PRODUCT MANUAL

Sensor

SunVue™ 30

ISO 9060:2018 Class A Spectrally Flat Thermopile Pyranometer with Integrated Dome Heating

09/2026
Copyright © 2026
Campbell Scientific, Inc.

RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

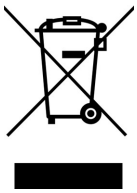
Please read first

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 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

The SunVue™30 is a spectrally flat Class A pyranometer designed in accordance with ISO 9060:2018. It provides highly accurate measurements of solar irradiance under a wide range of environmental conditions and is suitable for demanding applications in meteorology, climatology, photovoltaic performance monitoring, and scientific research.

The instrument measures the total hemispherical solar irradiance incident on a plane surface. This includes both the direct solar radiation received from the sun and the diffuse radiation scattered by the atmosphere. Measured irradiance values are provided in units of watts per square meter (W/m^2).

The SunVue 30 incorporates a digital RS-485 communication interface and supports the industry-standard Modbus RTU protocol, enabling seamless integration with data loggers, PLCs, SCADA systems, and other industrial monitoring platforms. The sensor is fully compatible with systems capable of communicating via Modbus RTU, allowing straightforward configuration, monitoring, and data acquisition.

To ensure reliable operation in demanding outdoor environments, the SunVue 30 is equipped with industrial-grade Class 4 surge protection, providing enhanced immunity against transient overvoltages and electrical disturbances commonly encountered in field installations. This robust design supports long-term, trouble-free operation even in harsh environmental conditions.

2. Precautions

Please read the following precautions and this manual carefully before installing, operating, or servicing the SunVue 30. Failure to observe these instructions may result in reduced measurement accuracy, damage to the instrument, or loss of warranty coverage.

- READ AND UNDERSTAND the Safety section at the back of this manual.
- Handle the pyranometer with care at all times. Excessive mechanical shock, impact, or dropping the instrument may damage internal components and affect calibration accuracy.
- Do not touch or scratch the glass dome. Fingerprints, contamination, and surface damage can degrade the optical performance of the sensor and lead to measurement errors.

- Ensure that the instrument is mounted securely and properly leveled before operation. Incorrect installation may cause inaccurate irradiance measurements.
- Install the pyranometer at a location with the least possible obstruction of the sky view. Shadows from nearby structures, trees, poles, antennas, or other objects can significantly influence the measurement results.
- Avoid mounting the sensor near highly reflective surfaces, such as metal structures, painted walls, windows, or reflective roofing materials, as reflected radiation may introduce measurement errors.
- Verify that the supply voltage is within the specified operating range before connecting power to the instrument. Incorrect supply voltage may result in malfunction or permanent damage.
- Ensure correct wiring of both the power supply and RS-485 communications lines. Improper connections may prevent operation and could damage the device.
- Maintain proper sealing of all cable glands and connectors to prevent moisture ingress. Water penetration may impair performance and lead to permanent sensor damage.
- Do not disassemble, modify, or attempt to repair the instrument. The SunVue 30 contains no user-serviceable parts. Repairs and recalibration should only be performed by authorized service personnel.
- Inspect and clean the glass dome regularly in accordance with the maintenance instructions provided in this manual. Accumulated dirt, dust, snow, frost, or bird droppings can significantly reduce measurement accuracy.
- In locations exposed to frequent condensation, frost, or high humidity, operation with the integrated heater enabled is recommended to ensure optimum performance.
- Following severe weather events, transportation, or maintenance activities, verify that the sensor remains level and undamaged before returning it to service.

3. Initial inspection

The SunVue 30 ships with the following:

- SunVue 30 Pyranometer
- Radiation shield
- Cable (optional)

- Transport protection cap for dome
- Mounting set
- Calibration and product certificates

Upon receipt of the SunVue 30, inspect the packaging and contents for damage. File damage claims with the shipping company.

Immediately check package contents. Thoroughly check all packaging material for product components that may be concealed. Check model numbers, part numbers, and product descriptions against the shipping documents. Model or part numbers are found on each product. The Campbell Scientific number may differ from the part or model number printed on the sensor by the sensor vendor. Ensure you received the expected cable lengths. Contact Campbell Scientific immediately about discrepancies

3.1 Recommended accessories

For proper and safe installation and operation, the following accessories are recommended.

