Operations and Maintenance Manual

System

SunSentry™20

Solar Operational Meteorological Monitoring Station

08/2026

RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

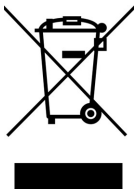
Please read first

About this manual

Please note that this manual was produced by Campbell Scientific Inc. primarily for the North American market. Some spellings, weights and measures may reflect this. In addition, while most of the information in the manual is correct for all countries, certain information is specific to the North American market and so may not be applicable to Europe, Middle East, and Africa (EMEA) or Asia Pacific (APAC) users. Differences include the U.S. standard external power supply details where some information (for example the AC transformer input voltage) will not be applicable for EMEA or APAC use. Please note, however, *that when a power supply adapter is ordered from Campbell Scientific it will be suitable for use in your country*.

Reference to some radio transmitters, digital cell phones and aerials (antennas) may also not be applicable according to your locality. Some brackets, shields and enclosure options, including wiring, are not sold as standard items in the EMEA or APAC market; in some cases alternatives are offered.

Recycling information for countries subject to WEEE regulations 2012/19/EU



At the end of this product's life it should not be put in commercial or domestic refuse but sent for recycling. Any batteries contained within the product or used during the product's life should be removed from the product and also be sent to an appropriate recycling facility, per The Waste Electrical and Electronic Equipment (WEEE) Regulations 2012/19/EU. Campbell Scientific can advise on the recycling of the equipment and in some cases arrange collection and the correct disposal of it, although charges may apply for some items or territories. For further support, please contact Campbell Scientific, or your local agent.

Table of contents

1. Introduction

This document describes the operations and maintenance (O&M) requirements and procedures for the SunSentry™20 Operational Monitoring station. This document does not cover the initial unboxing and installation procedures and steps for the SunSentry 20. For detailed installation information, please refer to the SunSentry 20 Installation Guide.

This manual will provide information on each component of the SunSentry 20 Station from enclosures to sensors. It will also discuss and explain scheduled and unscheduled maintenance procedures. Additional information on the SunSentry 20 can be found at www.campbellsci.com/sunsentry.

2. What is the SunSentry 20?

The SunSentry 20 Operational Monitoring station is a purpose-built, all-inclusive solution designed for operational solar monitoring requirements in compliance with IEC 61724-1:2017 & 2021. The SunSentry 20 offers flexible measurement options while reducing complexity by using a unique station interface that simplifies configuration, installation, and operations. Designed to serve as the core of any operational solar monitoring system required by IEC 61724-1, the SunSentry 20 can be configured to meet either Class A or Class B requirements.

The SunSentry 20 user interface (UI) introduces users to a simplistic flexibility that is unique to Campbell Scientific. Providing a user experience that allows easy setup of the station as well as long term ease of use throughout the life of solar project.

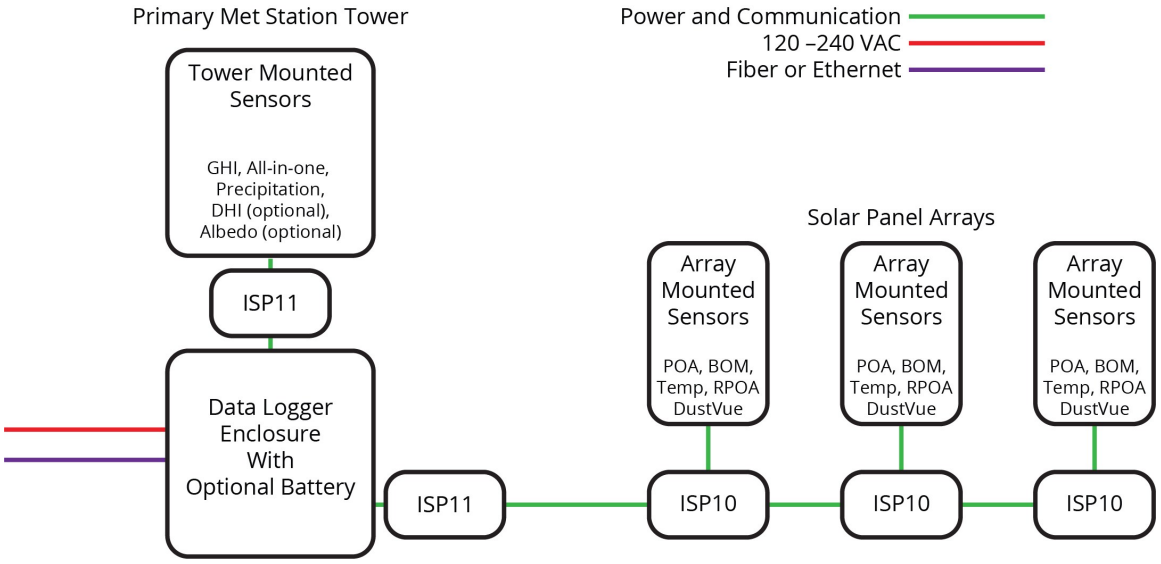


Figure 2-1. Diagram of major station components

2.1 Main Met enclosure

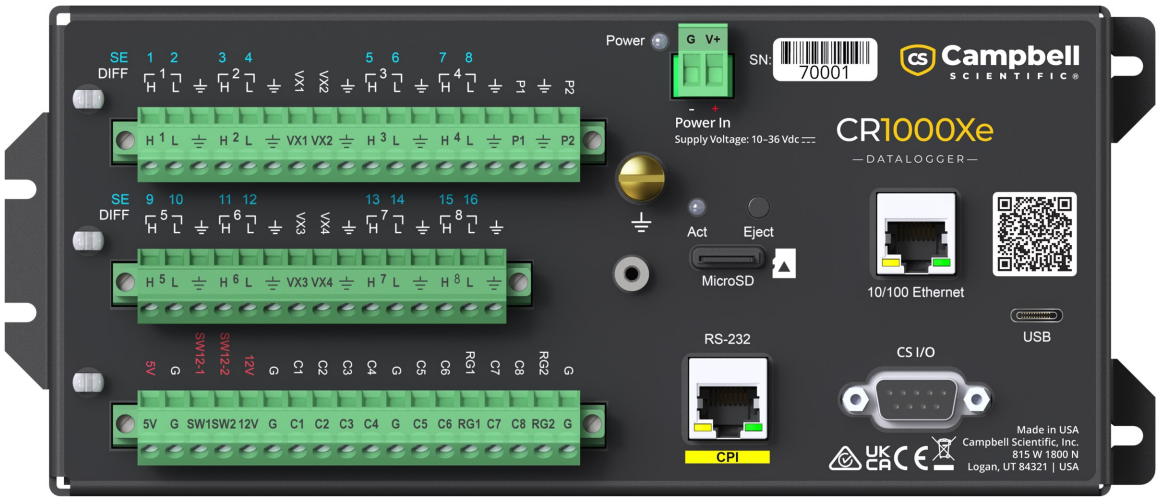
The SunSentry 20 Main Met enclosure includes the CR1000Xe as its core data logger. This station component also includes sensor connections, power connections, and optional battery backup (UPS option) all within a single environmental enclosure.

> **CAUTION:**
> Do not modify the enclosure wiring. Each SunSentry 20 is engineered and built to the application requirements. For questions about any specific SunSentry 20 station, contact Campbell Scientific.

2.1.1 Data logger

The CR1000Xe provides measurement and control for a wide variety of applications. Its reliability and ruggedness make it an excellent choice for solar meteorological stations that are installed in environmentally demanding environments and are critical to power plant operation.

The CR1000Xe is a low-powered device that measures analog and digital sensors, processes and stores measurements. The SunSentry 20 uses Modbus TCP and DNP3 protocols to communicate with a power plant SCADA system and stores data in non-volatile flash memory. The data logger is configured using an internal, web-hosted, user interface that allows for simple sensor selection and station configuration while still allowing users a wide range of flexibility in choosing sensors.



2.2 Main Met status monitoring features

The SunSentry 20 may include status monitoring and diagnostic features that enable the remote operator to see issues in real time. These include battery balance, AC power status, enclosure door open/close, enclosure temperature and humidity, 24 VDC electronic circuit breaker state with remote reset capabilities, and battery fuse condition.

Table 2-1: Main Met status monitoring features			
Device	Function/Measurement	State (MB map)	Description
Battery Balance Monitor		0 1 2 3 4 5 6 7 8 10	OK Battery 1 Low Voltage Battery 2 Low Voltage Battery 1 High Voltage Battery 2 High Voltage Fuse Open Circuit Batteries voltages are > 0.4V different No Batteries present No Charge Voltage, No Batteries Battery Health not Reported
Power Supply Monitor	• Meanwell - LAD Series (TTL Out) • Meanwell - DRC Series (Relay Contact Out) • Pheonix Contact - Quint4 Series (Relay Contact Out)	0 1 2 3 4 5 10	AC_OK_DC_OK AC_IN_OK AC_OK_DC_LOW AC_FAIL_DC_CRITICAL_ LOW DC_V_HIGH AC_FAIL_DC_OK AC_INPUT_V_UNKNOWN
Sensor Circuit Protection	Electronic Circuit Breaker Reset Circuit Breaker	0 1 0	Normal Fault Write 0 to MB address 44597

Table 2-1: Main Met status monitoring features			
Device	Function/Measurement	State (MB map)	Description
CS211 (optional) pn 43525	Enclosure State	0 1 2	OK, Desiccant working well Warning, Desiccant close to exhaustion Alarm, Desiccant exhausted
	Door Open / Close	Time	Open Time, Open Duration, Close Time
	Temperature	C°	Cabinet Temperature
	Humidity	%	Cabinet Humidity
AC Surge Protection (optional) pn 46433	AC Surge Protection Device	0 1	Normal Fault

Battery balance monitoring is standard in the SunSentry 20. The SunSentry 20 is a 24 VDC system and uses two 12 V lead-acid batteries as backup during short power failures. The batteries are connected in series to provide 24 VDC power. The AC-to-DC power supply charges both batteries and the voltage of each battery is monitored. The data logger will issue an alert if the battery voltages are not balanced.

Action must be taken if the batteries differ by more than 0.5 V. Batteries can overheat when they are imbalanced. Replacing or charging the batteries separately may be necessary to ensure proper balance and operation. The batteries should be fully charged before installation to help ensure they are balanced.

The following messages are displayed in the UI Dashboard:

Table 2-2: Battery balance monitoring messages in UI Dashboard	
Modbus signal	Dashboard message
0	Battery Balance is OK
1	WARNING: Battery 1 Voltage is low, Check, Charge or Replace the battery
2	WARNING: Battery 2 Voltage is low, Check, Charge or Replace the battery
3	WARNING: Battery 1 Voltage is High, Check, Discharge or Replace the battery

Table 2-2: Battery balance monitoring messages in UI Dashboard	
Modbus signal	Dashboard message
4	WARNING: Battery 2 Voltage is High, Check, Discharge or Replace the battery
5	WARNING: Battery Fuse open, Replace Fuse & Manually Reset Circuit Breaker
6	WARNING: Batteries are imbalanced, Check, Charge Separately or Replace the batteries
7	WARNING: Battery Charge Voltage Present, Batteries Not Connected
8	WARNING: No Charge Voltage (fuse is blown or NO AC) and Batteries Not Connected (powered by USB port only)
10 or -999,999	Batteries are not monitored

NOTE:
Battery wires are terminated with ¼ inch ring terminals. Ensure that locally acquired batteries use bolt style terminals with bolts that are ¼ inch or less in diameter.

AC-to-DC power supply is monitored by the SunSentry 20 to provide AC input and/or DC output monitoring. Power supplies provide either a relay contact switch or a TTL signal indicating the state of the power input or output. The SunSentry 20 UI can be configured to read either type of signal.

Sensor Circuit Protection consists of a four-amp electronic circuit breaker on the 24 VDC bus to the sensors. The circuit breaker is monitored for or its state: healthy (not tripped) or fault (tripped). In a fault state, the UI will display the text "24V circuit breaker TRIPPED".

A Modbus command can be issued to reset the circuit breaker. The UI will attempt to reset it three times. If the fault persists, the message will change to "24V circuit breaker Reset FAILED". This indicates the fault condition cannot be reset remotely. The fault must be physically removed, and the button on the electronic circuit breaker must be pressed to reset it.

The button may also need to be pressed when applying power to the system for the first time. Under normal operating conditions, the LED is steadily green.

Table 2-3: Electronic circuit breaker LED definition			
Signaling			Description
Opened	Red	lit	Short circuit or overload, undervoltage or overvoltage, cooling phase 5 sec.
		Flashing rapidly (approx. 5 Hz)	unexpected voltage at output, e.g., input and output reversed (Vout >Vin)
	Off	LED Off	No operating voltage
Closed	Green	Lit	Normal Operation
	Yellow	Lit	>80% load
		Flashing	Display of the nominal current
	Off	LED Off	No operating voltage

Door open/closed switch is recommended but is optional. The CS211 is an accessory that provides door open/closed feedback in the UI and in Modbus registers. The CS211 also provides cabinet temperature and humidity measurements. This is a factory-installed accessory.

AC Input line surge protection is optional. The AC SPD is an accessory that provides additional surge protection to the AC input lines of the Main Met enclosure. The SunSentry 20 uses an

industry-leading surge protective device that is UL Listed type 1 and IEC type 2, designed for single-phase power supply networks with neutral conductor for (120 or 240 VAC). It features replaceable surge protection plugs with a local status indicator (green/red) and plug-in remote signaling.This is a factory-installed accessory.

2.3 UPS accessories

These common accessories provide UPS functionality.

- pn 46444 – single 55 Ahr battery (NOTE: requires 2 per station)
- pn 41457 – solar input kit without solar panel, includes charge controller and wiring. Charges the backup batteries when AC power is not available. Solar panel is user-supplied.
- pn 42398 – solar panel with mounting, includes all mounting hardware and a 120 W solar panel. Charges the backup batteries when AC power is not available.

2.4 Sensor and cabling installation

The SunSentry 20 uses a true daisy chain communications solution. Campbell Scientific offers a complete line of cables and adapters to connect all digital RS-485 sensors to power and data logger communications. The Campbell Scientific cables with M12 5-pin connectors connect the sensors to the main met station communications ports. No pigtail wiring is needed.

2.4.1 Surge protection

SunSentry 20 offers superior surge protection at each sensor with the inclusion of the ISP10 (Inline Surge Protection) device that meets IEC 61000-4-5, level 4 (4kV, 2000A) surge protection standard. The ISP11 is available for additional surge protection at the enclosure-side of the cable run.

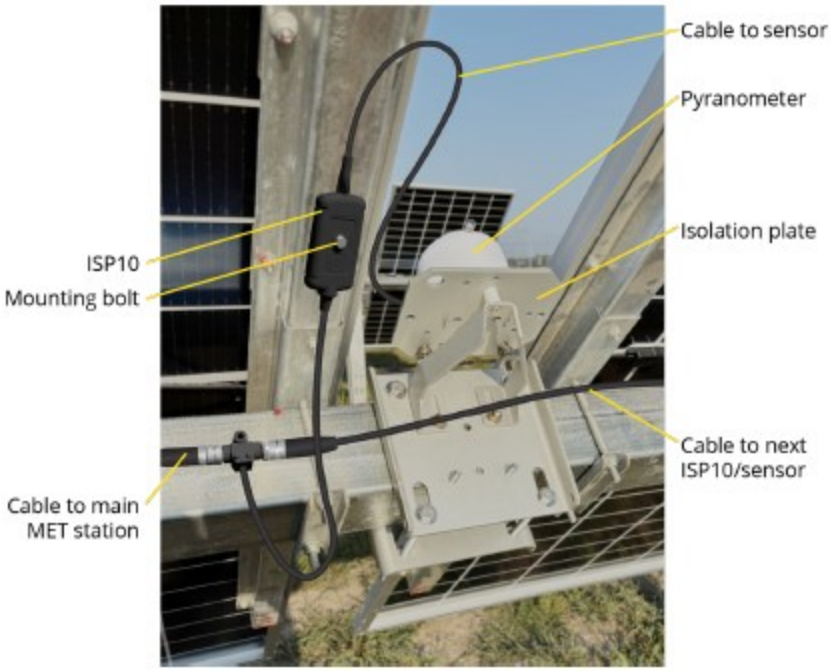


Figure 2-2. Sensor surge protection with ISP10

The ISP11 connects to the Main Met enclosure.

Figure 2-3. ISP11

Figure 2-4. Enclosure-side surge protection with ISP11

2.5 Driven piles

The SunSentry 20 uses available driven piles to mount the enclosures and sensors. Compatible pile sizes were selected to match those commonly used in solar power plant construction. The main sensor suite mounts to a driven pile using the CM400 Tower Mount with Crossarm. A separate driven pile is used to mount the optional albedo sensor using the CM410 mount. Campbell Scientific recommends the use of W6x12 piles. The following images show the layout of these driven piles.

