarin, the SolarBand-C3 DAQ may not display non-Unicode characters correctly. To fix this, set the default language for non-Unicode programs to English. First, open the Control Panel and go to Clock, Language, and Region, then click on Region settings, as shown in Figure 13. Next, navigate to the Administrative tab and select Change system locale..., as demonstrated in Figure 14. Finally, choose English from the drop-down menu, as shown in Figure 15, and press OK.

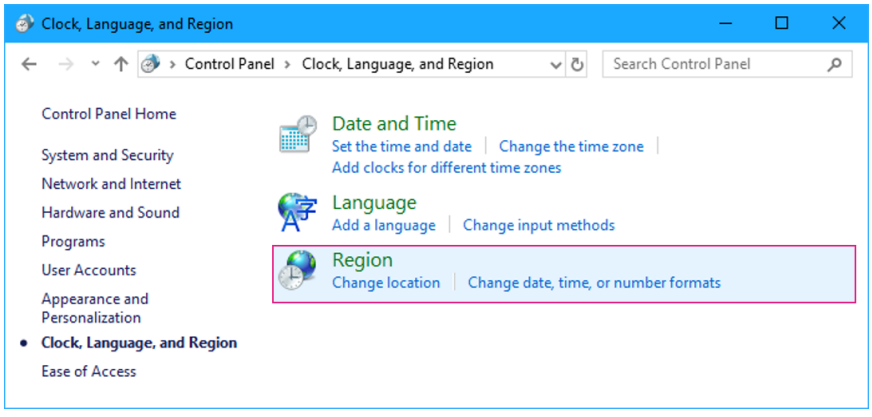


Figure 13: Clock, Language, and Region settings in the Control Panel.

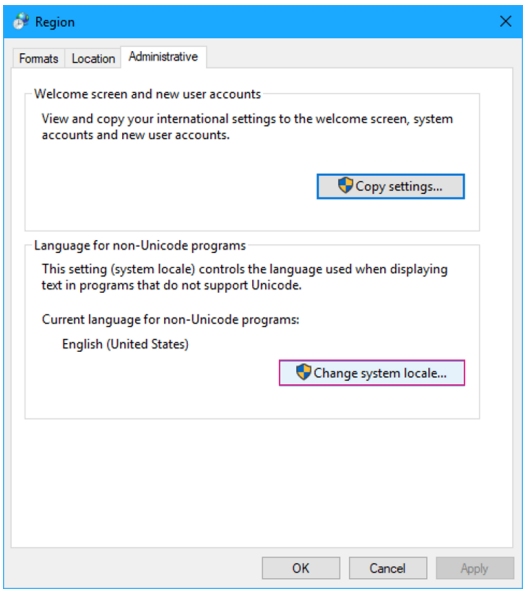


Figure 14: Changing the system locale in the Administrative tab of the Region settings.

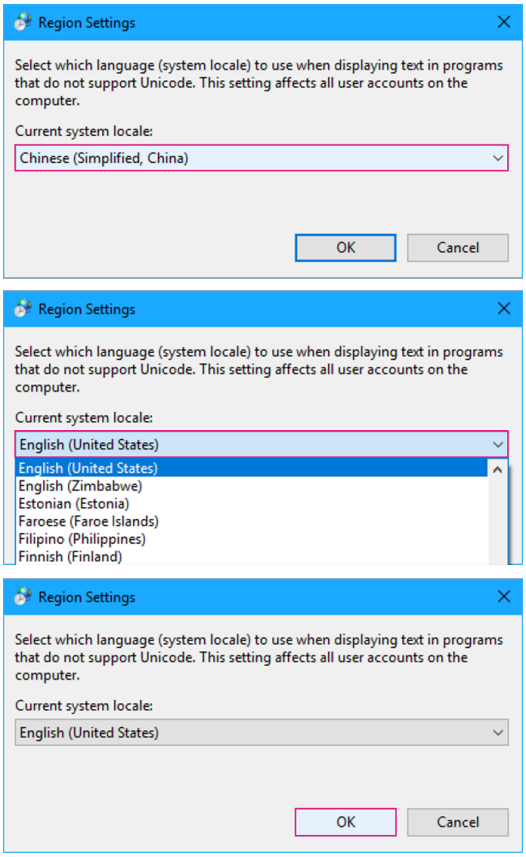


Figure 15: Changing the default language for non-Unicode characters.