- Campbell Scientific solar radiation mount, such as the CM256, CM261, CM266, CM268, or CM275
- ISP10 inline surge protection device for digital sensors
- Grounding cable

Recommended tools for installation:

- 13 mm wrench
- Torx T-25 screwdriver
- Other standard field tools may be required based on your site.

4. Theory of operation

4.1 Measuring solar irradiance

The SunVue 30 measures global solar irradiance, the total shortwave solar radiation incident on a plane. The measured irradiance consists of two components:

- Direct solar radiation arriving from the sun.
- Diffuse sky radiation scattered by molecules, aerosols, and clouds.

When mounted horizontally, the instrument measures **Global Horizontal Irradiance (GHI)**

$$GHI = DNI\cos(\theta_z) + DHI$$

where

GHI = Global Horizontal Irradiance

DNI = Direct Normal Irradiance

DHI = Diffuse Horizontal Irradiance

θ_z = Solar zenith angle

When mounted in the plane of a photovoltaic array, the SunVue 30 measures **Plane-of-Array (POA) irradiance**, which is commonly used for PV performance monitoring.

4.2 Spectrally flat response

Solar radiation reaching the Earth's surface spans approximately **285 nm to 3000 nm**, covering ultraviolet, visible, and near-infrared wavelengths.

The SunVue 30 is designed to have a **spectrally flat response**, meaning its sensitivity remains nearly constant across this wavelength range.

This minimizes measurement errors caused by changes in atmospheric conditions, cloud cover, air mass, or solar elevation.

A spectrally flat response allows the instrument to measure solar irradiance independently of the spectral distribution of sunlight, making it suitable for accurate meteorological and photovoltaic applications.

4.3 Thermopile measurement principle

In order to achieve a spectrally flat sensitivity, the SunVue 30 is a **thermopile-based pyranometer**.

Incoming solar radiation passes through a precision optical dome and is absorbed by a specially designed black absorbing surface. The absorbed energy raises the temperature of the absorber slightly above the temperature of the instrument body.

The absorber is thermally connected to the instrument body through a thermopile consisting of many thermocouples connected in series.

The resulting temperature difference produces a small voltage through the **Seebeck effect**

$$V = NS\Delta T$$

where

(V) is the thermopile output voltage

(N) is the number of thermocouples

(S) is the Seebeck coefficient

(ΔT) is the temperature difference between the absorber and the instrument body

The output voltage is directly proportional to the incident solar irradiance.

The SunVue 30 converts this voltage into irradiance using an individual factory calibration coefficient.

4.4 Cosine response

The irradiance intercepted by a horizontal surface depends on the angle of incidence of sunlight.

According to Lambert's cosine law,

$$E = E_0 \cos(\theta)$$

where

(θ) is the angle between the incoming radiation and the normal to the sensing surface.

An ideal pyranometer produces an output proportional to this cosine relationship.

The optical design of the SunVue 30 minimizes deviations from the ideal cosine response over the full hemisphere, reducing measurement errors at low solar elevation angles.

4.5 Optical dome

The precision optical dome serves several important functions:

- Protects the sensing element from weather
- Transmits nearly all solar radiation across the instrument's spectral range
- Provides a uniform hemispherical field of view
- Reduces sensitivity to wind
- Helps reduce thermal offsets caused by long-wave infrared exchange with the sky

The dome is manufactured from high-transmittance optical glass designed for long-term environmental stability.

4.6 Thermal design

Changes in ambient temperature can introduce errors if the sensing element and instrument body are not in thermal equilibrium.

The SunVue 30 incorporates a carefully designed thermal structure that minimizes thermal gradients and reduces offset errors produced by changing environmental conditions.

This design improves measurement stability during rapid temperature changes and under clear-sky nighttime conditions. It is also equipped with dome heater mitigate dew and frost accumulation on the dome.

4.7 Factory calibration

Each SunVue 30 is individually calibrated against a traceable reference pyranometer under controlled conditions.

The calibration determines the sensor sensitivity

$$S = \frac{V}{E}$$

where

(S) is the sensitivity ($\mu V/(W \cdot m^{-2})$)

(V) is the thermopile output

(E) is irradiance.

The calibration coefficient stored with each instrument converts the measured thermopile output into irradiance in units of $W \cdot m^{-2}$.

4.8 Suitability for Class A solar monitoring

The SunVue 30 is designed to meet the performance requirements of an ISO 9060:2018 Spectrally Flat Class A pyranometer.

