PRODUCT MANUAL

Sensor

# ClimaVue™ 40

## Compact Digital Weather Sensor


Revision: 12/2024



RELIABLE MONITORING SINCE 1974

Campbell SCIENTIFIC®

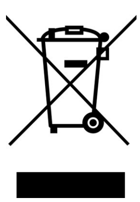
# Please read first

## 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 European 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 British/European 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 European 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 products 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

The ClimaVue™40 is an affordable all-in-one meteorological sensor that consumes little power and is quickly deployed. It uses the Modbus protocol to report air temperature, relative humidity, vapor pressure, barometric pressure, wind (speed, gust, and direction), precipitation, and lightning strike (count and distance). A built-in tilt sensor indicates if the mounting mast has tilted. The ClimaVue 40 must be level for the precipitation sensor to operate properly. This diverse product is ideal for remote locations to fill gaps in large networks or when a simple solution is needed.

# 2. Precautions

- READ AND UNDERSTAND the Safety section at the back of this manual.
- Care should be taken when opening the shipping package to not damage or cut the cable jacket. If damage to the cable is suspected, consult with a Campbell Scientific support and implementation engineer.
- The ClimaVue 40 is a precision instrument. Please handle it with care.
- To avoid shock or damage to the instrument, never apply power while wiring.
- Ensure the ClimaVue 40 is properly wired to the data logger before applying power. Applying power when incorrectly wired could damage the ClimaVue 40 beyond repair.
- When mounting the ClimaVue 40 to the mast, do not over-tighten the V bolt as it will cause the plastic to break.
- For the precipitation sensor to operate properly, the ClimaVue 40 must be mounted within 2 degrees of level on a mast that will not tilt in the wind.

> **NOTE:**
> The built-in bubble level and the internal tilt sensor can be used during installation to level the ClimaVue 40 to within these specifications. Recording and monitoring the tilt sensor readings can help alert you when the sensor is no longer level. Refer to Tilt sensor (p. 5) and Mounting procedure (p. 11) for more information.

- Routine maintenance is essential for accurate rainfall measurements. Debris blocking the inlet (funnel, spring, downspout, and flared hole) can result in under reporting of rainfall. Debris blocking the downspout screen can result in over reporting of rainfall.
- When attaching the extension cable to the ClimaVue 40 cable, only hand tighten the connectors. Using tools to tighten the connectors can permanently weld the stainless steel connectors together.
- When cleaning or handling, apply only light pressure on the sonic transducers.
- When cleaning, do not immerse the sensor in water and do not touch the temperature sensor needle.
- Before integrating the ClimaVue 40 into a system, make sure to follow the recommended installation instructions and have the proper protections in place to safeguard sensors from damage.
- This non-heated sensor is not suitable for solid precipitation or riming environments (Snow and ice accumulation [p. 18]).
- Heavy rains and strong winds can temporarily affect the accuracy of the measurements (Heavy rain and strong wind [p. 19]).

# 3. Initial inspection

Upon receipt of the ClimaVue 40, inspect the packaging and contents for damage. File damage claims with the shipping company.

# 4. Overview

All sensors are integrated into a single, small, form-factor unit, requiring minimal installation effort. With a robust design that prevents errors because of wear, the ClimaVue 40 is ideal for long-term, remote installations.

Upon power up, the ClimaVue 40 initializes an internal timer to 55. This internal timer is incremented by 1 every second and resets to 0 after incrementing to 59.

While powered up, the ClimaVue 40 takes precipitation, wind, and air temperature measurements every second and logs the values internally. By default, tilt, atmospheric pressure, relative humidity, and the temperature of the RH sensor are measured every 60 seconds at the internal timer interval of 4 seconds and logged internally. Vapor pressure is computed from the relative humidity and air temperature every 60 seconds and logged internally.

**Features:**

- All common meteorological measurements with one simple digital (Modbus) output
- Less than 1 mA average current at 12 VDC consumption making it ideal for solar-powered sites
- Integrated tilt sensor helps assure the sensor stays level over time
- No sensor configuration required
- Compact design for quick, low impact installation
- Low maintenance, which significantly lowers maintenance cost and time
- Detachable cable from sensor for fast sensor swap / servicing
- Compatible with Campbell Scientific CRBasic data loggers: CR6 series, CR1000X series, and CR350 series

## 4.1 Liquid precipitation gauge

The ClimaVue 40 has a 9.31-cm (3.67 in) diameter rain-collection funnel. A spring in the funnel acts as a filter to keep out large particles, while also allowing enough flow to avoid water backing up. Rain collected by the funnel exits the funnel through a precision flared hole that forms the rain into drops of a known size. The falling drops hit and momentarily bridge the gap between two gold pins, creating an electrical pulse.