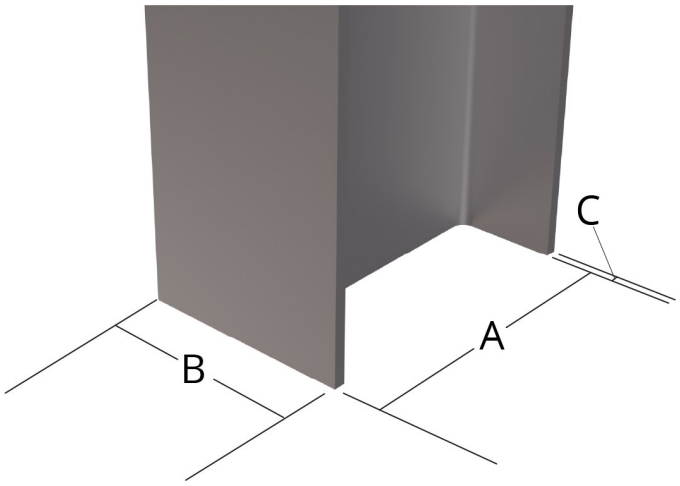


Figure 2-5. H-pile orientation

The CM400 tower mounts to all W6 H-piles or other H-piles with the following dimensions:

Section Depth A: 14 to 24 cm (5.5 to 9.5 in)

Flange Width B: 7.6 to 17.8 cm (3 to 7 in)

Flange Thickness C: < 1.8 cm (0.7 in)

For optimal installation that does not require drilling the pile, drive the pile as shown in orientation A (in Figure 2-6 [p. 12]).

Orientation B (in Figure 2-6 [p. 12]) also allows installation of the CM400 mounting structure. However, mounting in orientation B requires drilling holes and using ½-13 X 2 inch bolts, which must be supplied separately. The pile must have a flange width adequate to accommodate the drilled holes.

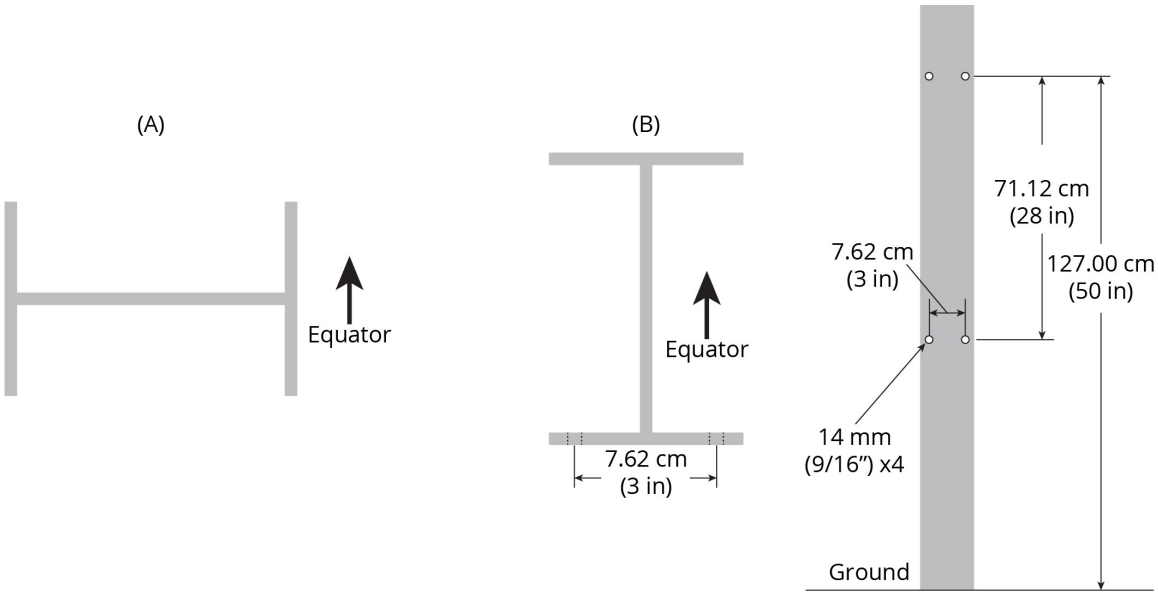


Figure 2-6. Pile dimensions

2.6 Sensors

The following sections highlight recommended sensors for a SunSentry 20 deployment, along with high-level details that are important to consider. Refer to the sensor manuals for more information about the sensors.

> NOTE:
> The sensor suite selected for each SunSentry 20 system is flexible to suit the needs of each project. A full list of sensors currently supported by the SunSentry 20 can be found at www.campbellsci.com/sunsentry.

> NOTE:
> The sensors should have been configured for this SunSentry 20 system prior to installation. The Modbus address and communications protocol settings must match the configuration settings in the user interface.

2.6.1 Irradiance sensors

Irradiance sensors are ISO 9060:2018 Class A pyranometers used for IEC 61724-1:2021 Class A monitoring of global horizontal irradiance (GHI). Class A, C, or reference cells can be used for the other irradiance parameters.

2.6.1.1 Main Met tower

- Global Horizontal Irradiance (GHI)—These sensors are typically installed on the main met tower. Redundant sensors may be used but are not required.
- Albedo—Albedo is the ratio of horizontal upwelling irradiance to total downwelling irradiance. For best performance, Class A sensors with lowest thermal offsets are ideal for this measurement. The CM275 Albedometer Mounting Stand co-locates both sensors on a single bracket that is mounted to the CM410 Pile Mount Crossarm for Albedo are or to another horizontal crossarm such as the CM206.
- Diffuse Horizontal Irradiance (DHI)—Best DHI measurements are performed with shaded and tracking pyranometers. However, many other options are common.

2.6.1.2 Solar array

- Plane of Array (POA)—These sensors are commonly installed on the solar array to ensure orientation matches that of the PV array, including trackers. Campbell Scientific has many mounting options.
- Rear side Plane of Array (RPOA)—Used in bifacial module applications, these measurements, like the POA measurements can be mounted in a variety of ways.

2.6.2 All-in-one weather sensor

The SunSentry 20 typically uses the ClimaVue™40 Compact Digital Weather Sensor. This multi-parameter meteorological sensor is designed for solar plant operational monitoring and solar resource assessment with IEC 61724-1 compliance. At Campbell Scientific, we recognize the importance of and are well known for our instrumentation accuracy and reliability. We also recognize that ease of operation and overall cost of operation are critical. With the ClimaVue 40, you will get this and more. In adherence to IEC 61724-1 (2021), the ClimaVue 40 provides ambient air temperature, precipitation, relative humidity, wind speed, and wind direction measurements. The sensor also offers vapor pressure, tilt, lightning strike, and lightning average distance measurements.

The SunSentry 20 may also use other multi-parameter meteorological sensors, such as the MetSENS-series and the Lufft WX_XXX-series, to measure:

- Wind speed and wind direction
- Ambient temperature
- Relative humidity (water stuck in the air)
- Barometric pressure
- Precipitation (water falling)
    - Rain
    - Hail
    - Snow

2.6.3 Soiling sensors

The SunSentry 20 typically uses the DustVue-series solar-module soiling sensor to measure and calculate the soiling-loss index to provide solar energy professionals with the information needed to evaluate and manage the impact of soiling on their photovoltaic (PV) power plant performance.

The DustVue-series has been designed with ease of use in mind and can be used on any PV installation.

These sensors may include any of the following, based on model selection:

- Measurements provided by the CS241 Back-of-Module Temperature Sensor, which has been optimized for bifacial panels
- Prewired connectors for module temperature measurements and solar panels used for the soiling measurement
- Modbus RTU communications with a standard Modbus register map
- Data filtering to maximize accuracy
- Storage of historic data
- Wide range of options for mounting the enclosure to site specific structures

This sensor joins our extensive line of high-quality, turn-key measurement solutions for solar and other renewable energy applications. Campbell Scientific measurement solutions provide PV performance engineers with the data needed to validate performance models and determine energy yield.

Other soiling sensors may also be used.

2.6.4 Back-of-module (BOM) temperature sensor

The SunSentry 20 uses the CS241DM G2 surface-mountable, back-of-module temperature sensor. It is designed for bifacial photovoltaic (PV) module performance assessment and soiling. The sensor head has been redesigned for easier installation. The measurement performance has been improved with a smaller footprint that is optimized to reduce back-of-module shading and eliminate surface cooling. Other improvements include greater sensor-to-module

bonding/adhesion and a thinner Teflon cable with a higher temperature rating. To meet the requirements of performance validation, every CS241DM G2 is supplied with a NIST-traceable, serialized calibration certificate.

3. Required tools and software

Required tools:

- Open end wrenches: 3/8 in, 7/16 in, 1/2 in, (2) 9/16 in
- Socket wrench set
- Magnetic compass
- Tape measure
- Nut driver (3/8 in)
- Level
- Pliers
- Flat-bladed screwdrivers
- Phillips screwdrivers

Additional tools required for concrete anchor installation (see Installation Guide):

- Hammer drill
- 3/4-inch masonry drill bit
- Eye protection
- Filter mask
- Wire brush (or compressed air)

Required software, drivers, and licenses:

- Laptop computer or mobile device with Web browser
- Sensor configuration software depending on the sensors used (refer to sensor manuals)

4. Safety

- Select a safe site to install the tower.
- The distance between any power lines and the installation site should be at least one and one-half times the height of the tower. Make the distance even greater, if possible. Since all overhead lines look somewhat alike, consider them all dangerous and stay well away from them.
- If there are power lines or buried utilities in the area, call the local utility providers for assistance.
- NEVER work alone; always have someone near who can summon help.
- Certain clothing may provide a degree of safety, but do not depend on it alone to preserve life (for example, rubber boots or shoes, industrial rubber gloves, or a long shirt or jacket).
- Check local weather conditions. Be sure it has not rained recently, and the ground is not wet or muddy. Make sure rain or thunderstorms are not predicted for the day the tower is to be installed.
- To avoid having the tower being blown into nearby power lines, do not install or remove towers in moderate or heavy winds.
- If it is necessary to use a ladder, choose a ladder made of non-conductive, non-metallic materials.
- Have someone present who has been trained in electric shock first aid, if possible.

5. Specifications

Enclosure description:	IP66
Size:	600 x 500 x 200 mm
Weight:	35 lbs
Material:	304SS
Access with special key/tool only included with box	
Power protection:	Power inputs are protected against surge, over-voltage, over-current, and reverse power. IEC 61000-4 Class 4 level.
Power source	
AC voltage range:	100 to 240 VAC, 15 % to +10 %
DC voltage range:	110 to 250 VDC, 18 % to +40 %
Frequency range (fN):	50 to 60 Hz, ±10 %
Solar input (w/ solar kit)	
Max. input voltage:	60 VDC
Max. solar current:	10 A
Max. panel power:	400 W
UPS battery	
Voltage range:	24 to 27.1 VDC (2 x 12 VDC, nominal)
Battery type:	Flooded/AGM
Processor:	CR1000Xe
Memory	
Total onboard:	128 MB of flash + 4 MB battery-backed SRAM
Data storage:	4 MB SRAM + 72 MB flash (extended data storage automatically used for auto-allocated Data Tables not being written to a card)
Data storage expansion:	Removable microSD flash memory, up to 16 GB

Program scan rate:	3 to 5 seconds
	NOTE: Typical configuration requires 5 second scan rate.
Real-time clock:	±3 min. per year (optional GPS correction to ±10 µs), NPT available or optional GPS correction to ±10 µs
Battery backed data logger:	The data logger is battery backed while external power is disconnected.
Battery backed main met station:	The system and sensor power are battery backed while external power is disconnected for minimum of 3 days (UPS version only) .
Dimensions:	23.8 x 10.1 x 6.2 cm (9.4 x 4.0 x 2.4 in); additional clearance required for cables and wires.
Weight/mass:	0.86 kg (1.9 lb)
Case material:	Anodized aluminum and 304SS
USB power:	Functions that will be active with USB 5 VDC applied include sending programs, adjusting data logger settings, and making some measurements.
CR1000Xe internal lithium battery:	AA, 2.4 Ah, 3.6 VDC (Tadiran TL 5903/S) for battery-backed SRAM and clock. 3-year life with no external power source. See also Internal battery in the CR1000Xe manual.
CR1000Xe average current drain:	Assumes 12 VDC on POWER IN terminals.
Idle:	<1 mA
Active 1 Hz scan:	1 mA
Active 20 Hz scan:	55 mA
Serial (RS-232/RS-485):	Active + 25 mA
Ethernet 1 minute:	Active + 1 mA
Ethernet idle:	Active + 4 mA
Ethernet link:	Active + 47 mA

6. Web UI

The *Web UI* is a program running on the SunSentry 20 data logger that simplifies the configuration of the meteorological station system layout. It automatically builds a data logger program that controls data logger communications between the sensors and customer network programs such as the SCADA system. Knowledge of CRBasic programming is not needed because the program is automatically created.

The *Web UI* has the following main menus:

- **Dashboard** provides real time data information collected from the sensors.
- **Configuration** enables quick and easy configuration of the system layout. After the configuration is complete, click **Apply to Station** to automatically create the data logger program. You can click **Config Report** to display and print the configuration, wiring, and Modbus information for the sensors. The configuration can also be saved and used to automatically configure the station if station recovery is needed or to configure other stations with identical configurations. Communications information is included in the saved file and needs to be changed if used for other stations in the same network.
- **Monitor Data** displays the data tables and contents. The data can be collected and downloaded, displayed, and graphed.
- **Diagnostics** accesses the data logger status table, which contains valuable troubleshooting and system performance information. Updates to the data logger operating system, programs and web pages are made using the **Updates** tab. The **Watch** tab provides a terminal window with limited communications monitoring capabilities.
- **Modbus Map** shows the Modbus map the SCADA system uses to collect the real time data from the sensors.

You can get up and running with your SunSentry 20 quickly. After connecting to the SunSentry 20 with a web browser, navigate to the **Configuration** page. There, you can configure a **Station Name**, **Location field**, and add **Station Notes**, if desired. Then follow these instructions to **Add Sensors** and set up **Network Options**.

6.1 Connect to the SunSentry 20

Connecting to the SunSentry 20 for the first time requires a direct connection using the USB port on the data logger.

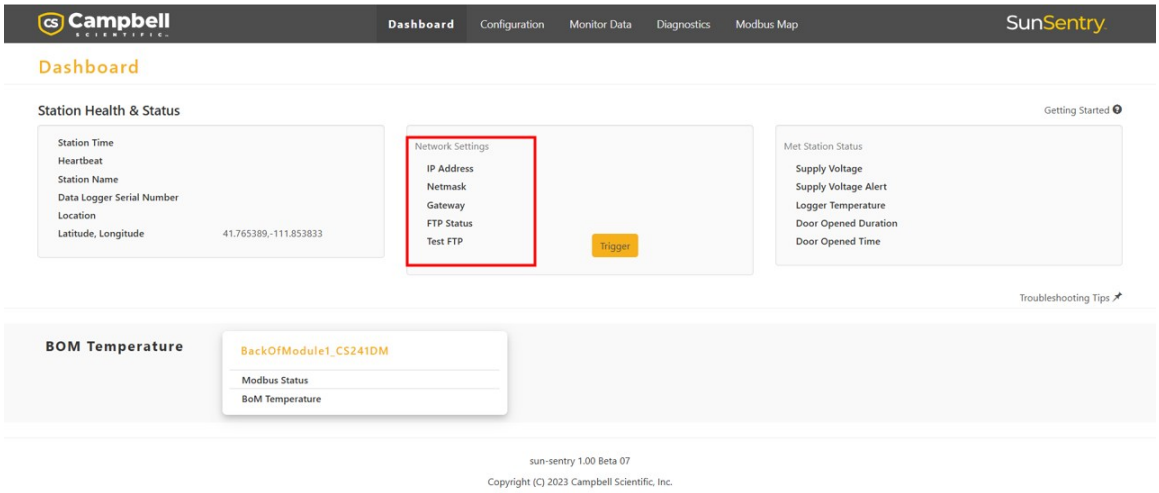
1. Use the USB cable to connect the SunSentry 20 to the computer USB port.
2. Type www.linktodevice.com or 192.168.66.1 (default IP) in the computer browser.
3. Click **Getting Started** for instructions or go directly to the **Configuration** page.

Once you are connected to the system with a web browser, navigate to the **Configuration** page. Enter the **Station Parameters**, set up **Communications Options**, and **Add Sensors**.

If you would like to be able to configure the SunSentry 20 system remotely, you will need to set up an account with **Administrator** privileges. See Set up user accounts (p. 32) for help on setting up user accounts.