Its low thermal offsets, excellent cosine response, spectrally flat response, and low temperature dependence make it suitable for high-accuracy measurements of global and plane-of-array irradiance used in:

- photovoltaic performance monitoring
- solar resource assessment
- meteorological observations
- research applications
- IEC 61724-1 Class A photovoltaic monitoring systems

5. Specifications

The following specifications summarize the technical characteristics of the SunVue 30 pyranometer, including its measurement performance, environmental ratings, electrical specifications, and communications interface.

ISO classification:	Spectrally flat Class A (ISO 9060:2018)
Spectral range:	285 to 2800 nm
Response time:	< 4 s
Zero offset A:	< 7 W/m^2
Zero offset B:	< 2 W/m^2
Nonlinearity:	< 0.2 %
Directional response:	< 10 W/m^2
Temperature response:	< 1 % (–30 to 60 °C)
Maximum irradiance:	3600 W/m^2

Internal relative humidity sensor range:	0 to 100 %
Internal relative humidity sensor accuracy:	±1.8 %
Internal relative humidity sensor resolution:	0.01 %
Internal pressure sensor range:	260 to 1260 mBar
Internal pressure sensor accuracy:	±1 mBar
Internal pressure sensor resolution:	0.25 mBar
Operating temperature range:	–30 to 80 °C
Storage temperature range:	–30 to 85 °C
Power consumption heated:	< 1.8 W
Power consumption unheated:	< 0.25 W
Operating voltage:	12 to 24 VDC
Digital output:	Modbus RS-485
	Irradiance W/m^2
	Body temperature °C
	Tilt angle °
	Device monitoring (internal humidity, internal pressure, power consumption)
Communications:	Modbus over two-wire RS-485
Transmission mode:	RTU
Surge protection:	IEC/EN 61000-4-5 (2014) up to ± 4 kV
Dimensions:	167 x 157 x 145 mm
Shipping Weight:	2 lbs

6. Installation

To achieve accurate and reliable solar irradiance measurements, careful consideration should be given to the installation location and mounting of the pyranometer.

For optimum performance, the instrument should be installed at a location with an unobstructed hemispherical view of the sky. Objects such as buildings, trees, poles, mountains, or other structures can obstruct incoming solar radiation and introduce measurement errors.

The installation site should be readily accessible to allow routine inspection, cleaning, and maintenance of the glass dome. The pyranometer should also be positioned away from nearby structures, walls, towers, or brightly colored surfaces that may reflect solar radiation onto the sensor and adversely affect measurement accuracy.

Care must be taken during transportation, installation, and operation to prevent mechanical shock or strong physical impacts. Excessive force or impact may damage the instrument and can alter its calibration characteristics, resulting in degraded measurement performance. For this reason, the pyranometer should always be handled with care and mounted securely to a stable support structure.

After installation, the instrument should be leveled according to the instructions provided in this manual to ensure compliance with the specified measurement accuracy.

6.1 Mechanical installation

To minimize measurement errors caused by thermal conduction from the mounting structure, the pyranometer should always be installed using a thermally and electrically isolating mounting plate. The mounting plate should provide thermal isolation from the support structure reducing the influence of thermal fluxes within the mounting rack.

The optional mast mounting angle is designed for installation on mounting poles and instrument masts. It is suitable for pole diameters from 1.3 in to 1.7 in (3.4 cm to 4.2 cm).

The mounting system allows installation on vertical, horizontal, and inclined masts, providing sufficient adjustment capability to achieve accurate sensor leveling regardless of the mounting orientation.

Figure 6-1. SunVue 30 mounting with Campbell Scientific solar radiation sensor mount

For optimum measurement performance, the cable connector should be oriented towards the north in the Northern Hemisphere and towards the south in the Southern Hemisphere.

Fine adjustment of the sensor orientation and horizontal position can be performed using the mast mounting assembly. After securing the sensor in place with the provided bolt, final sensor leveling will be done using the two leveling Phillips screws on the top of the mount plate if using a Campbell Scientific CM256, CM261, CM266, CM268, or CM275 mount, leaving the foot clip in place. If mounting the SunVue 30 to another surface, the foot clip can be removed and the sensor can be leveled using the two adjustable leveling feet.

Accurate leveling is essential for obtaining the specified measurement performance. The pyranometer incorporates an integrated spirit level that allows precise alignment of the instrument during installation. The sensor should be adjusted until the bubble is centered within the spirit level circle. The radius of the circle equals 0.15° tilt.