The ClimaVue 40 counts the pulses (drops) and calculates the water volume. As the rain intensity increases, the drops become smaller, but the ClimaVue 40 firmware contains an algorithm to automatically compensate for drop size as the rain increases.

The ClimaVue 40 is also equipped with a tipping bucket rain gauge. After passing the drop counter, the drops land in the tipping spoon reservoir for a secondary rainfall measurement. The tipping spoon is precisely calibrated to tip with a highly repeatable water volume. A count of tipping events is a record of amount of liquid precipitation.

The tipping spoon adds robustness to the rainfall measurement by extending the measurement range to capture extreme rainfall events of up to 1,500 mm/hr (the drop-counting method becomes unreliable at extremely high rainfall rates [>400 mm/hr]).

**NOTE:**
This non-heated sensor is not suitable for solid precipitation measurements or riming environments.

## 4.2 Anemometer

An ultrasonic anemometer underneath the rain gauge measures wind speed. Two pairs of orthogonally oriented transducers emit ultrasonic signals that bounce off the porous sintered glass plate and back up to the opposite sensor. The ClimaVue 40 calculates wind speed by measuring differences in the time it takes for sound to travel back and forth between the transducers. The wind measurement takes 42 milliseconds followed by 60 milliseconds of processing.

The ClimaVue 40 measures the wind speed and direction every second and records the instantaneous wind vector components. When queried, the ClimaVue 40 outputs the average of the instantaneous measurements since the last query for wind speed and direction and the maximum instantaneous wind speed value for wind gust.

The ClimaVue 40 keeps a running average of the last 10 measurements. If an instantaneous measurement is more than eight times the running average, the instantaneous measurement is rejected. It is not reported as the maximum gust or included in the data that is averaged over the output interval.

## 4.3 Relative humidity sensor

The relative humidity sensor is located behind the circular Teflon® screen in the same housing as the sonic transducers. The screen protects the sensor from liquid water and dust while allowing water vapor to freely pass to the sensor. The sensor measures relative humidity and temperature of the cavity, then uses those measurements to calculate vapor pressure. Vapor pressure doesn't change with temperature, but relative humidity does. Because the true air temperature (measured by the thermistor needle and corrected using wind measurements) differs from the cavity temperature, the true relative humidity is computed using the true air temperature and the calculated vapor pressure.

## 4.4 Thermistor

A small stainless steel needle containing a thermistor extends from the middle of the four sonic transducers in the center of the anemometer. The thermistor is naturally aspirated under the shade of the sensor body. The uncertainty on air temperature measurement is ±0.2 °C. The air temperature measurement can have a bias of up to 0.5 °C when the sensor is not in an actively aspirated solar shield. This is due to the direct solar loading through the body of the sensor. When integrated into a system with a Campbell data logger, such as SunScout or SunSentry, an algorithm can be applied to correct for this bias if a solar radiation measurement is available. For more information, refer to the ClimaVue™50—Correction of air temperature measurements from a radiation-exposed sensor White Paper available at: www.campbellsci.com/app-notes.

## 4.5 Tilt sensor

After initial leveling with a small level or the built-in bubble level, the internal tilt sensor helps users keep the ClimaVue 40 level. Regularly check the X and Y tilt data. Adjust the ClimaVue 40 leveling if it has tilted. More than two degrees off level can cause errors in the rain measurements. Although this tilt sensor may be used to level the instrument, it is much easier to use the small bubble level on the bottom of the anemometer plate.

The tilt sensor is an accelerometer that reads whatever acceleration it is experiencing. Under static conditions, this is the gravitational acceleration, and therefore provides an accurate indication of tilt. However, if the sensor is not securely mounted, the tilt sensor measures a combination of gravity and vibration.

## 4.6 Barometric pressure sensor

The barometric pressure sensor is located behind the Teflon screen next to the relative humidity sensor on the same circuit board. It measures the atmospheric pressure in the range of 500 to 1100 hPa.

## 4.7 Lightning sensor

The lightning sensor uses AM radio signals, which are disrupted by lightning. Circuitry inside the sensor detects disrupted AM signal. The ClimaVue 40 records the time of the disruption and determines strike distance based on the intensity of the signal.