6.2 Network Settings

The Modbus TCP/IP protocol is used to communicate with the local SCADA system or other data collection platforms. Under **Network Settings**, communications settings, such as the system network **IP Address**, must be entered to allow the system to be accessible using the local network.



The following other communication protocols are available.

- Three Modbus RTU communications channels for sensor communications:
  - **Modbus RTU Client C7 Main Met** (default, not optional)
  - **Modbus RTU Client C5 Array 1** (optional)
  - **Modbus RTU Client C3 Array 2** (optional)

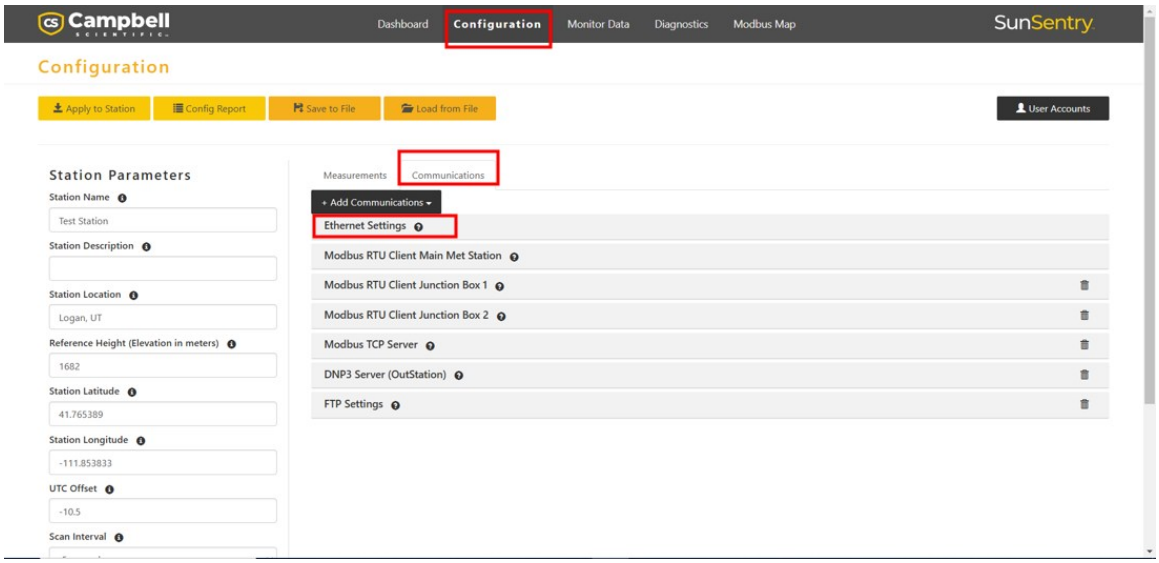
> **NOTE:**
> Direct wire to the data logger is required to use C3.

- **Modbus TCP Server** (optional, required for Modbus data retrieval from the SunSentry 20)
- **DNP3 Server (OutStation)** (optional)
- **NTP** and **FTP** services (optional)

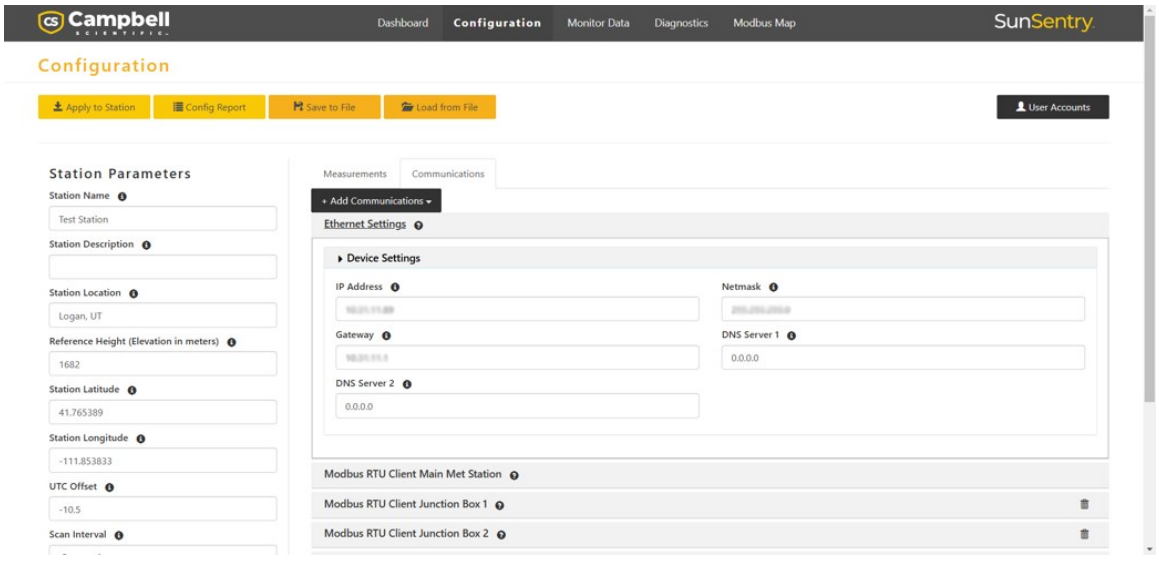
To configure those protocols, click **Configuration** then click **Communications.**

6.2.1 Ethernet Settings

1. Click the **Communications** tab then click **Ethernet Settings**.

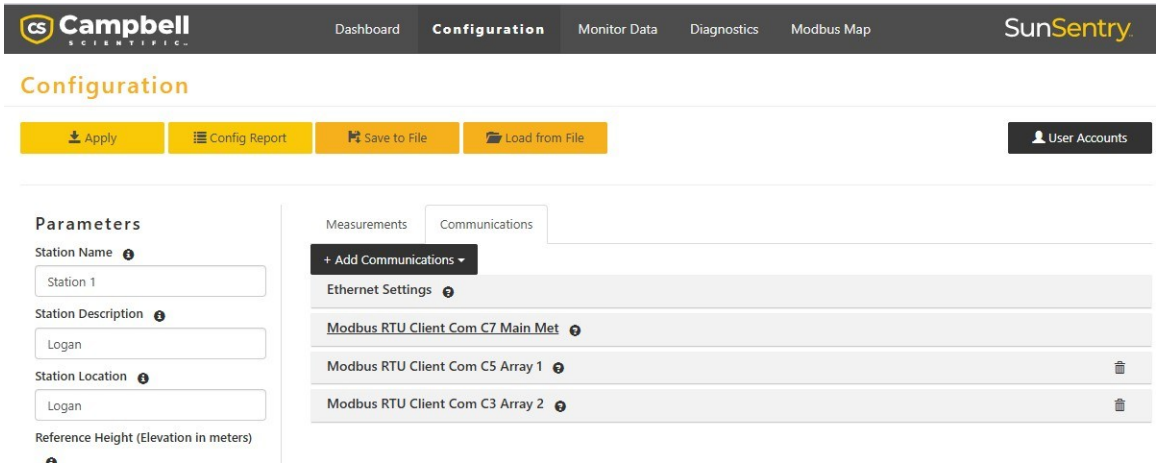


2. Configure the Ethernet Interface by entering the **IP Address**, **Netmask**, and **Gateway** settings required by the data collection system that will communicate with the SunSentry 20. Inline context help is available in the Web UI.

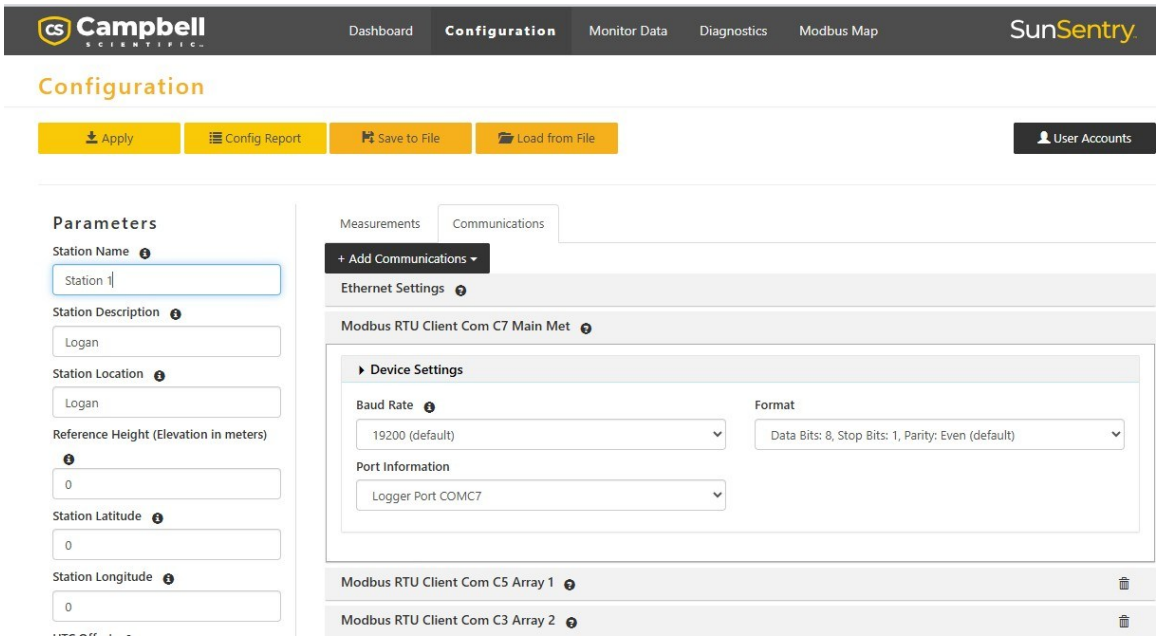


6.2.2 Modbus RTU Client Main Met Station

There are three Modbus RTU communications terminals in the SunSentry 20. The first communication terminal associated with the main met box is active by default and cannot be deleted. Click on the **Modbus RTU Client Main Met Station** to expand its available settings.



Click on **Modbus RTU Client Main Met Station** again to collapse the settings.

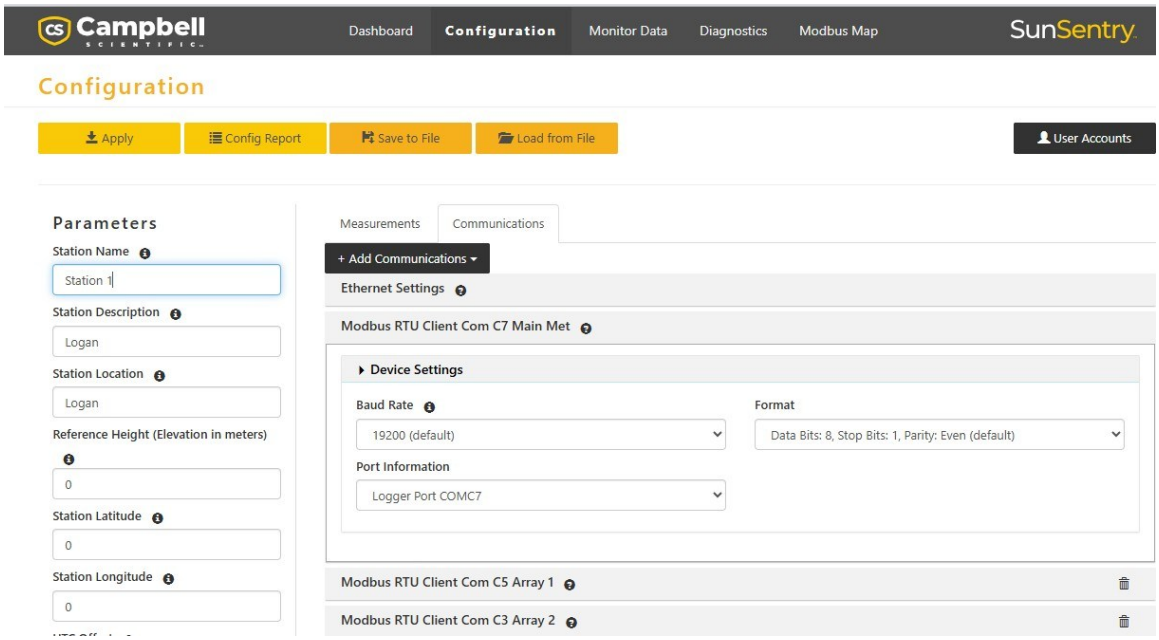


NOTE:
Ensure that each sensor is configured to match the communication terminal settings when sensors are added.

6.2.3 Modbus RTU Client Com C5 Array 1 and Modbus RTU Client Com C3 Array 2

Modbus RTU Client Com C5 Array 1 and Com C3 Array 2 communication ports are displayed by default and can be deleted if not used.

1. Click on the **Modbus RTU Client** to expand its available settings.

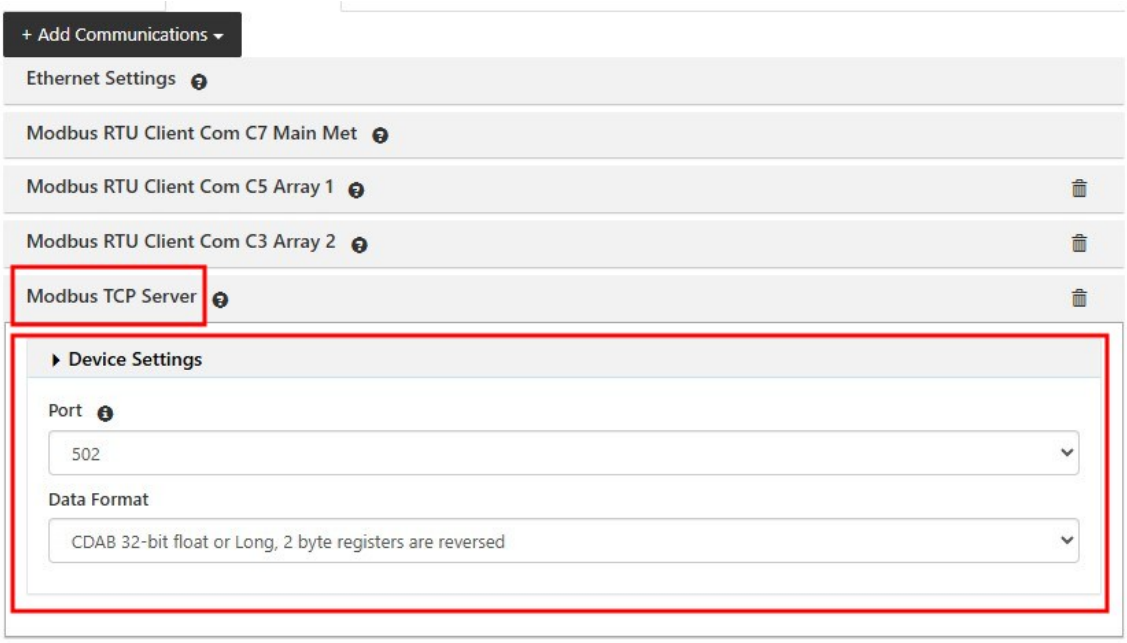


2. Configure the **Device Settings** (**Port** and **Format**) to match the configuration of the sensors using this communications port.
3. Click on **Modbus RTU Client** again to collapse the settings.

> **NOTE:**
> Ensure that each sensor is configured to match the communication port settings when sensors are added.