After installation, the leveling should be rechecked periodically as part of routine maintenance, particularly after severe weather events or any adjustment of the mounting structure.

> NOTE:
> The level bubble is viewable from above and below to make this task easier.

6.2 Electrical installation

The SunVue 30 is equipped with four electrical terminals: two terminals for the power supply and two terminals for the RS-485 communications interface. The sensor operates from a nominal supply voltage in the range of 12 to 24 VDC, allowing integration into a wide variety of meteorological, environmental monitoring, and industrial data acquisition systems.

The terminal assignments are provided in the following table.

Table 6-1: Pin-out, function, and data logger connection

Pin-out	Function	Data logger connection[1]
1	Power in (12 to 24 VDC)	12V
2	RS-485 (B+)	C (even)
3	RS-485 ground	G[2]
4	Power ground	G
5	RS-485 (A-)	C (odd)

[1] Assumes the sensor directly connects to the data logger.

[2] If the connection is RS-485 communications only, no power, then use the RG terminal; contact Campbell Scientific for more information.

NOTE:
Refer to the label on the cable for pin-out wire colors.

NOTE:
Sensor body **or** cable shield (electrically connected) need to be appropriately grounded to nearest suitable ground. (If using a Campbell Scientific RS485CBL cable with pigtail leads, the gray wire is the shield that should be connected to a suitable ground.) The ISP10 provides a suitable grounding attachment and also provides external and sacrificial protection.

When using a power supply separate from that of the data acquisition system, it is recommended to connect the ground lines to ensure stable communications.

NOTE:
When the SunVue 30 is properly powered, you will see an LED flashing (1 second on, 1 second off) when looking through the two holes between the two domes.

6.3 Site selection

Select an installation location that provides an unobstructed view of the sky over the entire hemisphere above the sensor. Nearby objects such as buildings, trees, poles, antennas, towers, and photovoltaic arrays can block direct sunlight or reduce diffuse sky radiation reaching the pyranometer, resulting in measurement errors.

Choose a mounting location that minimizes the potential for shading throughout the year, including during periods when the sun is at its lowest elevation. Remember that shadows change with both the time of day and the season.

Avoid locations where objects may cast intermittent shadows on the sensor, even for short periods. Partial shading of the pyranometer dome can produce significant errors in the measured irradiance.

6.3.1 Obstructions

Nearby structures reduce the portion of the sky visible to the pyranometer and therefore reduce the measured diffuse irradiance. For the most accurate measurements, the horizon should remain as unobstructed as possible in all directions.

If obstructions cannot be avoided, document their location and elevation angle, as they should be considered when interpreting measurement data.

6.3.2 Mounting above surrounding objects

Install the pyranometer sufficiently above nearby equipment, handrails, cable trays, or roof structures to prevent shading and minimize reflected radiation from surrounding surfaces.

Avoid mounting the sensor close to large vertical surfaces that may reflect or absorb significant amounts of solar radiation.

6.3.3 Reflection

Do not install the pyranometer directly above highly reflective surfaces such as bright metal roofs, painted equipment, mirrors, or glass structures unless these surfaces are representative of the intended measurement environment. Reflected sunlight can introduce positive measurement bias.

6.3.4 Dust and debris

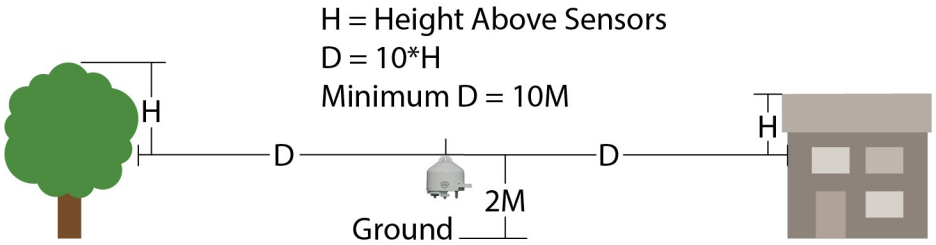
Select a location where the dome is less likely to accumulate dust, dirt, leaves, bird droppings, or snow. Avoid locations directly beneath trees, exhaust vents, cooling towers, or other sources of contamination.

6.3.5 Accessibility

Install the sensor where it can be safely accessed for routine cleaning, inspection, and leveling without disturbing its alignment.