# 5. Specifications

| | |
|---|---|
| **Scan rate:** | ≥1 s |
| **Output:** | Modbus through RS-485 |
| **Operating temperature range:** | –50 to 60 °C (except barometer and RH, which are –40 to 60 °C) |
| **Supply voltage:** | 3.6 to 15.0 VDC (continuous) |

Power consumption

| | |
|---|---|
| **Quiescent:** | 0.3 mA |
| **Maximum peak current:** | 33 mA |
| **Average:** | 1.0 mA |
| **Digital voltage (logic high):** | 2.8 V (minimum), 3.0 V (typical), 5.5 V (maximum) |
| **Digital voltage (logic low):** | –0.3 V (minimum), 0.0 V (typical), 0.8 V (maximum) |
| **Power line slew rate:** | 1.0 V/ms (use an oscilloscope to measure the voltage at the power input to the sensor as it is turned on to ensure it is supplying 1 V per millisecond or faster) |

Table 5-1: Measurement specifications

| Measurement | Range | Resolution | Accuracy or repeatability |
|---|---|---|---|
| Air temperature | –50 to 60 °C | 0.1 °C | ±0.2 °C at 25 °C;<br>±0.6 °C from –20 to 50 °C |
| Vapor pressure | 0 to 47 kPa | 0.01 kPa | Varies with temperature and humidity, ±0.2 kPa typical below 40 °C. Figure 5-1 (p. 7) shows accuracies for different temperature and humidity values. |
| Relative humidity | 0 to 100% | 0.1 | Varies with temperature and humidity, ±3% RH typical. Figure 5-2 (p. 7) shows accuracies for different temperature and humidity. |
| Barometric pressure | 1 to 120 kPa | 0.01 hPa | ±0.05 kPa at 25 °C |
| Wind speed | 0 to 60 m/s | 0.01 m/s | 0.3 m/s or 3%, whichever is greater |
| Wind speed max – 10 s gust | 0 to 60 m/s | 0.1 m/s | 0.3 m/s or 3%, whichever is greater |
| Wind direction | 0 to 359° | 1° | ±5° |
| Precipitation | 0 to 1500 mm/hr | 0.017 mm | ±5% of measurement from 0 to 1000 mm/hr |
| Tilt | ±90 | 0.1° | ±1° |

| Table 5-1: Measurement specifications | | | |
|---|---|---|---|
| **Measurement** | **Range** | **Resolution** | **Accuracy or repeatability** |
| Lightning strike count | 0 to 65535 strikes | 1 strike | Variable with distance, >25% detection at <10 km, typical |
| Lightning average distance | 0 to 40 km | 3 km | Variable |

| HUMIDITY (%RH) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 100 | ± 0.03 | ± 0.05 | ± 0.09 | ± 0.16 | ± 0.27 | ± 0.44 | ± 0.69 | ± 1.33 | ± 2.38 |
| 90 | ± 0.03 | ± 0.05 | ± 0.09 | ± 0.15 | ± 0.26 | ± 0.42 | ± 0.66 | ± 1.26 | ± 2.24 |
| 80 | ± 0.03 | ± 0.04 | ± 0.07 | ± 0.12 | ± 0.21 | ± 0.34 | ± 0.63 | ± 1.20 | ± 2.10 |
| 70 | ± 0.02 | ± 0.04 | ± 0.07 | ± 0.12 | ± 0.20 | ± 0.32 | ± 0.50 | ± 1.13 | ± 1.96 |
| 60 | ± 0.02 | ± 0.03 | ± 0.06 | ± 0.11 | ± 0.18 | ± 0.30 | ± 0.47 | ± 1.06 | ± 1.82 |
| 50 | ± 0.02 | ± 0.03 | ± 0.06 | ± 0.10 | ± 0.17 | ± 0.28 | ± 0.45 | ± 0.99 | ± 1.68 |
| 40 | ± 0.02 | ± 0.03 | ± 0.05 | ± 0.09 | ± 0.16 | ± 0.26 | ± 0.42 | ± 0.76 | ± 1.54 |
| 30 | ± 0.01 | ± 0.03 | ± 0.05 | ± 0.09 | ± 0.15 | ± 0.24 | ± 0.39 | ± 0.69 | ± 1.40 |
| 20 | ± 0.01 | ± 0.02 | ± 0.04 | ± 0.08 | ± 0.14 | ± 0.23 | ± 0.36 | ± 0.62 | ± 1.26 |
| 10 | ± 0.01 | ± 0.02 | ± 0.04 | ± 0.07 | ± 0.12 | ± 0.21 | ± 0.33 | ± 0.55 | ± 1.13 |
| 0 | ± 0.01 | ± 0.02 | ± 0.04 | ± 0.06 | ± 0.11 | ± 0.19 | ± 0.30 | ± 0.48 | ± 0.99 |
| | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
| | TEMPERATURE (°C) | | | | | | | | |