6.2.4 Modbus TCP Server

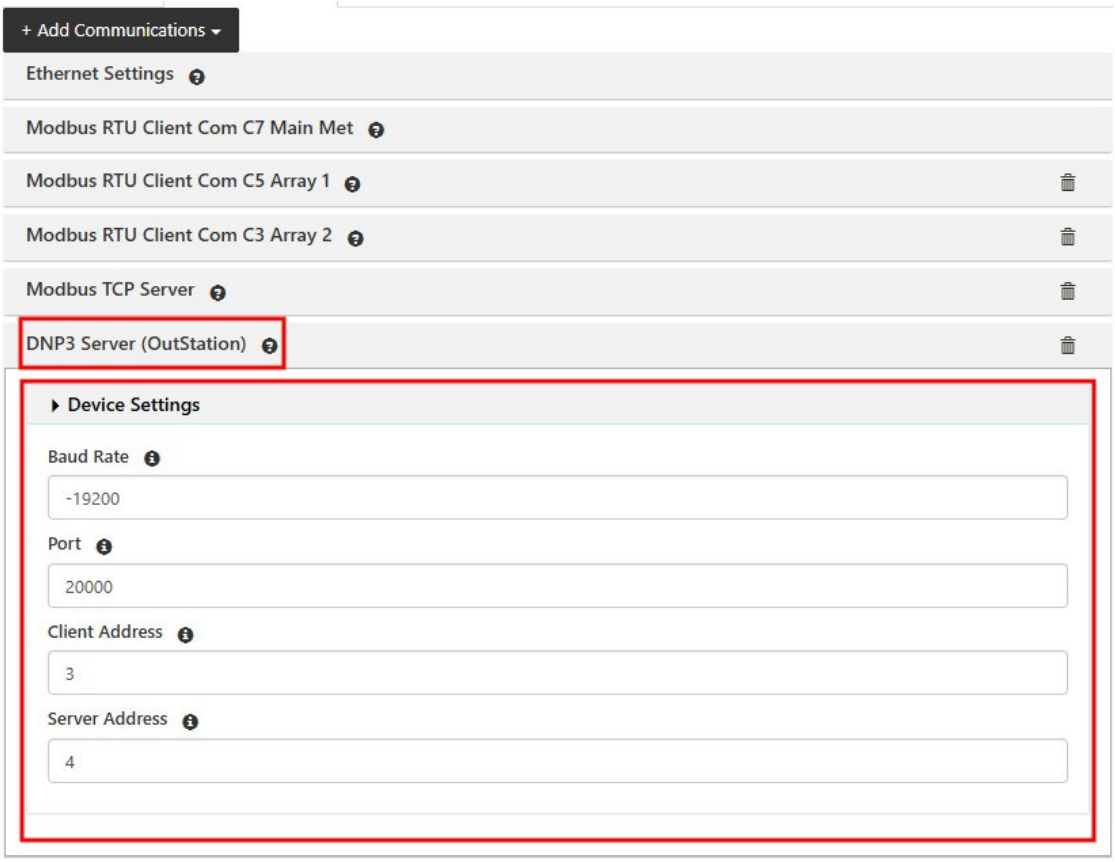
Selecting this option enables SunSentry 20 system to act as Modbus Server, serving the Modbus data from all attached sensors.



1. Click on **Modbus TCP Server** to expand its available settings.
2. Configure the **Device Settings** (**Port** and **Data Format**) to match the desired format.
3. Click on **Modbus TCP Server** again to collapse the settings.

6.2.5 DNP3 Server (OutStation)

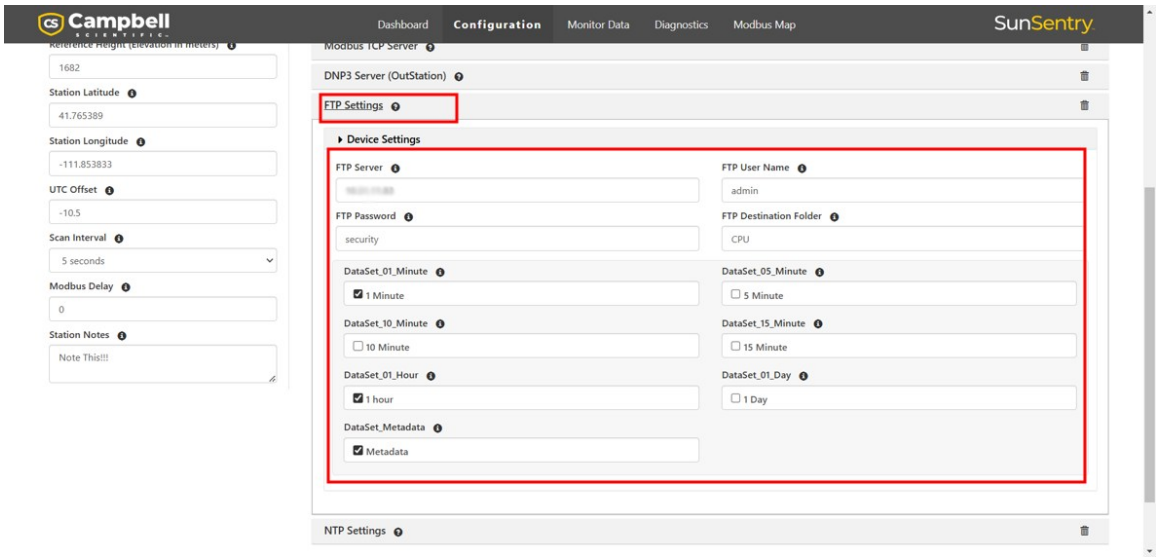
Selecting this option enables SunSentry 20 system to act as DNP3 Server, serving the Modbus data from all attached sensors.



1. Click on **DNP3 Server (OutStation)** to expand its available settings.
2. Configure the **Device Settings** (**Baud Rate**, **Port**, **Client Address**, and **Server Address**) to match the desired format.
3. Click on **DNP3 Server (OutStation)** again to collapse the settings.

6.2.6 FTP Settings

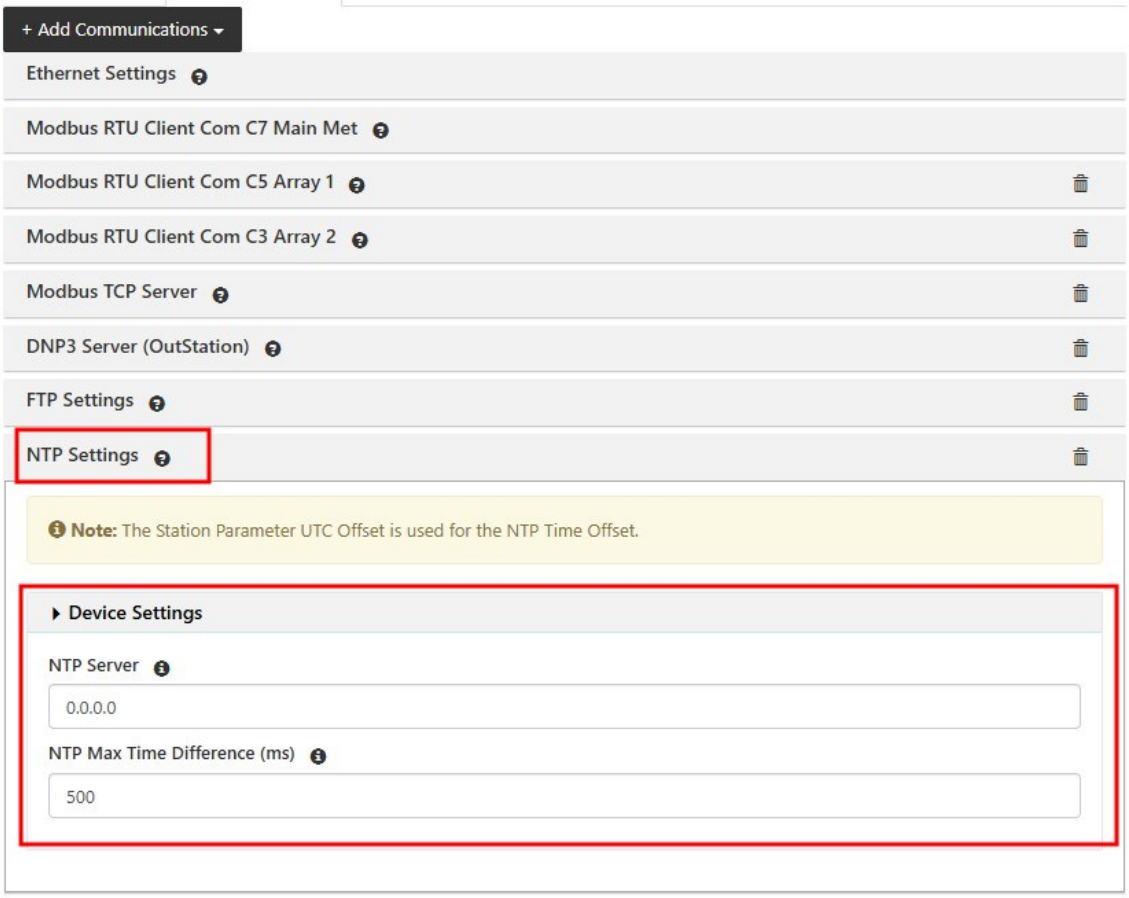
Selecting this option enables FTP streaming of the data table to an FTP server. The device will send the previous day's data to the FTP server at 1:00 am.



1. Click on **FTP Settings** to view available settings.
2. Configure the **FTP Settings** such as the **FTP Server**, **FTP Username**, **FTP Password**, and **FTP Destination Folder** to customize the FTP behavior.
3. Click on **FTP Settings** again to collapse the settings.

6.2.7 NTP Settings

The CR1000Xe internal clock is very reliable. However, if the application requires the clock to be synchronized by the Network Time Protocol (NTP), click on the **NTP Settings** to expand the **NTP Settings**. Configure the **NTP Server** and **Max Time Difference**) to customize the NTP behavior. Click on the communication option name again to collapse the settings.



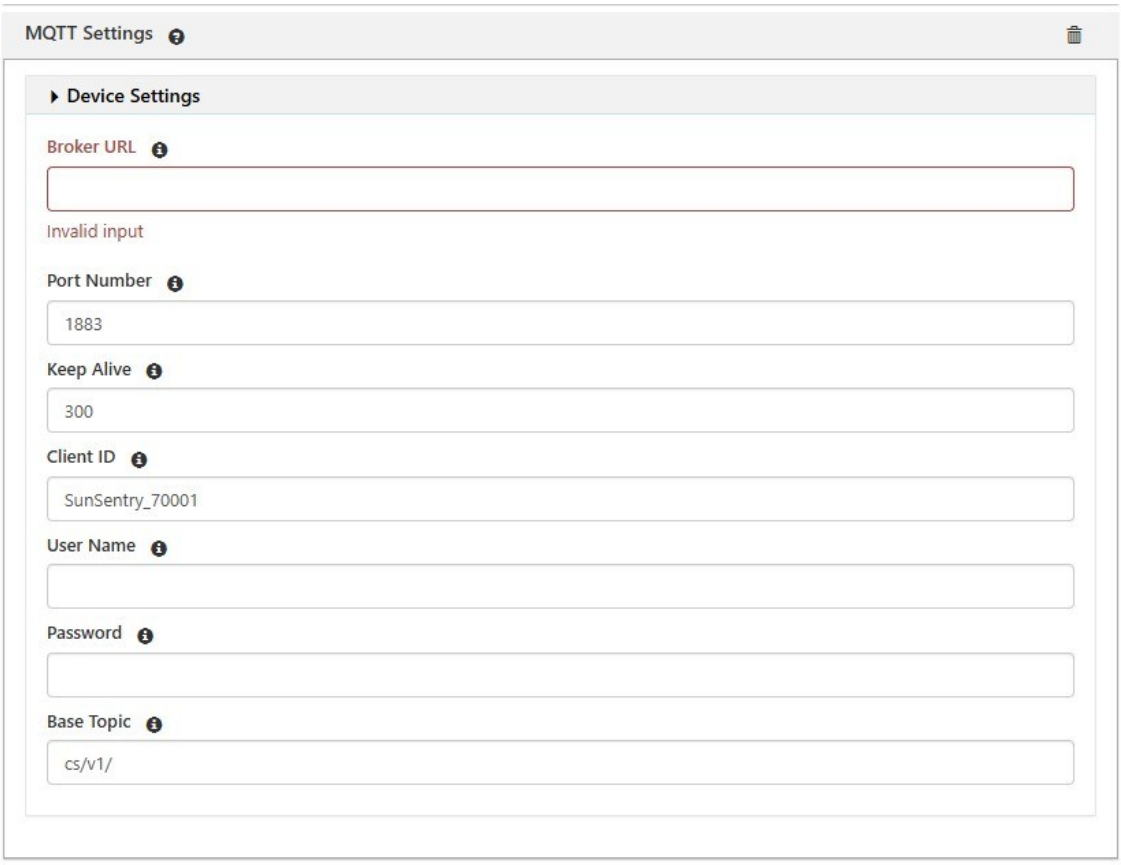
6.2.8 MQTT Settings

Selecting this option enables the publishing of data to an MQTT broker. The data will be published in the CSI Version of GeoJSON format. The following data will be published:

- **1-Minute MQTT Table data**: Every minute, all data from the **1-minute MQTT Data Table** will be published
- **Status data**: **Datalogger Status** data will be published every 30 minutes. The data will be published to the topic: {System Base Topic/}statusinfo

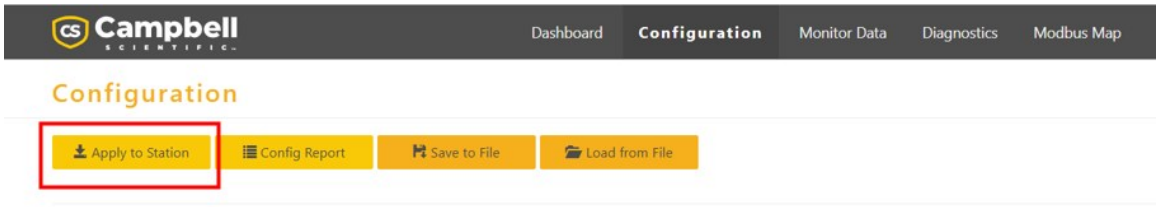
- **MQTT State data:** MQTT state info will be published every 1 minute. The payload is a JSON object that contains a "clientId" field and a "state" field.

In the Configuration window, enter the **MQTT Settings** (**Broker URL**, **Port Number**, **Client ID**, **Base Topic**) to customize the MQTT behavior.



6.2.9 Apply to Station

Click **Apply to Station** to apply the settings to the SunSentry 20 system or add sensors.



NOTE:
Apply to Station can be used at any time to apply the settings to the data logger. Single or multiple additions, changes or deletions of configuration can be applied at any time. **Apply to**

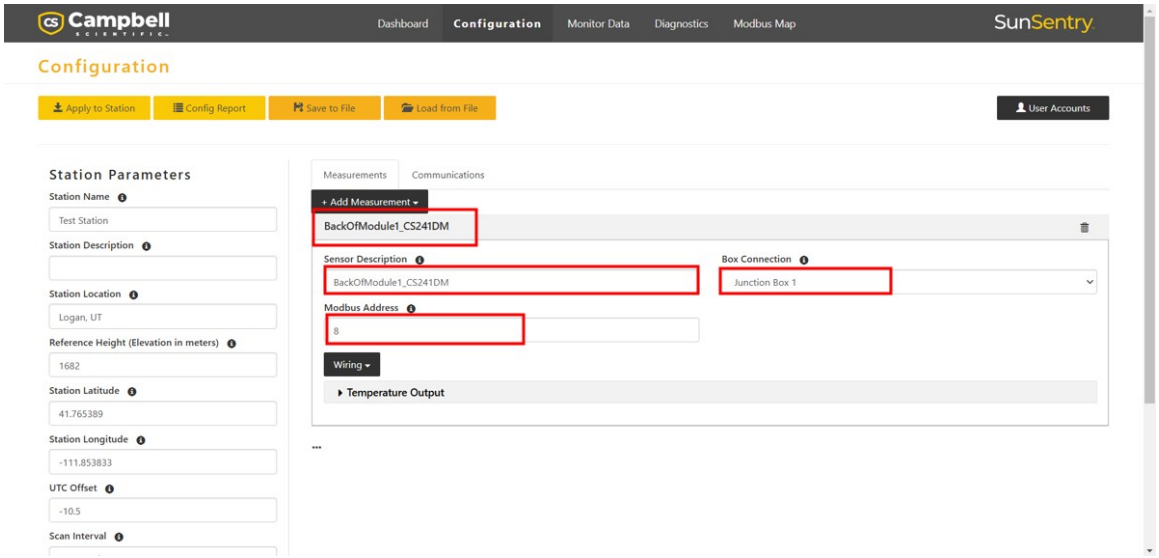
Station compiles the settings into a new *CRBasic* program. This new program creates new data tables thus all previous data is lost. The data logger program is updating and may take a few minutes to complete before new data is displayed.

6.3 Add sensors

Add up to two pyranometers of each functional type (GHI, POA, Albedo pairs, DHI), two compact weather sensors, six RPOA pyranometers and back-of-module temperature sensors, and two soiling sensors. The sensor menus are grouped by general output type, functional type, and manufacture model. Only one sensor can be added at a time. Click the listing to open the submenu. Click the listing again to close the submenu.

1. Click the Measurement tab.
2. Click +Add Measurement to see a list of available sensors.
3. Click the general output type desired, the functional type, and the manufacture model desired.
4. After a sensor appears in the list, type the parameters for that sensor to customize it for your application.
    a. Most sensors require the Modbus Address to be changed to match the Modbus address of the specific sensor being used. A default address will appear and can be used by ensuring the sensor is configured for the same address.
    b. Communications Port specifies which port the sensor is connected to. Each port is connected to a unique communications port on the data logger. Selecting the port the sensor is connected to ensures the software is configured to communicate with the sensor on the correct communication port.
    c. Sensor Description is used as the title of the measurements on the Dashboard. Although editable, Campbell Scientific suggests using the default sensor description for most circumstances.

d. Some sensors require input from other sensor outputs to function properly. Select from the drop-down menu presented or input the required data.