6.3.6 CAUTION — avoid shading

> **CAUTION:**
> Ensure that no object shades the pyranometer at any time during the intended measurement period. Even brief or partial shading of the dome can produce significant measurement errors. Consider the sun's changing position throughout the year when evaluating potential shading from nearby objects.



7. Modbus register map

The SunVue 30 communicates via an industry-standard RS-485 serial interface using the Modbus RTU protocol. This communications method enables reliable data transmission over long cable distances and allows seamless integration into data loggers, PLCs, SCADA systems, and other industrial monitoring equipment.

The factory-default communications settings are listed in Table 7-1 (p. 14). These parameters must be configured identically on the host device to establish successful communications with the pyranometer.

The complete Modbus register structure is described in Table 7-2 (p. 14), Table 7-3 (p. 15), Table 7-4 (p. 15), and Discrete inputs (p. 15) which provide detailed information on all available Input

and Holding Registers, Coils, and Discrete Inputs. The Input Registers contain measurement, status, and diagnostic data that can be read from the instrument, while the Holding Registers provide access to configurable operating parameters and device settings.

Table 7-1: Default settings of the Modbus protocol	
Address	1
Databits	8
Stopbits	1
Baudrate	19200
Parity	Even

Table 7-2: Input register map of the Modbus protocol

Register	Parameter	Datatype	Read/Write
3000	Irradiance temperature compensated [W/m^2]	FLOAT32	Read
3002	Body temperature [°C]	FLOAT32	Read
3004	Raw voltage [µV]	FLOAT32	Read
3006	Relative internal humidity [%]	FLOAT32	Read
3008	Internal pressure [mBar]	FLOAT32	Read
3010	Tilt angle x [°]	FLOAT32	Read
3012	Tilt angle y [°]	FLOAT32	Read
3014	Input Voltage [V]	FLOAT32	Read
3016	Current draw [mA]	FLOAT32	Read
3018	Power consumption [mW]	FLOAT32	Read
3020	Sensitivity [µV/(W/m^2)]	FLOAT32	Read
3400	Serial number	UINT16	Read
3401	Calibration Date (Bits: DDDDDMMMMYYYYYYY)	UINT16	Read
3402	Manufacturing Date (Bits: DDDDDMMMMYYYYYYY)	UINT16	Read
3403	Firmware version ((Major * 100) + (Minor * 10) + Patch	UINT16	Read

The date registers can be decoded by the following formula:

day = data_encoded >> 11

month = (data_encoded - (day << 11)) >> 7

year = data_encoded - (day << 11) - (month << 7) + 2000

Table 7-3: Holding register map of the Modbus protocol. These registers can be used to alter the communications confguration.

Register	Parameter	Datatype	Read/Write
4400	Modbus device address	UINT16	Read/Write
4401	Baudrate (0=2400; 1=4800; 2=9600; 3=19200)	UINT16	Read/Write
4402	Parity (0=None; 1=Even; 2=Odd)	UINT16	Read/Write

Table 7-4: Coils

Register	Parameter	Datatype	Read/Write
1000	Heater on/off control	Bit	Read/Write

Table 7-5: Discrete inputs

Register	Parameter	Datatype	Read/Write
2000	Heater status	Bit	Read

8. Operating modes

The SunVue 30 is equipped with an integrated dome heating system designed to prevent the formation of dew, frost, and light condensation on the outer glass dome. By maintaining a slightly elevated dome temperature, the heater helps ensure uninterrupted operation and reliable irradiance measurements under changing environmental conditions.

For installations in dry climates or applications where minimum power consumption is required, the heating function can be disabled via the Modbus interface by writing to the corresponding heater control coil. Disabling the heater reduces power consumption but may increase the risk of measurement errors caused by condensation or frost formation under certain weather conditions.

The SunVue 30 supports the following operating modes:

8.1 Normal mode

In Normal Mode, all sensor functions are active, including the integrated dome heating system. This operating mode provides optimum measurement performance and environmental protection across the full specified operating range.

Typical power consumption: < 1.8 W

8.2 Low power mode

In Low Power Mode, the dome heating system is disabled to minimize power consumption. This mode is intended for applications with limited power availability, such as solar-powered monitoring stations or remote installations operating in predominantly dry environmental conditions.

Typical power consumption: < 0.25 W (heater disabled)

9. Maintenance and calibration

To ensure long-term measurement accuracy and reliable operation, the pyranometer should be inspected, cleaned, and calibrated at regular intervals. Environmental influences such as dust, pollen, salt deposits, bird droppings, snow, and condensation can affect the amount of solar radiation reaching the sensor and may lead to measurement errors if not removed promptly.