*Figure 5-1. Vapor pressure accuracy at different temperatures and relative humidity*

| HUMIDITY (%RH) | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 100 | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% |
| 90 | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% | ±2.0% |
| 80 | ±2.0% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% | ±2.0% | ±2.0% |
| 70 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% | ±2.0% |
| 60 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% | ±2.0% |
| 50 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% | ±2.0% |
| 40 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% |
| 30 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% |
| 20 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% |
| 10 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% |
| 0 | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±1.5% | ±2.0% |
| | 0 | 10 | 20 | 30 | 40 | 50 | 60 | 70 | 80 |
| | TEMPERATURE (°C) | | | | | | | | |

*Figure 5-2. Relative humidity accuracy at different temperatures and relative humidity*

**Diameter (includes rain gauge filter):** 10 cm (4 in)

**Height:** 34 cm (13.4 in)

| | |
|---|---|
| Application of Council Directive | |
| 2011/65/EU: | Restrictions of Substances Directive (RoHs2) |
| 2014/30/EU: | Electromagnetic Compatibility Directive (EMC) |
| Standards to which conformity is declared | |
| EN 61326-1:2013: | Electrical equipment for measurement, control and laboratory use—EMC requirements—for use in industrial locations |
| EN 50581:2012: | Technical documentation for the assessment of electrical and electronic product with respect to the restriction of hazardous substances |
| Compliance documents: | View at: www.campbellsci.com/climavue-40 |

# 6. Installation



## 6.1 Wiring

The ClimaVue 40 can be directly read by a MeteoPV, CR6, CR1000X-series, or Modbus RTU RS-485 network (Table 6-1 [p. 9]). Other Campbell Scientific data loggers can use an MD485 multidrop interface to read the RS-485 output. Refer to the MD485 manual for more information. The Modbus address must be unique and may need to be changed if another sensor on the bus has the same address. Contact Campbell Scientific technical support for assistance changing the Modbus address.

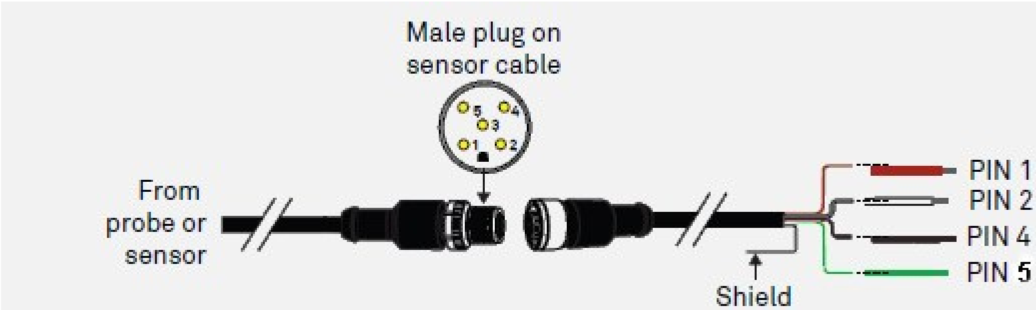



*Figure 6-1. Pin-out for ClimaVue 40*

Table 6-1: Wire color, function, and data logger connection

| Wire color | Pin | Wire function | Data logger connection[1] |
|---|---|---|---|
| Red | 1 | Power | **12V** |
| Black | 4 | Power ground | **G** |
| Green | 5 | RS-485 (A–) | **C** odd |
| White | 2 | RS-485 (B+) | **C** even |
| Clear | | Shield | **G** |

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

# 6.2 CRBasic programming

The RS-485 output can be directly read by a CR6-series, CR1000X-series, CR350-series, or Modbus RTU RS-485 network. Other Campbell Scientific data loggers can use an MD485 multidrop interface to read the RS-485 output.

A CR6, CR1000X, or CR350-series data logger programmed as a Modbus client can retrieve the values stored in the input registers (see Input register map [p. 15]). To do this, the CRBasic program requires the `SerialOpen()` instruction followed by `ModbusClient()` instruction.

> NOTE:
> `ModbusClient()` was formerly `ModbusMaster()`. Campbell Scientific, in conjunction with the Modbus Organization, is now using "client-server" to describe Modbus communications. The Modbus client(s) initiates communications and makes requests of server device(s). Server devices process requests and return an appropriate response (or error message). See https://modbus.org for more information. Existing programs that use the old Modbus terminology will still compile in the data logger.

The SerialOpen instruction has the following syntax:

```
SerialOpen (ComPort, Baud, Format, TXDelay, BufferSize, Mode)
```

The Format parameter is typically set to logic 1 low; even parity, one stop bit, 8 data bits. The Mode parameter should configure the ComPort as RS-485 half-duplex, transparent.

The ModbusClient() instruction has the following syntax:

```
ModbusClient (Result, ComPort, Baud, Addr, Function, Variable, Start, Length,
Tries, TimeOut, [ModbusOption])
```

The Addr parameter must match the sensor Modbus address.