5. View the wiring diagram for the sensor by clicking on **Wiring**. The wiring table is also available in the **Config Report**.
6. If you selected a sensor by mistake or no longer wish to have the SunSentry 20 read data from it, remove it from the running configuration by clicking the trash can icon next to the sensor heading.
7. Once you have added all the sensors, click Apply to Station (p. 29) and the SunSentry 20 will start reading your sensors. The data logger program automatically updates, which may take a few minutes to complete before new data is displayed.

6.4 Creating accounts and passwords

Each CR1000Xe manufactured will have a unique identifier (UID). The UID can be found on a QR-code sticker on the front of the data logger. The UID also serves as a unique, preprogrammed password. This password is used when connecting to the data logger using an IP connection. Direct connection using the USB port does not require this password. The first connection to the data logger must be made via the USB port. During this initial connection, user accounts should be created to allow future access to the SunSentry 20 data logger without needing the preprogrammed password.

The SunSentry 20 ***Web UI*** requires the use of the preprogrammed password unless additional user accounts are created. SunSentry 20 ***Web UI*** does not change this preprogrammed password but enables the new administrative accounts full access to the data logger.

The SunSentry 20 ***Web UI*** adds a layer of protection and enables multiple user accounts to be created with either no access, read only or administrator privileges. Once connected by following the instructions provided in Connect to the SunSentry 20 (p. 20), perform the following procedure to create the desired logon accounts.

6.4.1 Set up user accounts

The system is protected by password access. When connected through the USB connection, all access is granted. To control remote access to the device, you can create user accounts with different permission levels. To configure the device remotely (over the Ethernet port), you must set up a user account with **Administrator** permission level.

To manage user accounts, click **User Accounts** in the **Configuration** screen to access the **User Account Setup** dialog box. You must be connected over USB or logged in under a previously created account with administrator access.

Secure Administrator Access:

1. Select **admin** from the **Username List** (name can be changed from admin).
2. Enter a password in the **Password** field (password is not required but is highly recommended).
3. Close the page.
4. Click **Apply to Station**.

> **NOTE:**
> Web browsers may cache the password, so the password does not need entered each time the web page is accessed from the same computer.

The following table explains what permission levels are available.

Table 6-1: User account permissions

Permission level	Access
None	Disable an account without deleting it.
Read only	Permission to view the device values.
Administrator	Permission to view the device values, to edit the device configuration, and to create and edit accounts.

NOTE:
Creating a user account named anonymous without a password allows anyone who connects to the device to access it without entering credentials. By default, an anonymous account is provided with read-only permissions. This allows users to view the **Dashboard**, **Historical Data**, and **Modbus Map** pages without logging in.

The anonymous account without password must exist for the device to be accessed properly using the Apple Safari browser.

7. Troubleshooting

Symptom: Cannot connect to the station

- Verify the data logger has sufficient power by connecting to it and checking the battery voltage in the **Status** table. A healthy voltage typically reads slightly over 24 V. See a video on **Measuring Data Logger Output Voltage With a Multimeter** here:

  www.campbellsci.com/videos/basic-troubleshooting-01.

Symptom: Sensor not reporting

- Check the cable for signs of damage and possible moisture intrusion.
- Check sensor connections to ensure that they are connected to the correct terminal.
- Check the voltage to the sensors with a digital voltage meter.

7.1 Web interface recovery

In the unlikely event that web interface files are lost or corrupted, a data logger-hosted recovery page can be used to restore the web interface. This page can also be used to update the web interface when new versions are available. The recovery page is accessed by navigating to: **datalogger IP Address/recovery**. For example: **111.222.333.444/recovery**. This will open a **Recovery** page in the browser.

The **Send File** button on the recovery web page allows users to upload .obj or web.obj.gz files to restore web interface files on the data logger. The upload process may take several minutes.

8. Maintenance

During site visits, check the driven pile, concrete pad with pile adapter, tower, crossarms, sensor mounts, and junction box mounts. Tighten bolts when needed. Sensor maintenance schedule and tasks are provided in the following table.

Table 8-1: Irradiance and soiling sensors maintenance schedule and tasks

Sensor type	Recommended frequency range	Maintenance task	Task details	Effect mitigated
Irradiance Sensors	Site specific, depending on site conditions. Two times per week up to two times per month	Clean outer glass dome	Spray demineralized water then wipe with a soft cloth dry to clean	The irradiance measurement will be impacted due to change in transmittance
Irradiance Sensors	Weekly to monthly	Check appearance condition	Check for cracks and scratches on the glass dome and body	May lead to shade on the detector and enhanced soiling

Table 8-1: Irradiance and soiling sensors maintenance schedule and tasks				
Sensor type	Recommended frequency range	Maintenance task	Task details	Effect mitigated
Irradiance Sensors	Weekly to monthly	Check setup base condition	Check if the instrument is securely and properly tightened to the mounting base/ plate	Loose instruments and/or mounting plates can lead to damages of the instruments and/or injury.
Irradiance Sensors	Weekly to monthly	Check bubble level	Verify the bubble is in the center ring of bubble level if the irradiance sensor is setup in a horizontal (GHI) position.	An additional cosine/azimuth error will be introduced
Irradiance Sensors	Weekly to monthly	Check the tilt angle.	Check the tilt angle and roll angle in Modbus RTU output. If making a GHI measurement, check the sensor bubble level.	Any change in tilt position after the installation can affect the measurements due to the cosine response of the sensor.
Irradiance Sensors	Weekly to monthly	Check cable condition	Check if the instrument is tightened properly to the mounting base plate and the base plate and/or table is securely fastened in a proper condition.	A disconnected cable will cause sporadic reading errors or failure of operation. If the cable is damaged, it may cause noise or electric shock.
Irradiance Sensors	Weekly to monthly	Data validity	Check the daytime irradiance data and compare it to previous days or adjacent pyranometers.	Large differences may indicate installation issues or sensor problems

Table 8-1: Irradiance and soiling sensors maintenance schedule and tasks				
Sensor type	Recommended frequency range	Maintenance task	Task details	Effect mitigated
Irradiance Sensors	Weekly to monthly	Presence of noise	Check night-time irradiance values	Used to detect night-time offsets and sensor stability issues
Irradiance Sensors	Weekly to monthly	Check the dome heating current when the dome heating function is turned on.	Check dome heating current alert register using Modbus RTU output.	If the dome heating current is not energized properly, the dew and frost mitigation effect cannot be fully achieved.
Irradiance Sensors	Weekly to Monthly	Check the temperature inside	Check the body temperature via Modbus RTU output.	If the inside temperature becomes abnormally high, the life of the product will be shortened.
Irradiance Sensors	Weekly to Monthly	Check the efficacy of desiccant	Check the internal relative humidity alert status of the pyranometer in the Modbus RTU output.	The condition of the drying agent can slightly change over time. If the relative humidity becomes high, the glass dome might be fogging up.
Irradiance Sensors	Weekly to Monthly, before/after severe weather events	Check sun screen	Verify if the sun screen is securely attached on the body, and the knurling screw is securely tightened.	A loose sun screen or knurling screw may damage the instrument and/or increase measurement errors due to temperature increase by sun screen coming off.

Table 8-1: Irradiance and soiling sensors maintenance schedule and tasks				
Sensor type	Recommended frequency range	Maintenance task	Task details	Effect mitigated
Soiling Sensors	Weekly to monthly - Site Specific	Check soiling sensor entrance optics	If a clean reference sample is used, make sure it remains clean	The soiling measurements will have erroneous measurements due to reduced transmittance on the reference clean sample
Soiling Sensors	Weekly	Clean the reference/clean panel if using that method	Use normal water and wipe clean the surface.	Maintains proper soiling measurements.
Soiling Sensors	Weekly to monthly	Data validity	Check the daytime values and compare to previous days or adjacent sensor. Specific to soiling, look for changes in the soiling ratio (SR)	When large differences occur, operating problems or installation issues can be detected.
All Sensors	Yearly	Physical and electrical connections	Check for wear and damage, including corrosion, stress cracks, frayed cables, nicked or cut cable housing, loose cable clamps, cable tightness, etc. and take necessary corrective actions.	Damaged sensor, poor contacts and electrical noise, etc.

Table 8-1: Irradiance and soiling sensors maintenance schedule and tasks				
Sensor type	Recommended frequency range	Maintenance task	Task details	Effect mitigated
All Sensors	Per manufacturer recommendation	Calibration	To maintain the best possible measurement accuracy, calibration of the irradiance sensors is recommended. Contact Campbell Scientific for more details and requests for a calibration and maintenance service. Traditional thermopile pyranometers with the detector at the surface require calibrations at 2 years or sooner.	Due to natural aging of materials, the detector sensitivity of the pyranometer can gradually change over time.
All Sensors	Yearly	Check sensor connectors, cables, wiring, and grounding	Check full sensor cabling. Start with ensuring the connector is properly tightened on the sensor. If cables are not in conduit, verify they are not cracking or damaged. Ensure the wiring in the enclosures is proper and secure. Ensure ground and shield cables are properly connected to their respective termination points.	Lost data. Damaged connectors or wires can pull down a communication bus and cause problems with multiple sensors.

9. Modbus map

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Write to registers			
Circuit Breaker Reset (Write)	44597		Write 0 to this register to reset circuit breaker
System			
Heartbeat	40001		
BatteryVoltage	40003		V
Panel Temperature	40005		C
Door Open Duration	40007		Seconds
BatteryHealth	40009		0=OK; 1=Bat1 Vlow; 2=Bat2 Vlow; 3=Bat1 Vhigh; 4=Bat2 Vhigh; 5=Fuse open; 6=Imbalance; 7=Bat NOT Connected 10=Not Reported
Breaker1_24V_Status	40011		0 = OK, 1 = Tripped
Enclosure Temperature	40013		°C

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
AC Status	40015		0,1,2=AC OK; 3,5=AC Fault; 0,5=DC OK; 2,3,4=DC Fault; 10=AC Unknown, -999,999=Monitoring Not Configured
SPD Status	40017		0 = Normal, 1 = V Fault
Enclosure Humidity (RH)	40019		%
Status			
Supply_Voltage_Flag		40605	0 = OK, 1 = PS Fault, Low Voltage, 2 = PS Fault, Battery Powered, 3 = Low Voltage, 4 = High Voltage, 5 = NAN
Door Open Duration		40609	Seconds
Door Switch DoorOpenevent Year		40611	
Door Switch DoorOpenevent Month		40613	
Door Switch DoorOpenevent Day of Month		40615	
Door Switch DoorOpenevent Hour		40617	
Door Switch DoorOpenevent Minute		40619	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Door Switch DoorClosedevent Year		40621	
Door Switch DoorClosedevent Month		40623	
Door Switch DoorClosedevent Day of Month		40625	
Door Switch DoorClosedevent Hour		40627	
Door Switch DoorClosedevent Minute		40629	
Enclosure State		40631	0 = ≤ 10% of last 24 hrs above 80% RH; 1 = ≤ 30% of last 24 hrs above 80% RH; 2 = Alarm (> 30% of last 24 hrs above 80% RH)
Enclosure Temperature		40633	°C
Enclosure Relative Humidity		40635	%
Serial Number		40637	
MB Result Code			
All in One Met Sensor 1		40639	
All in One Met Sensor 2		40641	
GHI1		40643	
GHI2		40645	
POA1		40647	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
POA2		40649	
Albedo Up 1		40651	
Albedo Down 1		40653	
Albedo Up 2		40655	
Albedo Down 2		40657	
DHI1		40659	
DHI2		40661	
RPOA 1		40663	
RPOA 2		40665	
RPOA 3		40667	
RPOA 4		40669	
RPOA 5		40671	
RPOA 6		40673	
BOM 1		40675	
BOM 2		40677	
BOM 3		40679	
BOM 4		40681	
BOM 5		40683	
BOM 6		40685	
DustVue1, DV10, DV20		40687	
DustVue 2, DV10, DV20		40689	
Dust IQ 1		40691	
Dust IQ 2		40693	
DNI_1		40695	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DNI_2		40697	
RDE300i 1		40699	
RDE300i 2		40701	
GPS1		40703	
GPS2		40705	
Irradiance			
POA1 Irradiance temp compensated	40021	40801	W/m^2
POA1 Body Temp		40803	Deg C
POA1 Serial Number		40805	
POA1 Cal Date		40807	
POA1 Irradiance temp Uncompensated		40809	W/m^2
POA1 Humidity		40811	%
POA1 Pressure Average		40813	mbar
POA1 Fan Speed		40815	RPM
POA1 Heater Current		40817	A
POA1 Fan Current		40819	A
POA1 Tilt Angle		40821	Degrees
POA1 Tilt Angle X		40823	Degrees
POA1 Tilt Angle Y		40825	Degrees
POA1 Pyranometer Status		40827	
POA1 Heater ON/OFF		40829	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
POA1 RotationAboutZ		40831	Degrees
POA1 Unused		40833	
POA1 User Defined / Spare		40835	
POA2 Irradiance temp compensated	40023	40861	W/m^2
POA2 Body Temp		40863	Deg C
POA2 Serial Number		40865	
POA2 Cal Date		40867	
POA2 Irradiance temp Uncompensated		40869	W/m^2
POA2 Humidity		40871	%
POA2 Pressure Average		40873	mbar
POA2 Fan Speed		40875	RPM
POA2 Heater Current		40877	A
POA2 Fan Current		40879	A
POA2 Tilt Angle		40881	Degrees
POA2 Tilt Angle X		40883	Degrees
POA2 Tilt Angle Y		40885	Degrees
POA2 Pyranometer Status		40887	
POA2 Heater ON/OFF		40889	
POA2 RotationAboutZ		40891	Degrees
POA2 Unused		40893	
POA2 User Defined / Spare		40895	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
GHI1 Irradiance temp compensated	40025	40921	W/m^2
GHI1 Body Temp		40923	Deg C
GHI1 Serial Number		40925	
GHI1 Cal Date		40927	
GHI1 Irradiance temp Uncompensated		40929	W/m^2
GHI1 Humidity		40931	%
GHI1 Pressure Average		40933	mbar
GHI1 Fan Speed		40935	RPM
GHI1 Heater Current		40937	A
GHI1 Fan Current		40939	A
GHI1 Tilt Angle		40941	Degrees
GHI1 Tilt Angle X		40943	Degrees
GHI1 Tilt Angle Y		40945	Degrees
GHI1 Pyranometer Status		40947	
GHI1 Heater ON/OFF		40949	
GHI1 RotationAboutZ		40951	Degrees
GHI1 Unused		40953	
GHI1 User Defined / Spare		40955	
GHI2 Irradiance temp compensated	40027	40981	W/m^2
GHI2 Body Temp		40983	Deg C

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
GHI2 Serial Number		40985	
GHI2 Cal Date		40987	
GHI2 Irradiance temp Uncompensated		40989	W/m^2
GHI2 Humidity		40991	%
GHI2 Pressure Average		40993	mbar
GHI2 Fan Speed		40995	RPM
GHI2 Heater Current		40997	A
GHI2 Fan Current		40999	A
GHI2 Tilt Angle		41001	Degrees
GHI2 Tilt Angle X		41003	Degrees
GHI2 Tilt Angle Y		41005	Degrees
GHI2 Pyranometer Status		41007	
GHI2 Heater ON/OFF		41009	
GHI2 RotationAboutZ		41011	Degrees
GHI2 Unused		41013	
GHI2 User Defined / Spare		41015	
ALB1Up Irradiance temp compensated		41041	W/m^2
ALB1Up Body Temp		41043	Deg C
ALB1Up Serial Number		41045	
ALB1Up Cal Date		41047	
ALB1Up Irradiance temp Uncompensated		41049	W/m^2

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
ALB1Up Humidity		41051	%
ALB1Up Pressure Average		41053	mbar
ALB1Up Fan Speed		41055	RPM
ALB1Up Heater Current		41057	A
ALB1Up Fan Current		41059	A
ALB1Up Tilt Angle		41061	Degrees
ALB1Up Tilt Angle X		41063	Degrees
ALB1Up Tilt Angle Y		41065	Degrees
ALB1Up Pyranometer Status		41067	
ALB1Up Heater ON/OFF		41069	
ALB1Up RotationAboutZ		41071	Degrees
ALB1Up Unused		41073	
ALB1Up User Defined / Spare		41075	
ALB1Down Irradiance temp compensated		41101	W/m^2
ALB1Down Body Temp		41103	Deg C
ALB1Down Serial Number		41105	
ALB1Down Cal Date		41107	
ALB1Down Irradiance temp Uncompensated		41109	W/m^2
ALB1Down Humidity		41111	%
ALB1Down Pressure Average		41113	mbar
ALB1Down Fan Speed		41115	RPM