9.1 Cleaning

The glass dome should be inspected regularly and cleaned whenever contamination is visible. The required cleaning frequency depends on the installation environment and may range from daily inspections in harsh environments to monthly inspections in clean locations.

For cleaning, use clean water and a soft, lint-free cloth. If necessary, a mild detergent may be used to remove stubborn contamination. Avoid abrasive materials, solvents, or aggressive

cleaning agents, as these may damage the optical surface and affect the instrument's performance.

After cleaning, verify that the dome is free from residues and that no scratches or other damage are present. Any damaged dome should be replaced to maintain measurement accuracy.

9.2 Routine inspection

During regular maintenance, the following items should be checked:

- Cleanliness and condition of the glass dome
- Mechanical integrity of the mounting hardware
- Proper sensor leveling and inclination
- Cable condition and connector integrity
- Absence of moisture ingress or condensation

Any abnormalities detected during inspection should be investigated and corrected before continued operation.

9.3 Calibration

The sensitivity of a pyranometer may change slowly over time due to aging effects and environmental exposure. To maintain traceability and compliance with international measurement standards, the instrument should be recalibrated at regular intervals.

Recommended calibration interval: Every two years in accordance with ISO 9847 calibration practices for pyranometers. More frequent calibration may be appropriate for installations operating in particularly demanding environments or when required by quality assurance procedures.

Calibration should be performed by an accredited laboratory or by the manufacturer using traceable reference instruments.

After recalibration, an updated calibration certificate and sensitivity factor will be issued. The new sensitivity value should be applied immediately to ensure continued measurement accuracy.

9.4 Remote diagnostics

The pyranometer provides comprehensive diagnostic information that can be accessed remotely via the Modbus RTU interface. These diagnostic parameters support preventive maintenance,

troubleshooting, and verification of proper instrument operation without requiring physical access to the sensor.

The following diagnostic values are available:

- Sensor inclination
- Internal temperature
- Internal relative humidity
- Internal atmospheric pressure
- Heater status
- Power consumption

Continuous monitoring of these parameters enables early detection of installation issues, environmental influences, or potential sensor faults. For example, excessive inclination may indicate a disturbed mounting position, while elevated humidity values may indicate moisture ingress or a developing sealing problem.

Regular review of the diagnostic data is recommended as part of a preventive maintenance program. This allows corrective actions to be taken before measurement performance is affected.

Appendix A. Example CRBasic programs

The following CRBasic code examples demonstrate how to communicate with the SunVue 30 using a Campbell Scientific data logger. The first example illustrates how to retrieve measurement and diagnostic data from the sensor, while the second example shows how to modify the device's Modbus address.

Changes to the Modbus address, baud rate or parity settings are stored in the device but do not take effect until the sensor has been power-cycled. After restarting the instrument, communications must be established using the updated serial communications settings.

Refer to the Modbus register map in this manual for detailed information on available registers, data formats, and configuration options.

CRBasic Example 1: CR1000X program that measures the SunVue 30

```
'CR1000X Data Logger
'Example Script to read out a SunVue with Modbus address 1

Const MB_TIMEOUT=50
Const MB_RETRIES=1

Const SV_MB_ADDR = 1

Public Information_SunVue(4) As Long
Public Date_SunVue(2) As String * 20
Public Measurement_SunVue(11)
Public Heater_status As Boolean
Public mb_status

Dim day_SV As Long
Dim month_SV As Long
Dim year_SV As Long
Dim i As Long

Alias Measurement_SunVue(1)= Irradiance_SunVue
Alias Measurement_SunVue(2)= Body_Temperature_SunVue
Alias Measurement_SunVue(3)= Voltage_raw_SunVue
Alias Measurement_SunVue(4)= Humidity_SunVue
Alias Measurement_SunVue(5)= Pressure_SunVue
Alias Measurement_SunVue(6)= Tilt_angle_x_SunVue
```