An example program is available at Example program (p. 29) and can be downloaded at www.campbellsci.com/downloads/climavue40-example-programs.

## 6.3 Siting

Erect the sensor away from obstructions such as trees and buildings. The horizontal distance from an obstruction should be at least ten times the height of the obstruction. If mounting the sensor on the roof of a building, the height of the sensor, should be at least 1.5 times the height of the building.

## 6.4 Mounting

The ClimaVue 40 includes a V-bolt for mounting to a pipe with a nominal outer diameter of 31.8 to 50.8 mm (1.25 to 2.0 in). The CM310 mounting pole is recommended to mount the ClimaVue 40 with a small enclosure and solar panel (no other sensors). The ClimaVue 40 can mount to a crossarm by using the ClimaVue50, MetSENS, or WindSonic Mounting Pipe Kit, which includes a mounting tube and a CM220 Right Angle Mounting Kit (includes bracket, two U-bolts, and four nuts).

### 6.4.1 Required tools

- 1/2-in open-end wrench
- Torpedo level
- UV-resistant cable ties
- Compass
- Ladder

## 6.4.2 Mounting procedure

1. If using a crossarm, attach the mounting tube to the crossarm by using the CM220 Right Angle Mounting Kit, then mount the crossarm to the tripod or tower (Figure 6-2 [p. 11]).

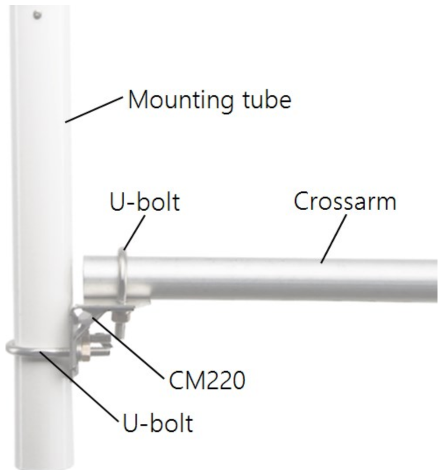



*Figure 6-2. ClimaVue50, MetSENS, or WindSonic Mounting Pipe Kit and crossarm*

2. Loosely mount the ClimaVue 40 to the tripod mast, CM300-series pole, or mounting tube by using the V-bolt, washers, and nuts (Figure 6-3 [p. 11]).

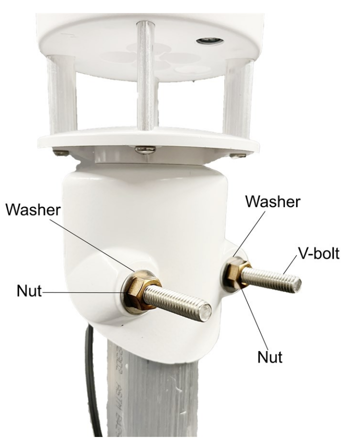



*Figure 6-3. ClimaVue 40 mounted to a pole with V-bolt and nuts*

3. Orient the ClimaVue 40 so the engraved **N** points to True North (Figure 6-4 [p. 12]). Determining True North and sensor orientation (p. 26) contains detailed information on determining True North using a compass and the magnetic declination for the site.

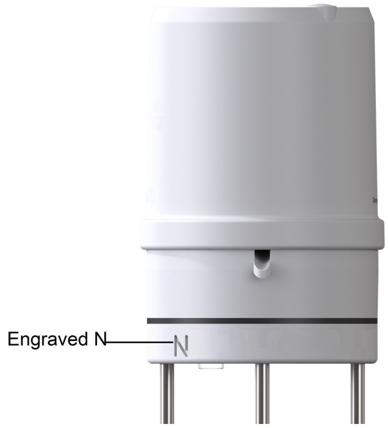



*Figure 6-4. Engraved N on the ClimaVue 40*

4. Use a torpedo level or the bubble level underneath the sensor to level it (Figure 6-5 [p. 12]). The angle of the instrument mount may need to be adjusted if the mast is not vertical. Shims can be added between the top of the mast and the bottom of the ClimaVue 40 to achieve level. The sensor must be within ±2° of dead level (0, 0) in both the X and Y directions to accurately measure rainfall. The ±2° can be confirmed by viewing the Tilt North(+)/South(–) and Tilt West(+)/East(–) orientation values returned by the `0128` and `012A` registers.

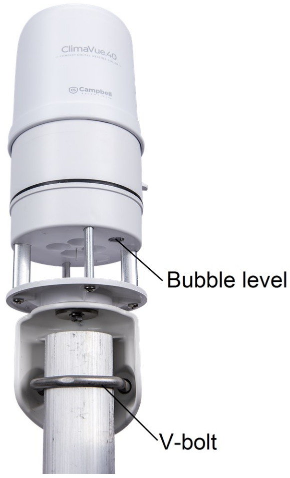



*Figure 6-5. Bubble level on the ClimaVue 40*

5. Once level, tighten the V-bolt nuts by hand until hand-tight, then gently tighten with a wrench and recheck the level.