6 Datalogger Setup

The SolarBand-C3 can be connected to any datalogger that has an RS-485 port and supports the Modbus RTU protocol. This section explains how to connect the SolarBand-C3 to a data logger, using the Campbell Scientific CR6 datalogger as an example. Wiring, serial port configuration, and example datalogger code are provided. These instructions can also be adapted for other suitable dataloggers.

6.1 Datalogger Wiring

The SolarBand-C3 communicates via the RS-485 Modbus RTU protocol in half-duplex mode. The CR6 series datalogger has two half-duplex RS-485 ports, either of which can be used. The wiring connections between the SolarBand-C3 and the CR6 datalogger are summarized in Table 2, and the CR6's I/O terminals are shown in Figure 16. In this example, the CR6's COMC1 port is used along with its onboard 12 V power supply.

Table 2: Wiring guide for the SolarBand-C3 with a CR6 datalogger.

SolarBand-C3 wire	CR6 datalogger pin	Pin function
Blue	12 V	Output voltage
White	G	Common ground
Black	C1	A- RS-485 input
Brown	C2	B+ RS-485 input

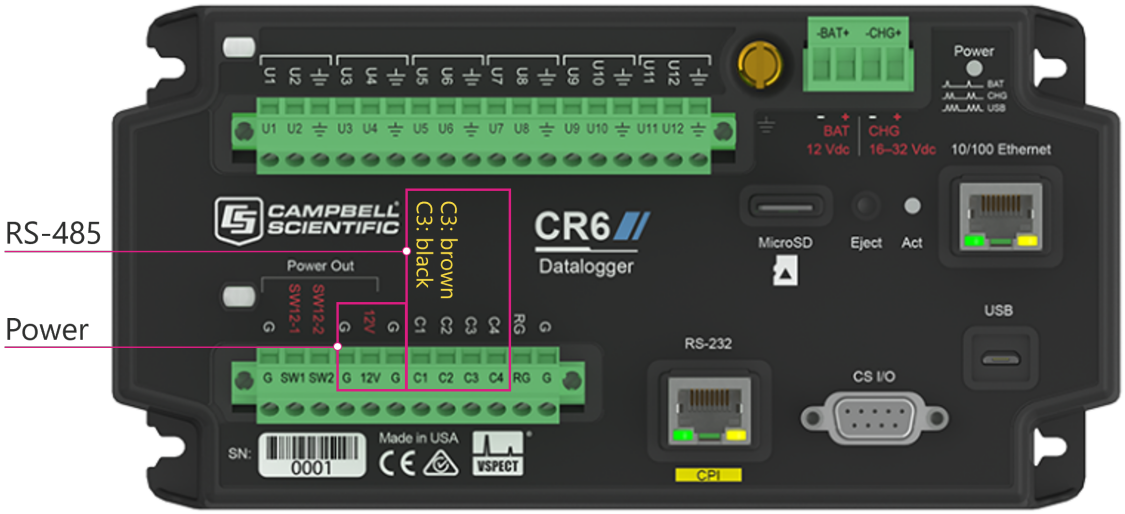


Figure 16: CR6 datalogger I/O terminals.

6.2 Serial Port Configuration

The default serial port configuration used by the SolarBand-C3 is detailed in Table 3.

Table 3: SolarBand-C3 default serial port configuration.

Parameter	Value
Baud rate	19200
Parity	Even
Data bits	8
Stop bits	1

6.3 Modbus Protocol

To obtain data from the SolarBand-C3, the user needs to access certain Modbus registers and convert the values obtained into the final measurements. A complete list of the relevant SolarBand-C3 registers and their corresponding conversion formulas is provided in Appendix A. Key points regarding Modbus communication with the SolarBand-C3 include the following:

1. The serial port must be configured as per Table 3.
2. Default Modbus slave ID is 55. The slave ID can be changed within the SolarBand-C3 DAQ software in the `Calibration Settings` tab.
3. Maximum sampling rate is 200 ms.
4. Read holding registers using the function code 0x03.

For example, to obtain the DHI from the instrument follow these steps:

1. Retrieve the 16-bit data from register 36 using function code 0x03.
2. Convert the obtained value to DHI in W/m^2 by dividing it by 10.0.

Appendix B contains a CR Basic program that demonstrates how to retrieve all relevant parameters from the SolarBand-C3 using a CR6 datalogger.