CRBasic Example 1: CR1000X program that measures the SunVue 30

```
Alias Measurement_SunVue(7)= Tilt_angle_y_SunVue
Alias Measurement_SunVue(8)= Input_voltage_SunVue
Alias Measurement_SunVue(9)= Current_draw_SunVue
Alias Measurement_SunVue(10)= Power_consumption_SunVue
Alias Measurement_SunVue(11)= Sensitivity

Alias Information_SunVue(1) = Serial_number
Alias Information_SunVue(2) = Calibration_date_temp
Alias Information_SunVue(3) = Manufacturing_date_temp
Alias Information_SunVue(4) = Firmware_version

Alias Date_SunVue(1) = Calibration_date
Alias Date_SunVue(2) = Manufacturing_date

Units Irradiance_SunVue = W/m^2
Units Body_Temperature_SunVue = DegC
Units Voltage_raw_SunVue = V
Units Humidity_SunVue = %
Units Pressure_SunVue = mBar
Units Tilt_angle_x_SunVue = deg
Units Tilt_angle_y_SunVue = deg
Units Input_voltage_SunVue = V
Units Current_draw_SunVue = mA
Units Power_consumption_SunVue = mW
Units Sensitivity = uV/(W/m^2)

'Define Data Tables
DataTable (SunVue_table,1,-1) 'Set table size to # of records, or -1 to
                              'autoallocate.
  DataInterval (0,10,Sec,0)
  Sample (11,Measurement_SunVue(),IEEE4)
  Sample (1,Information_SunVue(1),IEEE4)
  Sample (1,Information_SunVue(2),IEEE4)
  Sample (2,Date_SunVue(),String)
  Sample (1,Heater_status,Boolean)
EndTable

'Main Program
BeginProg

  'open communications port, setup for RS-485
  SerialOpen(ComC5,19200,2,2,50,4)

  Scan (2,Sec,0,0)
    ' Retrieving data from the SunVue30 and save it to the Measurement variable
    ModbusClient(mb_status,ComC5,19200,SV_MB_ADDR,4,Measurement_SunVue,3001,11,MB_RETRIES,MB_TIMEOUT,2)
    ' Retrieving general information from Sensor
```

CRBasic Example 1: CR1000X program that measures the SunVue 30

```
    ModbusClient(mb_status,ComC5,19200,SV_MB_ADDR,4,Information_SunVue,3401,4,MB_RETRIES,MB_TIMEOUT,3)
    ' Retrieving general information from Sensor
    ModbusClient(mb_status,ComC5,19200,SV_MB_ADDR,2,Heater_status,2001,1,MB_RETRIES,MB_TIMEOUT,3)

    For i = 1 To 2
      'Decode date from modbus reading
      day_SV = Information_SunVue(i+1) >> 11
      month_SV = (Information_SunVue(i+1) - (day_SV << 11)) >> 7
      year_SV = Information_SunVue(i+1) - (day_SV << 11) - (month_SV << 7) + 2000
      Date_SunVue(i) = day_SV + "." + month_SV + "." + year_SV
    Next i

    CallTable SunVue_table 'Writing measurement data to the data table
  NextScan
EndProg
```

Second script to change Modbus address and heater status:

CRBasic Example 2: CR1000X program to set SunVue 30 Modbus address and heater status

```
'Example Script to set the modbus address and the heater status to a SunVue
'The parameters of in this script can be altered using the device configuration
'utility. After setting "write_settings to 1 the parameters will be written
'to the registers.

Const MB_TIMEOUT=50
Const MB_RETRIES=1

' Settings on logger site for communication
Public current_modbus_address = 1 'default

' New setting written to the device.
Public new_modbus_address As Long = 2
Public new_heater_status As Boolean = 0

Public write_settings = 0
Public mb_status

'Main Program
BeginProg
  new_modbus_address = 1
  ' When parity and baudrate have changed from default, the settings in the
  ' SerialOpen and the ModbusMaster command have to be adapted)
  SerialOpen(ComC1,19200,2,2,50,4) 'open communication port, setup for RS-485
  Scan (1,Sec,0,0)
    If write_settings = 1 Then
      ' modbus address register writing command to change the modbus address of
      ' the device
      ' the modbus address is effective immediately after the write
      ModbusClient(mb_status,ComC1,19200,current_modbus_address,5,new_heater_status,1001,1,MB_RETRIES,MB_TIMEOUT,2)
      ModbusClient(mb_status,ComC1,19200,current_modbus_address,6,new_modbus_address,4401,1,MB_RETRIES,MB_TIMEOUT,2)
      Delay(0,100,mSec)
      write_settings = 0
    EndIf
  NextScan
EndProg
```

Limited warranty

Covered equipment is warranted/guaranteed against defects in materials and workmanship under normal use and service for the period listed on your sales invoice or the product order information web page. The covered period begins on the date of shipment unless otherwise specified. For a repair to be covered under warranty, the following criteria must be met:

1. There must be a defect in materials or workmanship that affects form, fit, or function of the device.

2. The defect cannot be the result of misuse.

3. The defect must have occurred within a specified period of time; and

4. The determination must be made by a qualified technician at a Campbell Scientific Service Center/ repair facility.

The following is not covered:

1. Equipment which has been modified or altered in any way without the written permission of Campbell Scientific.

2. Batteries; and

3. Any equipment which has been subjected to misuse, neglect, acts of God or damage in transit.

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. For directions on how to return equipment, see Assistance.