> **CAUTION:**
> Do not over-tighten V-bolt as it will cause the plastic to break.

6. Mate the extension cable connector to the cable connector. Only hand tighten the connectors.

> **CAUTION:**
> Hand tighten only! Using tools to tighten the connectors can permanently weld the stainless steel connectors together.

7. Route the cable down the pole to the instrument enclosure.
8. Secure the cable to the crossarm (if applicable) and tripod or pole by using cable ties.

### 6.4.3 Optional bird spike kit

The optional bird-spike kit helps discourage birds from roosting on the ClimaVue 40. The kit consists of a plastic ring with flexible spikes. When installed, the spikes point upwards and extend 10.2 cm (4 in) above the funnel. Their shape and location minimize interference with rain measurements. The spikes are designed to repel, but hurt the birds.

The plastic ring includes secondary spike positions that can be drilled by the user to install additional short spikes. The additional spikes are to be provided by the user.

Items included in kit:

(13) Spikes (includes one spare)

(1) Spike ring

Required tools (not included):

(1) Pliers

Bird-spike kit installation procedure:

1. Count all parts to ensure nothing was lost in shipping.
2. Gently press a bird spike into a slot on the bird spike ring by hand.
3. Using pliers, pinch the bird spike near its base and press down until it is fully seated.

4. Repeat steps 2 and 3 for all bird spikes (Figure 6-6 [p. 14]).

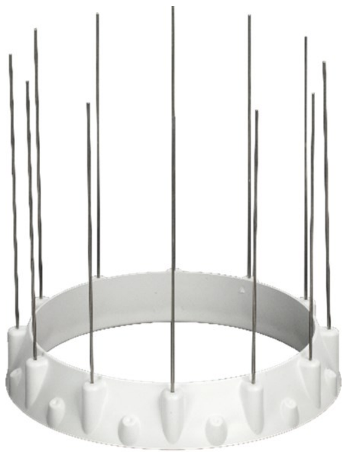


*Figure 6-6. Spikes inserted into the plastic ring slots*

5. Tug upward on each spike to make sure the spike is pressed in.
6. Position the ring on top of the ClimaVue 40.

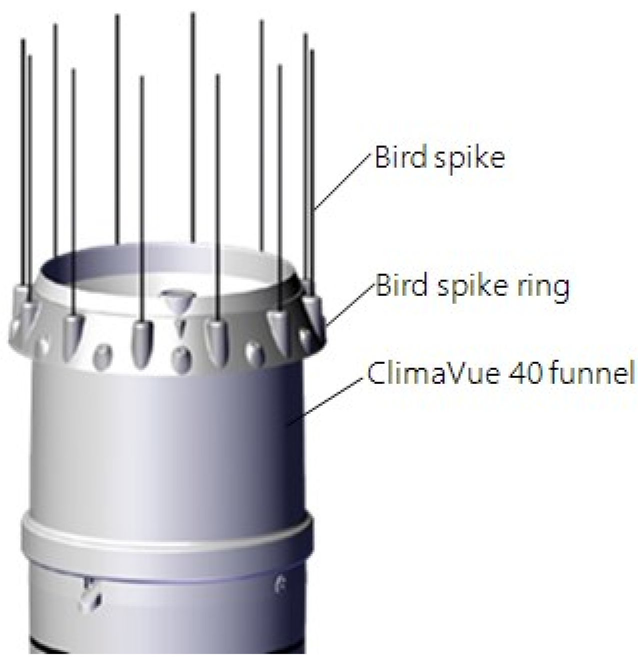



*Figure 6-7. Bird-spike kit mounted properly*

7. Press finished bird deterrent onto the ClimaVue 40 funnel to at least the depth shown in Figure 6-7 (p. 14).

# 7. Operation



## 7.1 Default serial settings

Table 7-1: Default serial settings

| Parameter | Default value |
|---|---|
| Baud rate | 19200 |
| Data bits | 8 |
| Parity | even |
| Stop bit | 1 |
| Default Modbus address | 1 |

## 7.2 Input register map

ClimaVue 40 measurements are accessed using the input register (function code 4). All measurements are 32-bit values that span two registers. Each 32-bit value is aligned on an even register address (for example, 0x100, 0x102, 0x104). Both registers comprising a 32-bit value must be read for the 32-bit measurement data reported to be valid. If a Read Input Register command results in only one register for a given measurement being read, the 16-bit data from that measurement will be read as 0 instead of being read as the upper or lower 16-bit word of the 32-bit measurement value.