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
ALB1Down Heater Current		41117	A
ALB1Down Fan Current		41119	A
ALB1Down Tilt Angle		41121	Degrees
ALB1Down Tilt Angle X		41123	Degrees
ALB1Down Tilt Angle Y		41125	Degrees
ALB1Down Pyranometer Status		41127	
ALB1Down Heater ON/OFF		41129	
ALB1Down RotationAboutZ		41131	Degrees
ALB1Down Albedo	40029	41133	
ALB1Down User Defined / Spare		41135	
ALB2Up Irradiance temp compensated		41161	W/m^2
ALB2Up Body Temp		41163	Deg C
ALB2Up Serial Number		41165	
ALB2Up Cal Date		41167	
ALB2Up Irradiance temp Uncompensated		41169	W/m^2
ALB2Up Humidity		41171	%
ALB2Up Pressure Average		41173	mbar
ALB2Up Fan Speed		41175	RPM
ALB2Up Heater Current		41177	A
ALB2Up Fan Current		41179	A
ALB2Up Tilt Angle		41181	Degrees

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
ALB2Up Tilt Angle X		41183	Degrees
ALB2Up Tilt Angle Y		41185	Degrees
ALB2Up Pyranometer Status		41187	
ALB2Up Heater ON/OFF		41189	
ALB2Up RotationAboutZ		41191	Degrees
ALB2Up Unused		41193	
ALB2Up User Defined / Spare		41195	
ALB2Down Irradiance temp compensated		41221	W/m^2
ALB2Down Body Temp		41223	Deg C
ALB2Down Serial Number		41225	
ALB2Down Cal Date		41227	
ALB2Down Irradiance temp Uncompensated		41229	W/m^2
ALB2Down Humidity		41231	%
ALB2Down Pressure Average		41233	mbar
ALB2Down Fan Speed		41235	RPM
ALB2Down Heater Current		41237	A
ALB2Down Fan Current		41239	A
ALB2Down Tilt Angle		41241	Degrees
ALB2Down Tilt Angle X		41243	Degrees
ALB2Down Tilt Angle Y		41245	Degrees
ALB2Down Pyranometer Status		41247	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
ALB2Down Heater ON/OFF		41249	
ALB2Down RotationAboutZ		41251	Degrees
ALB2Down Albedo	40031	41253	
ALB2Down User Defined / Spare		41255	
DHI1 SPN1_DNI	40033	41281	
DHI1 SPN1_DIF Diffuse (DHI)	40035	41283	
DHI1 SPN1_GHI Reference		41285	
DHI1 DIF/GHI		41287	
DHI1 Heater Status		41289	
DHI1 TBD		41291	
DHI1 TBD		41293	
DHI1 TBD		41295	
DHI1 TBD		41297	
DHI1 TBD		41299	
DHI1 TBD		41301	
DHI1 TBD		41303	
DHI1 TBD		41305	
DHI2 SPN1_DNI	40037	41341	
DHI2 SPN1_DIF Diffuse (DHI)	40039	41343	
DHI2 SPN1_GHI		41345	
DHI2 DIF/GHI		41347	
DHI2 Heater Status		41349	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DHI2 TBD		41351	
DHI2 TBD		41353	
DHI2 TBD		41355	
DHI2 TBD		41357	
DHI2 TBD		41359	
DHI2 TBD		41361	
DHI2 TBD		41363	
DHI2 TBD		41365	
RPOA1 Irradiance temp compensated	40041	41401	W/m^2
RPOA1 Body Temp		41403	Deg C
RPOA1 Serial Number		41405	
RPOA1 Cal Date		41407	
RPOA1 Irradiance temp Uncompensated		41409	W/m^2
RPOA1 Humidity		41411	%
RPOA1 Pressure Average		41413	mbar
RPOA1 Fan Speed		41415	RPM
RPOA1 Heater Current		41417	A
RPOA1 Fan Current		41419	A
RPOA1 Tilt Angle		41421	Degrees
RPOA1 Tilt Angle X		41423	Degrees
RPOA1 Tilt Angle Y		41425	Degrees

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RPOA1 Pyranometer Status		41427	
RPOA1 Heater ON/OFF		41429	
RPOA1 RotationAboutZ		41431	Degrees
RPOA2 Irradiance temp compensated	40043	41461	W/m^2
RPOA2 Body Temp		41463	Deg C
RPOA2 Serial Number		41465	
RPOA2 Cal Date		41467	
RPOA2 Irradiance temp Uncompensated		41469	W/m^2
RPOA2 Humidity		41471	%
RPOA2 Pressure Average		41473	mbar
RPOA2 Fan Speed		41475	RPM
RPOA2 Heater Current		41477	A
RPOA2 Fan Current		41479	A
RPOA2 Tilt Angle		41481	Degrees
RPOA2 Tilt Angle X		41483	Degrees
RPOA2 Tilt Angle Y		41485	Degrees
RPOA2 Pyranometer Status		41487	
RPOA2 Heater ON/OFF		41489	
RPOA2 RotationAboutZ		41491	Degrees
RPOA3 Irradiance temp compensated	40045	41521	W/m^2

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RPOA3 Body Temp		41523	Deg C
RPOA3 Serial Number		41525	
RPOA3 Cal Date		41527	
RPOA3 Irradiance temp Uncompensated		41529	W/m²
RPOA3 Humidity		41531	%
RPOA3 Pressure Average		41533	mbar
RPOA3 Fan Speed		41535	RPM
RPOA3 Heater Current		41537	A
RPOA3 Fan Current		41539	A
RPOA3 Tilt Angle		41541	Degrees
RPOA3 Tilt Angle X		41543	Degrees
RPOA3 Tilt Angle Y		41545	Degrees
RPOA3 Pyranometer Status		41547	
RPOA3 Heater ON/OFF		41549	
RPOA3 RotationAboutZ		41551	Degrees
RPOA4 Irradiance temp compensated	40047	41581	W/m²
RPOA4 Body Temp		41583	Deg C
RPOA4 Serial Number		41585	
RPOA4 Cal Date		41587	
RPOA4 Irradiance temp Uncompensated		41589	W/m²
RPOA4 Humidity		41591	%

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RPOA4 Pressure Average		41593	mbar
RPOA4 Fan Speed		41595	RPM
RPOA4 Heater Current		41597	A
RPOA4 Fan Current		41599	A
RPOA4 Tilt Angle		41601	Degrees
RPOA4 Tilt Angle X		41603	Degrees
RPOA4 Tilt Angle Y		41605	Degrees
RPOA4 Pyranometer Status		41607	
RPOA4 Heater ON/OFF		41609	
RPOA4 RotationAboutZ		41611	Degrees
RPOA5 Irradiance temp compensated	40049	41641	W/m^2
RPOA5 Body Temp		41643	Deg C
RPOA5 Serial Number		41645	
RPOA5 Cal Date		41647	
RPOA5 Irradiance temp Uncompensated		41649	W/m^2
RPOA5 Humidity		41651	%
RPOA5 Pressure Average		41653	mbar
RPOA5 Fan Speed		41655	RPM
RPOA5 Heater Current		41657	A
RPOA5 Fan Current		41659	A
RPOA5 Tilt Angle		41661	Degrees

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RPOA5 Tilt Angle X		41663	Degrees
RPOA5 Tilt Angle Y		41665	Degrees
RPOA5 Pyranometer Status		41667	
RPOA5 Heater ON/OFF		41669	
RPOA5 RotationAboutZ		41671	Degrees
RPOA6 Irradiance temp compensated	40051	41701	W/m^2
RPOA6 Body Temp		41703	Deg C
RPOA6 Serial Number		41705	
RPOA6 Cal Date		41707	
RPOA6 Irradiance temp Uncompensated		41709	W/m^2
RPOA6 Humidity		41711	%
RPOA6 Pressure Average		41713	mbar
RPOA6 Fan Speed		41715	RPM
RPOA6 Heater Current		41717	A
RPOA6 Fan Current		41719	A
RPOA6 Tilt Angle		41721	Degrees
RPOA6 Tilt Angle X		41723	Degrees
RPOA6 Tilt Angle Y		41725	Degrees
Pyranometer Status		41727	
Heater ON/OFF		41729	
RotationAboutZ		41731	Degrees

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Back of Module Temperature			
BOM1 Temperature	40053	41761	Deg C
BOM1 Serial Number		41763	
BOM1 Counter		41765	
BOM1 Sensor Status		41767	
BOM1 Range Check		41769	
BOM2 Temperature	40055	41801	Deg C
BOM2 Serial Number		41803	
BOM2 Counter		41805	
BOM2 Sensor Status		41807	
BOM2 Range Check		41809	
BOM3 Temperature	40057	41841	Deg C
BOM3 Serial Number		41843	
BOM3 Counter		41845	
BOM3 Sensor Status		41847	
BOM3 Range Check		41849	
BOM4 Temperature	40059	41881	Deg C
BOM4 Serial Number		41883	
BOM4 Counter		41885	
BOM4 Sensor Status		41887	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
BOM4 Range Check		41889	
BOM5 Temperature	40061	41921	Deg C
BOM5 Serial Number		41923	
BOM5 Counter		41925	
BOM5 Sensor Status		41927	
BOM5 Range Check		41929	
BOM6 Temperature	40063	41961	Deg C
BOM6 Serial Number		41963	
BOM6 Counter		41965	
BOM6 Sensor Status		41967	
BOM6 Range Check		41969	
Weather			
Air Temperature1	40079	42001	Deg C
Relative Humidity1	40081	42003	%
Barometric Pressure1	40083	42005	hPa
WindSpeed1	40085	42007	m/s
Wind Direction1	40087	42009	Deg
Dew Point1	40089	42011	Deg C
Compass Heading of North Mark1		42013	Degrees
WindDirCorrected1		42015	Degrees
Precip (Sample) qty per scan		42017	mm,in

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Precip (Totalize) 1min	40091	42019	mm,in
Rain_Hourly	40093	42021	mm,in
Rain_daily	40095	42023	mm,in
Precip 5 min		42025	mm,in
Precip 10 min		42027	mm,in
Precip 15 min		42029	mm,in
Lightning Strikes		42031	# strikes
Lightning StrikeDistance		42033	km
Gust_WindSpeed		42035	m/s
Polar Orientation		42037	Degrees
North_WindSpeed		42039	m/s
East_WindSpeed		42041	m/s
XOrientation		42043	Degrees
YOrientation		42045	Degrees
BaroVue10 Sensor Temperature		42047	Degrees C
BaroVue10 Quality metric		42049	
TempVue Instantaneous temperature	40079	42051	Degrees C
TempVue 60s average temperature		42053	Degrees C
TempVue 24 hr minimum temperature		42055	Degrees C
TempVue 24 hr maximum temperature		42057	Degrees C

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
TempVue 24 hr average temperature		42059	Degrees C
TempVue Measurement period		42061	
TempVue Error flag		42063	
TempVue Serial number		42065	
TempVue OS Version		42067	
TempVue Model ID		42069	
TempVue Instantaneous temperature		42067	Degrees F
TempVue 60 s average temperature		42069	Degrees F
TempVue 24 hr minimum temperature		42071	Degrees F
TempVue 24 hr maximum temperature		42073	Degrees F
TempVue 24 hr average temperature		42075	Degrees F
TempVue Measurement period		42077	
TempVue Error flag		42079	
Air Temperature2	40099	42101	Deg C
Relative Humidity2	40101	42103	%
Barometric Pressure2	40103	42105	hPa
WindSpeed2	40105	42107	m/s
Wind Direction2	40107	42109	Deg

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Dew Point2	40109	42111	Deg C
Compass Heading of North Mark1		42113	Degrees
WindDirCorrected1		42115	Degrees
Precip (Sample) qty per scan		42117	mm,in
Precip (Totalize) 1min	40111	42119	mm,in
Rain_Hourly	40113	42121	mm,in
Rain_daily	40115	42123	mm,in
Precip 5 min		42125	mm,in
Precip 10 min		42127	mm,in
Precip 15 min		42129	mm,in
Strikes		42131	# strikes
StrikeDistance		42133	km
Gust_WindSpeed		42135	m/s
Polar Orientation		42137	Degrees
North_WindSpeed		42139	m/s
East_WindSpeed		42141	m/s
XOrientation		42143	Degrees
YOrientation		42145	Degrees
BaroVue10 Sensor Temperature		42047	Degrees C
BaroVue10 Quality metric		42049	
TempVue2 Instantaneous temperature	40099	42147	Degrees C

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
TempVue2 60 s average temperature		42149	Degrees C
TempVue2 24 hr minimum temperature		42151	Degrees C
TempVue2 24 hr maximum temperature		42153	Degrees C
TempVue2 24 hr average temperature		42155	Degrees C
TempVue2 Measurement period		42157	
TempVue2 Error flag		42159	
TempVue2 Serial number		42161	
TempVue2 OS Version		42163	
TempVue2 Model ID		42165	
TempVue2 Instantaneous temperature		42163	Degrees F
TempVue2 60 s average temperature		42165	Degrees F
TempVue2 24 hr minimum temperature		42167	Degrees F
TempVue2 24 hr maximum temperature		42169	Degrees F
TempVue2 24 hr average temperature		42171	Degrees F
TempVue2Measurement period		42173	
TempVue2Error flag		42175	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Precipitation			
Snowdepth sample each scan		42201	Meters
Snowdepth sample depth every hour	40119	42203	Meters
Snowdepth sample depth every 24 hrs	40121	42205	Meters
Snowedepth sample depth every 5 Minutes		42207	Meters
Snowvue AirTempC		42209	Deg C
Snowvue Distance to target		42211	Meters
Snowvue TempCorrDistTarg		42213	Meters
Snowvue IntTemp		42215	Deg C
Snowvue IntRH		42217	%
Snowvue Pitch		42219	Degrees
Snowvue Roll		42221	Degrees
Snowvue SupVolt		42223	Volts
Snowvue ResFreq		42225	Hz
Snowvue Alert		42227	
Snowdepth sample each scan		42261	Meters
Snowdepth sample depth every hour	40123	42263	Meters
Snowdepth sample depth every 24 hrs	40125	42265	Meters

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Snowdepth sample depth every 5 Minutes		42267	Meters
Snowvue AirTC		42269	Deg C
Snowvue DT		42271	Meters
Snowvue TCDT		42273	Meters
Snowvue IntTemp		42275	Deg C
Snowvue IntRH		42277	%
Snowvue Pitch		42279	Degrees
Snowvue Roll		42281	Degrees
Snowvue SupVolt		42283	Volts
Snowvue ResFreq		42285	Hz
Snowvue Alert		42287	
Rain per scan	40127	42321	mm
Rain Accumulation 1 min	40129	42323	mm
Rain Accumulation 1 hour	40131	42325	mm
Rain Accumulation 1 day	40133	42327	mm
Rain Accumulation 5 min		42329	mm
Rain Accumulation 10 min		42331	mm
Rain Accumulation 15 min		42333	mm
RainVue1 Supply voltage (VDC)		42335	V
RainVue1 Temperature (°C)		42337	Deg C

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RainVue1 Sensor level (Degrees from normal, flat)		42339	Degrees
RainVue1 Time since last measurable precipitation event (Days)		42341	
RainVue1 Lithium battery voltage (VDC)		42343	V
RainVue1 Serial number: SN=xxxxxxx		42345	
Rain per scan	40137	42381	mm
Rain Accumulation 1 min	40139	42383	mm
Rain Accumulation 1 hour	40141	42385	mm
Rain Accumulation 1 day	40143	42387	mm
Rain Accumulation 5 min		42389	mm
Rain Accumulation 10 min		42391	mm
Rain Accumulation 15 min		42393	mm
RainVue2 Supply voltage (VDC)		42395	V
RainVue2 Temperature (°C)		42397	Deg C
RainVue2 Sensor level (Degrees from normal, flat)		42399	Degrees
RainVue2 Time since last measurable precipitation event (Days)		42401	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
RainVue2 Lithium battery voltage (VDC)		42403	V
RainVue2 Serial number: SN=xxxxxxx		42405	
Hail Disdrometer(1) Hit_Cnt	40149	42441	hits
Hail Disdrometer(2) Class_Label_10		42443	%
Hail Disdrometer(3) Class_Label_15		42445	%
Hail Disdrometer(4) Class_Label_20		42447	%
Hail Disdrometer(5) Class_Label_25		42449	%
Hail Disdrometer(6) Class_Label_30		42451	%
Hail Disdrometer(7) Class_Label_35		42453	%
Hail Disdrometer(8) Class_Label_40		42455	%
Hail Disdrometer(9) Class_Label_45		42457	%
Hail Disdrometer(10) Class_Label_50		42459	%
Hail Disdrometer(11) Class_Label_55		42461	%
Hail Disdrometer(12) Class_Label_60		42463	%
Hail Disdrometer(13) Class_Label_65		42465	%
Hail Disdrometer(14) Class_Label_70		42467	%
Hail Disdrometer(15) Class_Label_75		42469	%