Other manufacturer's products, that are resold by Campbell Scientific, are warranted only to the limits extended by the original manufacturer.

CAMPBELL SCIENTIFIC EXPRESSLY DISCLAIMS AND EXCLUDES ANY IMPLIED WARRANTIES OF

MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. Campbell Scientific hereby disclaims, to the fullest extent allowed by applicable law, any and all warranties and conditions with respect to the products, whether express, implied, or statutory, other than those expressly provided herein.

Campbell Scientific will, as a default, return warranted equipment by surface carrier prepaid. However, the method of return shipment is at Campbell Scientific's sole discretion. Campbell Scientific will not reimburse the claimant for costs incurred in removing and/or reinstalling equipment. This warranty and the Company's obligation thereunder is in lieu of all other

warranties, expressed or implied, including those of suitability and fitness for a particular purpose. Campbell Scientific is not liable for consequential damage.

In the event of any conflict or inconsistency between the provisions of this Warranty and the provisions of Campbell Scientific's Terms, the provisions of Campbell Scientific's Terms shall prevail. Furthermore, Campbell Scientific's Terms are hereby incorporated by reference into this Warranty. To view Terms and conditions that apply to Campbell Scientific, Logan, UT, USA, see Terms and Conditions. To view terms and conditions that apply to Campbell Scientific offices outside of the United States, contact the regional office that serves your country.

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 Limited 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.

Global Sales and Support Network

A worldwide network to help meet your needs

Campbell Scientific Regional Offices

Australia

Location:	Garbutt, QLD Australia
Phone:	61.7.4401.7700
Email:	info@campbellsci.com.au
Website:	www.campbellsci.com.au

Brazil

Location:	São Paulo, SP Brazil
Phone:	11.3732.3399
Email:	vendas@campbellsci.com.br
Website:	www.campbellsci.com.br

Canada

Location:	Edmonton, AB Canada
Phone:	780.454.2505
Email:	dataloggers@campbellsci.ca
Website:	www.campbellsci.ca

China

Location:	Beijing, P. R. China
Phone:	86.10.6561.0080
Email:	info@campbellsci.com.cn
Website:	www.campbellsci.com.cn

Costa Rica

Location:	San Pedro, Costa Rica
Phone:	506.2280.1564
Email:	info@campbellsci.cc
Website:	www.campbellsci.cc

France

Location:	Montrouge, France
Phone:	0033.0.1.56.45.15.20
Email:	info@campbellsci.fr
Website:	www.campbellsci.fr

Germany

Location:	Bremen, Germany
Phone:	49.0.421.460974.0
Email:	info@campbellsci.de
Website:	www.campbellsci.de

India

Location:	New Delhi, DL India
Phone:	91.11.46500481.482
Email:	info@campbellsci.in
Website:	www.campbellsci.in

Japan

Location:	Kawagishi, Toda City, Japan
Phone:	048.400.5001
Email:	jp-info@campbellsci.com
Website:	www.campbellsci.co.jp

South Africa

Location:	Stellenbosch, South Africa
Phone:	27.21.8809960
Email:	sales@campbellsci.co.za
Website:	www.campbellsci.co.za

Spain

Location:	Barcelona, Spain
Phone:	34.93.2323938
Email:	info@campbellsci.es
Website:	www.campbellsci.es

Thailand

Location:	Bangkok, Thailand
Phone:	66.2.719.3399
Email:	info@campbellsci.asia
Website:	www.campbellsci.asia

UK

Location:	Shepshed, Loughborough, UK
Phone:	44.0.1509.601141
Email:	sales@campbellsci.co.uk
Website:	www.campbellsci.co.uk

USA

Location:	Logan, UT USA
Phone:	435.227.9120
Email:	info@campbellsci.com
Website:	www.campbellsci.com