The reported measurements come from internal accumulators that hold periodic and aperiodic data that was collected during a measurement interval. The measurement interval is the duration of time between two Read Input Register commands or the duration between device power-up or reset and the first Read Input Register command since device reset. Depending on measurement type, the measurements are averages, total counts, minimums, or maximums.

**Table 7-2: Input register map (function code 4)**

| Register address[1] | Measurement (unit) | Data type |
|---|---|---|
| 1002 to 1003 | Total precipitation (mm ) | 32-bit single-precision floating-point |
| 1004 to 1005 | Precipitation drop counter (number of drops) | 32-bit single-precision floating-point |
| 1006 to 1007 | Precipitation tip counter (number of tips) | 32-bit unsigned integer |
| 1008 to 1009 | Precipitation (µs/cm) | 32-bit single-precision floating-point |
| 1010 to 1011 | Lightning strike count (number of strikes) | 32-bit unsigned integer |
| 1012 to 1013 | Average lightning strike distance (km) | 32-bit single-precision floating-point |
| 1014 to 1015 | Wind speed (m/s) | 32-bit single-precision floating-point |
| 1016 to 1017 | Wind direction (°) | 32-bit single-precision floating-point |
| 1018 to 1019 | Gust wind speed (m/s) | 32-bit single-precision floating-point |
| 1020 to 1021 | Air temperature (°C) | 32-bit single-precision floating-point |
| 1022 to 1023 | Vapor pressure (kPa) | 32-bit single-precision floating-point |
| 1024 to 1025 | Atmospheric pressure (kPa) | 32-bit single-precision floating-point |
| 1026 to 1027 | Relative humidity (%) | 32-bit single-precision floating-point |
| 1028 to 1029 | Relative humidity sensor temperature (°C) | 32-bit single-precision floating-point |

| Table 7-2: Input register map (function code 4) | | |
|---|---|---|
| Register address[1] | Measurement (unit) | Data type |
| 1030 to 1031 | Single orientation (°) | 32-bit single-precision floating-point |
| 1032 to 1033 | T min (°C) | 32-bit single-precision floating-point |
| 1034 to 1035 | T max (°C) | 32-bit single-precision floating-point |
| 1036 to 1037 | North wind speed (m/s) | 32-bit single-precision floating-point |
| 1038 to 1039 | East wind speed (m/s) | 32-bit single-precision floating-point |
| 1040 to 1041 | X direction orientation (°) | 32-bit single-precision floating-point |
| 1042 to 1043 | Y direction orientation (°) | 32-bit single-precision floating-point |
| [1]The Input Register map for measurements starts at 0x0100 to avoid an accidental 0x0000 starting address from the Modbus client. This is admittedly a somewhat arbitrary choice. | | |

# 7.3 Device identity registers

| Table 7-3: Device identity register map (function code 4) | | |
|---|---|---|
| Registers | Data | Data type |
| 3000 to 3006 | Sensor serial number | ASCII string 13 chars +1 null terminator |
| 3007 | Firmware version (encoded as (Major*100) + Minor | U16 |
| 3008 to 3012 | Sensor model number (CVUE40) | ASCII string 8 chars + 2 null terminators |
| 3013 | RH Daughterboard Serial Number | U16 |
| Non-Customer-Facing Device Identity Registers | | |
| 3200 | Firmware Major Version | U16 |

| Table 7-3: Device identity register map (function code 4) | | |
|---|---|---|
| Registers | Data | Data type |
| 3201 | Firmware Minor Version | U16 |
| 3202 | Firmware Build Version | U16 |

## 7.4 Holding registers

| Table 7-4: Holding register map (function code 3) | | | |
|---|---|---|---|
| Register address | Data | Data type | Read/write status |
| 1000 | Modbus server address<br>• Range: 1 to 247<br>• Default: 1 | U16 | R/W |
| 1001 | Modbus parity bit format<br>• 0: No parity<br>• 1: Odd parity<br>• 2: Even parity (default) | U16 | R/W |
| 1002 | Modbus stop bit format<br>• 1: One stop bit (default)<br>• 2: Two stop bits<br>0 stop bits is not supported | U16 | R/W |
| 2000 to 2006 | Serial number | ASCII string | R/W |
| 2007 | Vendor (2: CVUE40) | U16 | R/W |

## 7.5 Snow and ice accumulation

The ClimaVue 40 is not heated, so it will not measure frozen precipitation until snow and ice that have accumulated in the funnel melt. In locations with heavy snowfall or long periods below freezing, snow will fill the funnel and no longer accumulate, leading to inaccurate precipitation measurements even when the precipitation melts. Accumulation of snow, ice, or frost can compromise the wind measurements if accumulation occurs in the anemometer acoustic pathway or on the acoustic mirror.