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Hail Disdrometer(16) Class_Label_99		42471	%
Hail Disdrometer(1) Hit_Cnt	40159	42541	hits
Hail Disdrometer(2) Class_Label_10		42543	%
Hail Disdrometer(3) Class_Label_15		42545	%
Hail Disdrometer(4) Class_Label_20		42547	%
Hail Disdrometer(5) Class_Label_25		42549	%
Hail Disdrometer(6) Class_Label_30		42551	%
Hail Disdrometer(7) Class_Label_35		42553	%
Hail Disdrometer(8) Class_Label_40		42555	%
Hail Disdrometer(9) Class_Label_45		42557	%
Hail Disdrometer(10) Class_Label_50		42559	%
Hail Disdrometer(11) Class_Label_55		42561	%
Hail Disdrometer(12) Class_Label_60		42563	%
Hail Disdrometer(13) Class_Label_65		42565	%
Hail Disdrometer(14) Class_Label_70		42567	%
Hail Disdrometer(15) Class_Label_75		42569	%
Hail Disdrometer(16) Class_Label_99		42571	%

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
GPS			
latitude_a 'Degrees latitude (+ = North; - = South)		44401	degrees
latitude_b 'Minutes latitude		44403	minutes
longitude_a 'Degress longitude (+ = East; - = West)		44405	degrees
longitude_b 'Minutes longitude		44407	minutes
speed 'Speed		44409	knots
course 'Course over ground		44411	degrees
magnetic_variation 'Magnetic variation from true north (+ = 'East; - = West)		44413	unitless
fix_quality 'GPS fix quality: 0 = invalid, 1 = GPS, 2 = 'differential GPS, 6 = estimated		44415	unitless
nmbr_satellites 'Number of satellites used for fix altitude 'Antenna altitude		44417	unitless
altitude 'Antenna altitude		44419	m
pps 'usec into sec of system clock when PPS 'rising edge occurs, typically 990,000 once 'synced		44421	ms
dt_since_gprmc 'Time since last GPRMC string, normally less 'than 1 second		44423	s

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
gps_ready 'Counts from 0 to 10, 10 = ready		44425	unitless
max_clock_change 'Maximum value the clock was changed in msec		44427	ms
nmbr_clock_change		44429	samples
DaylightHours		44431	
Local_SolarNoon		44433	
SunRise		44435	
SunSet		44437	
latitude 'Degrees.Minutes (+ = North; - = South)	40229	44439	degrees.minutes
longitude_a 'Degrees.Minutes (+ = East; - = West)	40231	44441	degrees.minutes
Soiling			
DustIQ Soiling Ratio	40179	42641	
DustIQ Soiling_Loss_Index_Geff	40181	42643	
DustIQ Soiling Ratio2	40183	42645	
DustIQ Soiling_Loss_Index_Geff2	40185	42647	
DustIQ DATAMODEL_VERSION		42649	
DustIQ SOFTWARE_VERSION		42651	
DustIQ SERIAL_NUMBER		42653	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustIQ CALIBRATION_YEAR		42655	
DustIQ CALIBRATION_MONTH		42657	
DustIQ CALIBRATION_DAY		42659	
DustIQ TILT_X_DIRECTION		42661	Degrees
DustIQ TILT_Y_DIRECTION		42663	Degrees
DustIQ BACKPANEL_TEMP		42665	Deg C
DustIQ DEVICE_VOLTAGE		42667	V
DustIQ STATUS_FLAGS		42669	
DustIQ IR_CALIBRATION_STATUS_BEFORE		42671	
DustIQ IR_CALIBRATION_STATUS_AFTER		42673	
DustIQ2 Soiling Ratio	40187	42741	
DustIQ2 Soiling_Loss_Index_Geff	40189	42743	
DustIQ2 Soiling Ratio2	40191	42745	
DustIQ2 Soiling_Loss_Index_Geff2	40193	42747	
DustIQ2 DATAMODEL_VERSION		42749	
DustIQ2 SOFTWARE_VERSION		42751	
DustIQ2 SERIAL_NUMBER		42753	
DustIQ2 CALIBRATION_YEAR		42755	
DustIQ2 CALIBRATION_MONTH		42757	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustIQ2 CALIBRATION_DAY		42759	
DustIQ2 TILT_X_DIRECTION		42761	Degrees
DustIQ2 TILT_Y_DIRECTION		42763	Degrees
DustIQ2 BACKPANEL_TEMP		42765	Deg C
DustIQ2 DEVICE_VOLTAGE		42767	V
DustIQ2 STATUS_FLAGS		42769	
DustIQ2 IR_CALIBRATION_ STATUS_BEFORE		42771	
DustIQ2 IR_CALIBRATION_ STATUS_AFTER		42773	
DustVue SoilingRatio	40179	42841	
DustVue Soiling_Loss_Index_Geff	40181	42843	
DustVue Soiling_Loss_Index_Isc		42845	
DustVue Heartbeat		42847	
DustVue IscTest		42849	A
DustVue IscRef		42851	A
DustVue TempTest		42853	Deg C
DustVue TempRef		42855	Deg C
DustVue GeffTest		42857	W/m^2
DustVue GeffRef		42859	W/m^2
DustVue Ref_Panel_washed		42861	
DustVue Offset_Geff		42863	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue Offset_Isc		42865	
DustVue Update_Offset		42867	
DustVue UTC_Offset_Userentered		42869	
DustVue Latitude_Userentered		42871	Degrees
DustVue Longitude_Userentered		42873	Degrees
DustVue TempCoefIscTest_ Userenter		42875	
DustVue TempCoefIscRef_ Userenter		42877	
DustVue IscTeststc_Userentered		42879	A
DustVue IscRefstc_Userentered		42881	A
DustVue SolNoonOffset_ Userentered		42883	
DustVue GeffThreshold_ Userentered		42885	W/m^2
DustVue RTU_Voltage		42887	V
DustVue RTU_Internal_Temp		42889	Deg C
DustVue LocalSolarNoon		42891	
DustVue CleanPanelWashed_Year		42893	
DustVue CleanPanelWashed_ Month		42895	
DustVue CleanPanelWashed_Day		42897	
DustVue DirtyAndCleanWashed_ Year		42899	
DustVue DirtyAndCleanWashed_ Month		42901	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue DirtyAndCleanWashed_ Day		42903	
DustVue2 SoilingRatio	40187	42941	
DustVue2 Soiling_Loss_Index_Geff	40189	42943	
DustVue2 Soiling_Loss_Index_Isc		42945	
DustVue2 Heartbeat		42947	
DustVue2 IscTest		42949	A
DustVue2 IscRef		42951	A
DustVue2 TempTest		42953	Deg C
DustVue2 TempRef		42955	Deg C
DustVue2 GeffTest		42957	W/m^2
DustVue2 GeffRef		42959	W/m^2
DustVue2 Ref_Panel_washed		42961	
DustVue2 Offset_Geff		42963	
DustVue2 Offset_Isc		42965	
DustVue2 Update_Offset		42967	
DustVue2 UTC_Offset_Userentered		42969	
DustVue2 Latitude_Userentered		42971	Degrees
DustVue2 Longitude_Userentered		42973	Degrees
DustVue2 TempCoefIscTest_ Userenter		42975	
DustVue2 TempCoefIscRef_ Userenter		42977	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue2 IscTeststc_Userentered		42979	A
DustVue2 IscRefstc_Userentered		42981	A
DustVue2 SolNoonOffset_ Userentered		42983	
DustVue2 GeffThreshold_ Userentered		42985	W/m^2
DustVue2 RTU_Voltage		42987	V
DustVue2 RTU_Internal_Temp		42989	Deg C
DustVue2 LocalSolarNoon		42991	
DustVue2 CleanPanelWashed_Year		42993	
DustVue2 CleanPanelWashed_ Month		42995	
DustVue2 CleanPanelWashed_Day		42997	
DustVue2 DirtyAndCleanWashed_ Year		42999	
DustVue2 DirtyAndCleanWashed _ Month		43001	
DustVue2 DirtyAndCleanWashed_ Day		43003	
DustVue20 Soiling Ratio Daily Isc	40183	43019	
DustVue20 Soiling Ratio Daily Pmax	40185	43021	
DustVue10 Daily Soiling Ratio	40179	43023	
DustVue10/20 Daily Soiling Ratio Rear	40181	43025	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue10 Last Soiling Ratio		43027	
DustVue10/20 Last Soiling Ratio Rear		43029	
DustVue10/20 Daily Soiling Ratio Num Samples		43031	
DustVue20 Last Soiling Ratio Isc		43033	
DustVue20 Last Soiling Ratio Pmax		43035	
DustVue10/20 System Status Code		43037	
DustVue10/20 Measurement Status Code		43039	
DustVue10/20 Measurement Flags		43041	
DustVue10/20 Time Year		43043	
DustVue10/20 Time Month		43045	
DustVue10/20 Time Day		43047	
DustVue10/20 Time Hour		43049	
DustVue10/20 Time Minute		43051	
DustVue10/20 Time Second		43053	
DustVue10/20 Solar Noon Hr		43055	
DustVue10/20 Solar Noon Minute		43057	
DustVue10/20 Sampling Period Status		43059	
DustVue10/20 Irradiance of Soiled panel		43061	W/m^2
DustVue10/20 Irradiance of Rear facing cell		43063	W/m^2

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue10/20 Sample Count		43065	
DustVue10/20 Cover Seal Heater Status		43067	
DustVue10/20 RTU Internal RH		43069	
DustVue10/20 Clean Reference Temp		43071	Deg C
DustVue10/20 Soiled Temp		43073	Deg C
DustVue10/20 Rear Soiled Temp		43075	Deg C
DustVue10/20 Serial Number		43077	
DustVue20(2) IV Curve: Panel Voltage (79)		43199	V
DustVue20(2) IV Curve: Panel Current (79)		43399	A
DustVue20(2) Soiling Ratio Daily Isc	40223	43099	
DustVue20(2) Soiling Ratio Daily Pmax	40225	43101	
DustVue10(2) Daily Soiling Ratio	40219	43103	
DustVue10/20(2) Daily Soiling Ratio Rear	40221	43105	
DustVue10(2) Last Soiling Ratio		43107	
DustVue10/20(2) Last Soiling Ratio Rear		43109	
DustVue10/20(2) Daily Soiling Ratio Num Samples		43111	
DustVue20(2) Last Soiling Ratio Isc		43113	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue20(2) Last Soiling Ratio Pmax		43115	
DustVue10/20(2) System Status Code		43117	
DustVue10/20(2) Measurement Status Code		43119	
DustVue10/20(2) Measurement Flags		43121	
DustVue10/20(2) Time Year		43123	
DustVue10/20(2) Time Month		43125	
DustVue10/20(2) Time Day		43127	
DustVue10/20(2) Time Hour		43129	
DustVue10/20(2) Time Minute		43131	
DustVue10/20(2) Time Second		43133	
DustVue10/20(2) Solar Noon Hr		43135	
DustVue10/20(2) Solar Noon Minute		43137	
DustVue10/20(2) Sampling Period Status		43139	
DustVue10/20(2) Irradiance of Soiled panel		43141	W/m^2
DustVue10/20(2) Irradiance of Rear facing cell		43143	W/m^2
DustVue10/20(2) Sample Count		43145	
DustVue10/20(2) Cover Seal Heater Status		43147	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
DustVue10/20(2) RTU Internal RH		43149	
DustVue10/20(2) Clean Reference Temp		43151	Deg C
DustVue10/20(2) Soiled Temp		43153	Deg C
DustVue10/20(2) Rear Soiled Temp		43155	Deg C
DustVue10/20 Serial Number		43157	
DustVue20(2) IV Curve: Panel Voltage (79)		43599	V
DustVue20(2) IV Curve: Panel Current (79)		43799	A
300i IV Curve Voltages (200 count)		43201	W/m^2
300i IV Curve Currents (200 count)		43401	W/m^2
Leader Performance Index_Pmax_ RC22	40199	44001	
Leader Performance Index_Isc_ RC22	40201	44003	
Leader Performance Index_Pmax_ AVG_RC22	40203	44005	
Leader Performance Index_Isc_ AVG_RC22	40205	44007	
Leader Status		44009	
Leader eCode		44011	
Leader Module Current		44013	A
Leader Module Voltage		44015	V
Leader Output Current		44017	A

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Leader Output Voltage		44019	V
Leader Module Temperature		44021	Deg C
Leader Module RTD Temperature		44023	Deg C
Leader Module Pmax		44025	W
Leader Module Imp		44027	A
Leader Module Vmp		44029	V
Leader Module Isc		44031	A
Leader Module Voc		44033	V
Leader Module Irradiance		44035	W/m^2
Leader Front Irradiance Uncorrected		44037	W/m^2
Leader Front Irradiance Corrected		44039	W/m^2
Leader Rear Irradiance		44041	W/m^2
Leader Total effective Irradiance		44043	W/m^2
Leader Sweep ID		44045	
Follower Performance Index_Pmax_ RC22		44201	
Follower Performance Index_Isc_ RC22		44203	
Follower Performance Index_Pmax_ AVG_RC22		44205	
Follower Performance Index_Isc_ AVG_RC22		44207	
Follower Status		44209	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Follower eCode		44211	
Follower Module Current		44213	A
Follower Module Voltage		44215	V
Follower Output Current		44217	A
Follower Output Voltage		44219	V
Follower Module Temperature		44221	Deg C
Follower Module RTe Temperature		44223	Deg C
Follower Module Pmax		44225	W
Follower Module Imp		44227	A
Follower Module Vmp		44229	V
Follower Module Isc		44231	A
Follower Module Voc		44233	V
Follower Module Irradiance		44235	W/m^2
RC22 AUX_RC22_front_Irr		44237	W/m^2
RC22 AUX_RC22_rear_east_Irr		44239	W/m^2
RC22 AUX_RC22_rear_West_Irr		44241	W/m^2
Leader AUX_MARS_ TransmissionLoss	40207	44009	
Leader2 IV Curve Voltages (200 count)		43601	W/m^2
Leader2 IV Curve Currents (200 count)		43801	W/m^2

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Leader2 Performance Index_Pmax_ RC22	40209	44601	
Leader2 Performance Index_Isc_ RC22	40211	44603	
Leader2 Performance Index_Pmax_ AVG_RC22	40213	44605	
Leader2 Performance Index_Isc_ AVG_RC22	40215	44607	
Leader2 Status		44609	
Leader2 eCode		44611	
Leader2 Module Current		44613	A
Leader2 Module Voltage		44615	V
Leader2 Output Current		44617	A
Leader2 Output Voltage		44619	V
Leader2 Module Temperature		44621	Deg C
Leader2 Module RTD Temperature		44623	Deg C
Leader2 Module Pmax		44625	W
Leader2 Module Imp		44627	A
Leader2 Module Vmp		44629	V
Leader2 Module Isc		44631	A
Leader2 Module Voc		44633	V
Leader2 Module Irradiance		44635	W/m^2
Leader2 Front Irradiance Uncorrected		44637	W/m^2
Leader2 Front Irradiance Corrected		44639	W/m^2

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Leader2 Rear Irradiance		44641	W/m^2
Leader2 Total effective Irradiance		44643	W/m^2
Follower2 Status		44801	
Follower2 eCode		44803	
Follower2 Performance Index_ Pmax_RC22		44805	W
Follower2 Performance Index_Isc_ RC22		44807	A
Follower2 Performance Index_ Pmax_AVG_RC22		44809	W
Follower2 Performance Index_Isc_ AVG_RC22		44811	A
Follower2 Module Current		44813	A
Follower2 Module Voltage		44815	V
Follower2 Output Current		44817	A
Follower2 Output Voltage		44819	V
Follower2 Module Temperature		44821	Deg C
Follower2 Module RTe Temperature		44823	Deg C
Follower2 Module Pmax		44825	W
Follower2 Module Imp		44827	A
Follower2 Module Vmp		44829	V
Follower2 Module Isc		44831	A
Follower2 Module Voc		44833	V