Appendix A:
SolarBand-C3 Modbus Map

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SolarBand-C3 Modbus *Holding* Register Map

Register number	Parameter	Description	Formula	Units	Type / Format
0	MODBUS_ADDRESS	ModBus address	value		R/W, U16
1	SERIAL_NUMBER	Serial number, SolarBand-C3	value		R, U16
2	BAUD_RATE	Serial port baud rate	value / 10.0	bps	R, U16
3	PARITY	Serial port parity settings	0 – no parity 1 – even parity 2 – odd parity		R, U16
4	GPS_FIX	GPS fix	0 – No GPS fix 1 – GPS fix		R, U16
5	YEAR	Current year	value	year	R, U16
6	MONTH	Current month	value	month	R, U16
7	DAY	Current day	value	day	R, U16
8	HOUR	Current hour	value	hr	R, U16
9	MINUTE	Current minute	value	min	R, U16
10	SECOND	Current second	value	sec	R, U16
11	LATITUDE	Local latitude, positive for Northern hemisphere	value / 100.0 - 200.0	deg	R, U16
12	LONGITUDE	Local longitude, positive for Eastern hemisphere	value / 100.0 - 200.0	deg	R, U16
13	V_SUPPLY	Input voltage	value / 100.0	volts	R, U16
14	HEATER_STATE	State of the internal heater	0 – OFF 1 – high (4 W) 2 – low (2 W) 3 – disabled		R, U16
15	DUTY_CYCLE	Duty cycle of the heater	value (0 to 255)		R, U16
17	CF_WRITE	Write current CFs to flash	1 – write CFs 0 – do nothing		R/W, U16
22	HEATER_MODE	Set the state of the internal heater	0 – OFF 1 – high (4 W) 2 – low (2 W) 3 – disabled		R/W, U16
26	SPA_ELV	Calculated local elevation angle	value / 100.0 - 200.0	deg	R, U16

Register number	Parameter	Description	Formula	Units	Type / Format
27	SPA_AZM	Calculated local azimuth angle	value / 100.0 - 200.0	deg	R, U16
28	C3_AZM	Current azimuth position of the band	value / 100.0 - 200.0	deg	R, U16
29	INTERNAL_TEMP	Internal temperature	value / 100.0 - 100.0	^{0}C	R, U16
30	INTERNAL_HUM	Internal humidity	value / 100.0	%	R, U16
31	V_CH1	Voltage, CH1	value / 10.0	mV	R, U16
32	V_CH2	Voltage, CH2	value / 10.0	mV	R, U16
33	V_CH3	Voltage, CH3	value / 10.0	mV	R, U16
34	V_CH4	Voltage, CH4	value / 10.0	mV	R, U16
35	GHI	Broadband GHI	value / 10.0	W/m^2	R, U16
36	DHI	Broadband DHI	value / 10.0	W/m^2	R, U16
37	DNI	Broadband DNI	value / 10.0	W/m^2	R, U16
38	GHI_SI	Si range GHI (280-1200 nm)	value / 10.0	W/m^2	R, U16
39	DHI_SI	Si range DHI (280-1200 nm)	value / 10.0	W/m^2	R, U16
40	SUN_DUR	Sun duration, DNI > 120	0 or 1		R, U16
41	DIF_RATIO	Ratio, DHI/GHI	value / 1000.0		R, U16
42	CLR_INDEX	Clearness index	value / 1000.0		R, U16
43	TILT	Device tilt	value / 10.0 – 200.0	deg	R, U16
51	CAL_YEAR	Calibration year		year	R/W, U16
52	CAL_MONTH	Calibration month		month	R/W, U16
53	CAL_DAY	Calibration day		day	R/W, U16
54	REF_T	Internal temperature at calibration	value / 100.0 - 100.0	^{0}C	R/W, U16
55	CF_CH1	Calibration factor, CH1	value / 10000.0	10 x W/m2/mV	R/W, U16
56	CF_CH2	Calibration factor, CH2	value / 10000.0	10 x W/m2/mV	R/W, U16
57	CF_CH3	Calibration factor, CH3	value / 10000.0	10 x W/m2/mV	R/W, U16
58	CF_CH4	Calibration factor, CH4	value / 10000.0	10 x W/m2/mV	R/W, U16