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Follower2 Module Irradiance		44835	W/m^2
AUX_RC22_front_Irr		44837	W/m^2
AUX_RC22_rear_east_Irr		44839	W/m^2
AUX_RC22_rear_West_Irr		44841	W/m^2
AUX_MARS_TransmissionLoss	40217	44843	
Generic			
Generic 1	40239	44999	
Generic 1	40241	45001	
Generic 1	40243	45003	
Generic 1	40245	45005	
Generic 1	40247	45007	
Generic 1 Precipitation (sample)	40249	45009	
Generic 1 Precipitation (Totalize)	40251	45011	
Generic 1		45013	
Generic 1		45015	
Generic 1		45017	
Generic 1		45019	
Generic 1		45021	
Generic 1		45023	
Generic 1		45025	
Generic 1		45027	
Generic 1		45029	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 1		45031	
Generic 2	40253	45033	
Generic 2	40255	45035	
Generic 2	40257	45037	
Generic 2	40259	45039	
Generic 2	40261	45041	
Generic 2 Precipitation (sample)	40263	45043	
Generic 2 Precipitation (Totalize)	40265	45045	
Generic 2		45047	
Generic 2		45049	
Generic 2		45051	
Generic 2		45053	
Generic 2		45055	
Generic 2		45057	
Generic 2		45059	
Generic 2		45061	
Generic 2		45063	
Generic 2		45065	
Generic 3	40267	45067	
Generic 3	40269	45069	
Generic 3	40271	45071	
Generic 3	40273	45073	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 3	40275	45075	
Generic 3 Precipitation (sample)	40277	45077	
Generic 3 Precipitation (Totalize)	40279	45079	
Generic 3		45081	
Generic 3		45083	
Generic 3		45085	
Generic 3		45087	
Generic 3		45089	
Generic 3		45091	
Generic 3		45093	
Generic 3		45095	
Generic 3		45097	
Generic 3		45099	
Generic 4	40281	45101	
Generic 4	40283	45103	
Generic 4	40285	45105	
Generic 4	40287	45107	
Generic 4	40289	45109	
Generic 4 Precipitation (sample)	40291	45111	
Generic 4 Precipitation (Totalize)	40293	45113	
Generic 4		45115	
Generic 4		45117	
Generic 4		45119	

Table 9-1: Modbus register map

Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 4		45121	
Generic 4		45123	
Generic 4		45125	
Generic 4		45127	
Generic 4		45129	
Generic 4		45131	
Generic 4		45133	
Generic 5	40295	45135	
Generic 5	40297	45137	
Generic 5	40299	45139	
Generic 5	40301	45141	
Generic 5	40303	45143	
Generic 5 Precipitation (sample)	40305	45145	
Generic 5 Precipitation (Totalize)	40307	45147	
Generic 5		45149	
Generic 5		45151	
Generic 5		45153	
Generic 5		45155	
Generic 5		45157	
Generic 5		45159	
Generic 5		45161	
Generic 5		45163	
Generic 5		45165	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 5		45167	
Generic 6	40309	45169	
Generic 6	40311	45171	
Generic 6	40313	45173	
Generic 6	40315	45175	
Generic 6	40317	45177	
Generic 6 Precipitation (sample)	40319	45179	
Generic 6 Precipitation (Totalize)	40321	45181	
Generic 6		45183	
Generic 6		45185	
Generic 6		45187	
Generic 6		45189	
Generic 6		45191	
Generic 6		45193	
Generic 6		45195	
Generic 6		45197	
Generic 6		45199	
Generic 6		45201	
Generic 7	40323	45203	
Generic 7	40325	45205	
Generic 7	40327	45207	
Generic 7	40329	45209	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 7	40331	45211	
Generic 7 Precipitation (sample)	40333	45213	
Generic 7 Precipitation (Totalize)	40335	45215	
Generic 7		45217	
Generic 7		45219	
Generic 7		45221	
Generic 7		45223	
Generic 7		45225	
Generic 7		45227	
Generic 7		45229	
Generic 7		45231	
Generic 7		45233	
Generic 7		45235	
Generic 8	40337	45237	
Generic 8	40339	45239	
Generic 8	40341	45241	
Generic 8	40343	45243	
Generic 8	40345	45245	
Generic 8 Precipitation (sample)	40347	45247	
Generic 8 Precipitation (Totalize)	40349	45249	
Generic 8		45251	
Generic 8		45253	
Generic 8		45255	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 8		45257	
Generic 8		45259	
Generic 8		45261	
Generic 8		45263	
Generic 8		45265	
Generic 8		45267	
Generic 8		45269	
Generic 9	40351	45271	
Generic 9	40353	45273	
Generic 9	40355	45275	
Generic 9	40357	45277	
Generic 9	40359	45279	
Generic 9 Precipitation (sample)	40361	45281	
Generic 9 Precipitation (Totalize)	40363	45283	
Generic 9		45285	
Generic 9		45287	
Generic 9		45289	
Generic 9		45291	
Generic 9		45293	
Generic 9		45295	
Generic 9		45297	
Generic 9		45299	
Generic 9		45301	

Table 9-1: Modbus register map			
Description	PrimaryData Reg# All Registers type - Float	MetaData Reg# All Registers type - Float	Units
Generic 9		45303	
Generic 10	40365	45305	
Generic 10	40367	45307	
Generic 10	40369	45309	
Generic 10	40371	45311	
Generic 10	40373	45313	
Generic 10 Precipitation (sample)	40375	45315	
Generic 10 Precipitation (Totalize)	40377	45317	
Generic 10		45319	
Generic 10		45321	
Generic 10		45323	
Generic 10		45325	
Generic 10		45327	
Generic 10		45329	
Generic 10		45331	
Generic 10		45333	
Generic 10		45335	
Generic 10		45337	

Appendix A. Replacement parts

Table A-1: Replacement parts

Component	Item	Additional description/information	Frequency
CR1000XE	3768 2-Pin Screw Terminal Plug Connector .2 inch pitch Straight Wire Entry 12-24 AWG Green Marked G 12V		As needed
CR1000XE	6554 Desiccant 1/6 Unit Bag	Enclosure accessories and items	As needed
CR1000XE	6044 Grommet for #6 or #8 Screw	Enclosure accessories and items	As needed
CR1000XE	505 Screw #6-32 x .375 Pan Phillips	Enclosure accessories and items	As needed
CR1000XE	8125 Flat-bladed Screwdriver, RS PRO SL2.5X60	Tools	As needed
CR1000XE	27555 USB 2.0 Cable Type A Pin (Male) to Micro B Pin (Male), 6/6.5ft	USB Cable	As needed
CR1000XE	10645 Screw #10-32 x .312 Pan Slot Brass	Ground lug	As needed
CR1000XE	30028 3.6V 2.4Ahr Lithium Battery AA	Logger battery	2-3 Years
CR1000XE	31676 CR1000X Replacement Connectors Analog Input 1-4	Replacement connectors on wiring panel	As needed
CR1000XE	31677 CR1000X Replacement Connectors Analog Input 5-8	Replacement connectors on wiring panel	As needed
CR1000XE	31678 CR1000X Replacement Connectors Power Out & Communications		As needed
SR30	39591	Glare screen for down facing albedo	As needed
MS-series	Call for quotation	Glare screen for down facing albedo	As needed

Table A-1: Replacement parts			
Component	Item	Additional description/information	Frequency
Solar sensor mounts	27522	Threadlocker Vibra-Tite VC3 1.0 ml Pouch	As needed
Main met enclosure	39112 DIN Rail Terminal Kit Containing 1 21329 Terminal, 1 End Cover w/Black, White, & Clear Wires - 39112	Additional terminal strip items	As needed
Main met enclosure	39643 RS-485 DIN Rail Terminal Bus Kit w/o Mounting - 39643	Additional terminal strip items	As needed
Main met enclosure	39120 DIN Rail Terminal Kit Containing 2 21329 Terminals, 1 End Cover w/Black, Green, Red, White, and Clear Wires - 39120	Additional terminal strip items	As needed
CS241DM	39349 T Coupler M12 Male/M12 Female Straight - 39349	For daisy chaining CS241DM	As needed
CS241DM	35154 3M Extreme Sealing Tape 4411N Clear Flashing Tape, (-40F to 200F), 1.5 inch X 5 yard roll, 40 mil Thick - 35154	For adhering CS-241 series sensors	As needed
CS241DM	39643 RS-485 DIN Rail Terminal Bus Kit w/o Mounting - 39643	Additional terminal strip items	As needed

Your SunSentry System Warranty

We're committed to the quality and reliability of your SunSentry system. Here's what's covered:

What's Protected: Your SunSentry enclosure and all Campbell Scientific-built components within it are warrantied against defects in materials and workmanship for 5 years from the date of shipment (unless otherwise specified on your invoice). Third-party components and any sensors purchased with your SunSentry carry the original manufacturer warranties.

Our Promise to You: If you experience any issues during the warranty period, at our discretion we'll repair, replace, or refund defective equipment that meets these conditions:

1. The issue stems from a defect in materials or workmanship that affects how the device works
2. The equipment hasn't been misused or damaged through improper handling
3. The defect occurred within your warranty period
4. Our qualified technicians at a Campbell Scientific Service Center confirm the defect

Setting Clear Expectations: We want to be transparent about where this warranty doesn't apply — not to limit your protection, but to set shared expectations. The warranty does not cover:

- Consumables that naturally wear out (e.g., batteries, desiccants, filters, chemicals)
- Buyout components. These are supported under their original manufacturer warranty
- Field services or the results of service work
- Damage caused by misuse, neglect, improper installation, unauthorized modifications, or extreme environmental conditions
- Bugs or compatibility issues with software used outside of a Campbell-supported environment
- Lost or damaged software media
- Rental, training, or promotional units
- Items provided at no cost or sold as spare parts
- Custom stations that differ materially from our SunSentry standardized station

Getting Help is Easy: If you need warranty service, simply contact your regional Campbell Scientific office. Visit www.campbellsci.com/contact to find the office serving your area. We'll guide you through the return process and, in most cases, ship your repaired equipment back to you at no charge via standard ground shipping.

Please note: While we cover the equipment repair and return shipping, customers are responsible for removal, reinstallation, and initial shipping costs to our service center.

Additional Terms: This warranty represents our complete warranty obligation and supersedes any implied warranties, including merchantability or fitness for specific purposes, to the fullest extent permitted by law. Campbell Scientific is not liable for consequential damages.

This warranty incorporates Campbell Scientific's Terms and Conditions, which prevail in case of any conflicts. For U.S. customers, please see our Terms and Conditions. International customers should contact their regional office for applicable terms.

We stand behind our products and are here to support you throughout the life of your SunSentry.

Assistance

Products may not be returned without prior authorization. Please inform us before returning equipment and obtain a **return material authorization (RMA) number** whether the repair is under warranty/guarantee or not. See Your SunSentry System Warranty for information on covered equipment.

Campbell Scientific regional offices handle repairs for customers within their territories. Please see the back page of the manual for a list of regional offices or visit www.campbellsci.com/contact to determine which Campbell Scientific office serves your country.

When returning equipment, a RMA number must be clearly marked on the outside of the package. Please state the faults as clearly as possible. Quotations for repairs can be given on request.

It is the policy of Campbell Scientific to protect the health of its employees and provide a safe working environment. In support of this policy, when equipment is returned to Campbell Scientific, Logan, UT, USA, it is mandatory that a "Declaration of Hazardous Material and Decontamination" form be received before the return can be processed. If the form is not received within 5 working days of product receipt or is incomplete, the product will be returned to the customer at the customer's expense. For details on decontamination standards specific to your country, please reach out to your regional Campbell Scientific office.

> NOTE:
> All goods that cross trade boundaries may be subject to some form of fee (customs clearance, duties or import tax). Also, some regional offices require a purchase order upfront if a product is out of the warranty period. Please contact your regional Campbell Scientific office for details.

Safety

DANGER — MANY HAZARDS ARE ASSOCIATED WITH INSTALLING, USING, MAINTAINING, AND WORKING ON OR AROUND TRIPODS, TOWERS, AND ANY ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC. FAILURE TO PROPERLY AND COMPLETELY ASSEMBLE, INSTALL, OPERATE, USE, AND MAINTAIN TRIPODS, TOWERS, AND ATTACHMENTS, AND FAILURE TO HEED WARNINGS, INCREASES THE RISK OF DEATH, ACCIDENT, SERIOUS INJURY, PROPERTY DAMAGE, AND PRODUCT FAILURE. TAKE ALL REASONABLE PRECAUTIONS TO AVOID THESE HAZARDS. CHECK WITH YOUR ORGANIZATION'S SAFETY COORDINATOR (OR POLICY) FOR PROCEDURES AND REQUIRED PROTECTIVE EQUIPMENT PRIOR TO PERFORMING ANY WORK.

Use tripods, towers, and attachments to tripods and towers only for purposes for which they are designed. Do not exceed design limits. Be familiar and comply with all instructions provided in product manuals. Manuals are available at www.campbellsci.com You are responsible for conformance with governing codes and regulations, including safety regulations, and the integrity and location of structures or land to which towers, tripods, and any attachments are attached. Installation sites should be evaluated and approved by a qualified engineer. If questions or concerns arise regarding installation, use, or maintenance of tripods, towers, attachments, or electrical connections, consult with a licensed and qualified engineer or electrician.

General

- Protect from over-voltage.
- Protect electrical equipment from water.
- Protect from electrostatic discharge (ESD).
- Protect from lightning.
- Prior to performing site or installation work, obtain required approvals and permits. Comply with all governing structure-height regulations, such as those of the FAA in the USA.
- Use only qualified personnel for installation, use, and maintenance of tripods and towers, and any attachments to tripods and towers. The use of licensed and qualified contractors is highly recommended.
- Read all applicable instructions carefully and understand procedures thoroughly before beginning work.
- Wear a hardhat and eye protection, and take other appropriate safety precautions while working on or around tripods and towers.
- Do not climb tripods or towers at any time, and prohibit climbing by other persons. Take reasonable precautions to secure tripod and tower sites from trespassers.
- Use only manufacturer recommended parts, materials, and tools.

Utility and Electrical

- You can be killed or sustain serious bodily injury if the tripod, tower, or attachments you are installing, constructing, using, or maintaining, or a tool, stake, or anchor, come in contact with overhead or underground utility lines.
- Maintain a distance of at least one-and-one-half times structure height, 6 meters (20 feet), or the distance required by applicable law, whichever is greater, between overhead utility lines and the structure (tripod, tower, attachments, or tools).
- Prior to performing site or installation work, inform all utility companies and have all underground utilities marked.
- Comply with all electrical codes. Electrical equipment and related grounding devices should be installed by a licensed and qualified electrician.
- Only use power sources approved for use in the country of installation to power Campbell Scientific devices.

Elevated Work and Weather

- Exercise extreme caution when performing elevated work.
- Use appropriate equipment and safety practices.
- During installation and maintenance, keep tower and tripod sites clear of un-trained or non-essential personnel. Take precautions to prevent elevated tools and objects from dropping.
- Do not perform any work in inclement weather, including wind, rain, snow, lightning, etc.

Internal Battery

- Be aware of fire, explosion, and severe-burn hazards.
- Misuse or improper installation of the internal lithium battery can cause severe injury.

- Do not recharge, disassemble, heat above 100 °C (212 °F), solder directly to the cell, incinerate, or expose contents to water. Dispose of spent batteries properly.

Use and disposal of batteries

- Where batteries need to be transported to the installation site, ensure they are packed to prevent the battery terminals shorting which could cause a fire or explosion. Especially in the case of lithium batteries, ensure they are packed and transported in a way that complies with local shipping regulations and the safety requirements of the carriers involved.
- When installing the batteries follow the installation instructions very carefully. This is to avoid risk of damage to the equipment caused by installing the wrong type of battery or reverse connections.
- When disposing of used batteries, it is still important to avoid the risk of shorting. Do not dispose of the batteries in a fire as there is risk of explosion and leakage of harmful chemicals into the environment. Batteries should be disposed of at registered recycling facilities.

Avoiding unnecessary exposure to radio transmitter radiation

- Where the equipment includes a radio transmitter, precautions should be taken to avoid unnecessary exposure to radiation from the antenna. The degree of caution required varies with the power of the transmitter, but as a rule it is best to avoid getting closer to the antenna than 20 cm (8 inches) when the antenna is active. In particular keep your head away from the antenna. For higher power radios (in excess of 1 W ERP) turn the radio off when servicing the system, unless the antenna is installed away from the station, e.g. it is mounted above the system on an arm or pole.

Maintenance

- Periodically (at least yearly) check for wear and damage, including corrosion, stress cracks, frayed cables, loose cable clamps, cable tightness, etc. and take necessary corrective actions.
- Periodically (at least yearly) check electrical ground connections.

WHILE EVERY ATTEMPT IS MADE TO EMBODY THE HIGHEST DEGREE OF SAFETY IN ALL CAMPBELL SCIENTIFIC PRODUCTS, THE CUSTOMER ASSUMES ALL RISK FROM ANY INJURY RESULTING FROM IMPROPER INSTALLATION, USE, OR MAINTENANCE OF TRIPODS, TOWERS, OR ATTACHMENTS TO TRIPODS AND TOWERS SUCH AS SENSORS, CROSSARMS, ENCLOSURES, ANTENNAS, ETC.

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