Appendix B:
CR6 Datalogger Program

```
'Description: Acquires data from the SolarBand-C3
'Datalogger:  CR6 from Campbell Scientific
'Author:      Spectrafy Inc.
'Version:     v1.0


'Defines user constants
Const ModbusAddress = 55
Const ModbusBaudRate = 19200 ' bps

Const DAQRate      = 5000 'ms
Const SamplingRate = 1000  'ms

'Declares public variables
Public ModbusData(18) As Long
Public OutputData(18) As Float
Public ModbusStatus as Long


'Declares data table column names for the SolarBand-C3
Alias OutputData(1)   = SPA_ELV          'Solar elevation angle
Alias OutputData(2)   = SPA_AZM          'Solar azimuth angle
Alias OutputData(3)   = C3_AZM           'C3 azimuth angle
Alias OutputData(4)   = INTERNAL_TEMP    'Internal temperature
Alias OutputData(5)   = INTERNAL_HUM     'Internal humidity
Alias OutputData(6)   = V_CH1            'Channel 1 voltage
Alias OutputData(7)   = V_CH2            'Channel 2 voltage
Alias OutputData(8)   = V_CH3            'Channel 3 voltage
Alias OutputData(9)   = V_CH4            'Channel 4 voltage
Alias OutputData(10)  = GHI              'Broadband GHI (280-4000 nm)
Alias OutputData(11)  = DHI              'Broadband DHI (280-4000 nm)
Alias OutputData(12)  = DNI              'Broadband DNI (280-4000 nm)
Alias OutputData(13)  = GHI_SI           'Silicon range GHI (280-1200 nm)
Alias OutputData(14)  = DHI_SI           'Silicon range DHI (280-1200 nm)
Alias OutputData(15)  = SUN_DUR          'Sun duration [0 or 1]
Alias OutputData(16)  = DIF_RATIO        'Diffuse ratio (DHI/GHI)
Alias OutputData(17)  = CLR_INDEX        'Sky clearness index
Alias OutputData(18)  = TILT             'Device tilt


'Defines data table for SolarBand-C3 data
DataTable (Spectrafy_C3,1,-1)        'Autoallocates table size
  DataInterval (0,DAQRate,mSec,100)    'Sets the DAQ rate
  Average (18,OutputData,IEEE4,0)      'Stores C3 data
EndTable
```

```
'Executes main program
BeginProg

  SerialOpen (ComC1,ModbusBaudRate,2,0,256,4)
  'Black wire (A-) to C1 terminal
  'Brown wire (B+) to C2 terminal
  'White wire (V-) to GND
  'Blue wire (V+) to 12 VDC
  'Baud rate: 19200 bps
  'Parity: Even (option "2")
  'Buffer size: 128 bytes
  'Mode: Half-duplex RS-485 (option "4")

  Scan (SamplingRate,mSec,0,0)

    'Acquires Modbus data from the C3
    ModbusClient(ModbusStatus,ComC1,ModbusBaudRate,ModbusAddress,3,
       ModbusData(),27,18,2,100,3)

    'Parses Modbus data
    SPA_ELV = ModbusData(1) / 100.0 - 200.0

    If SPA_ELV > 360.0 Then
      SPA_ELV = -1.0
      SPA_AZM = -1.0
      C3_AZM = -1.0
      INTERNAL_TEMP = ModbusData(4) / 100.0 - 100.0
      INTERNAL_HUM = ModbusData(5) / 100.0
      V_CH1 = ModbusData(6) / 1000.0
      V_CH2 = ModbusData(7) / 1000.0
      V_CH3 = ModbusData(8) / 1000.0
      V_CH4 = ModbusData(9) / 1000.0
      GHI = -1.0
      DHI = -1.0
      DNI = -1.0
      GHI_SI = -1.0
      DHI_SI = -1.0
      SUN_DUR = -1.0
      DIF_RATIO = -1.0
      CLR_INDEX = -1.0
      TILT = ModbusData(18) / 10.0 - 200.0
    Else
      SPA_AZM = ModbusData(2) / 100.0 - 200.0
      C3_AZM = ModbusData(3) / 100.0 - 200.0
      INTERNAL_TEMP = ModbusData(4) / 100.0 - 100.0
      INTERNAL_HUM = ModbusData(5) / 100.0
      V_CH1 = ModbusData(6) / 1000.0
      V_CH2 = ModbusData(7) / 1000.0
      V_CH3 = ModbusData(8) / 1000.0
```

```
97          V_CH4 = ModbusData(9) / 1000.0
98          GHI = ModbusData(10) / 10.0
99          DHI = ModbusData(11) / 10.0
100         DNI = ModbusData(12) / 10.0
101         GHI_SI = ModbusData(13) / 10.0
102         DHI_SI = ModbusData(14) / 10.0
103         SUN_DUR = ModbusData(15)
104         DIF_RATIO = ModbusData(16)
105         CLR_INDEX = ModbusData(17)
106         TILT = ModbusData(18) / 10.0 - 200.0
107
108       EndIf
109       CallTable Spectrafy_C3
110
111     NextScan
112
113   EndProg
```