# 7.6 Heavy rain and strong wind

During strong storms, water can splash off the horizontal bottom plate of the anemometer envelope and interrupt the signal passing between the sonic transducers. The spikes on the bottom plate help dissipate the rainwater to minimize splashing and reduce the likelihood the wind measurements are interrupted. Additionally, porous polyethylene membranes protect the ultrasonic transducers from direct splashing and the sintered (porous) glass construction draws water from the upper surface of the acoustic mirror to keep a constant sound path length. Despite these features, heavy rain and strong winds can cause water to reach the membranes and also cause temporary water buildup on the acoustic mirror. The hydrophobic nature of the transducer protective membranes and the quick-draining ability of the acoustic mirror should limit wind measurement interruptions to heavy rain and bring wind measurement back online soon after extreme conditions abate.

# 7.7 Correcting pressure to sea level

The weather service, most airports, radio stations, and television stations adjust the atmospheric pressure to a common reference (sea level). Eq. 1 (p. 19) can be used to find the difference in pressure between the sea level and the site in kPa. That value (**dP**) is then added to the absolute pressure measurement returned by the ClimaVue 40 as seen in the example program. Once that is done, the program shows the pressure conversion to hPa. U. S. Standard Atmosphere and dry air were assumed when Eq. 1 (p. 19) was derived (Wallace, J. M. and P. V. Hobbes, 1977: *Atmospheric Science: An Introductory Survey*, Academic Press, pp. 59-61).

$$dP = 101.325\left\{1 - \left(1 - \frac{E}{44307.69231}\right)^{5.25328}\right\} \qquad \text{Eq. 1}$$

The value **dP** is in kPa and the site elevation, **E**, is in meters. Add **dP** value to the offset in the measurement instruction.

Use Eq. 2 (p. 19) to convert feet to meters.

$$E\left(m\right) = \frac{E(ft)}{3.281\,ft/m} \qquad \text{Eq. 2}$$

The corrections involved can be significant. For example, at 100 kPa and 20 °C, barometric pressure will decrease by 0.11 kPa for every 10 m increase in altitude.

# 8. Troubleshooting and maintenance

**NOTE:**
All factory repairs and recalibrations require a returned material authorization (RMA) and completion of the "Statement of Product Cleanliness and Decontamination" form. Refer to the Assistance page for more information.



## 8.1 Maintenance and calibration

Sensor maintenance should be performed at regular intervals, depending on the desired accuracy and the conditions of use.

1. Remove cobwebs, leaves, bird droppings, wasp nests, or other debris from the temperature sensor (Figure 8-1 [p. 21]), ultrasonic transducer openings (Figure 8-1 [p. 21]), rain gauge funnel (Figure 8-2 [p. 21]), and plate (Figure 8-3 [p. 22]).

   **CAUTION:**
   Do not touch the temperature sensor when cleaning, because it is very delicate and can be damaged if pushed into the body.

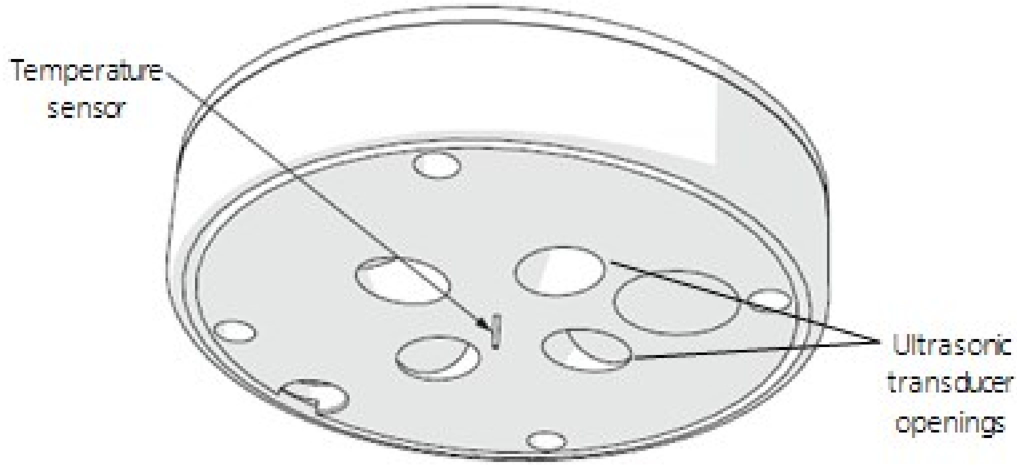



*Figure 8-1. Temperature sensor and ultrasonic transducer openings*

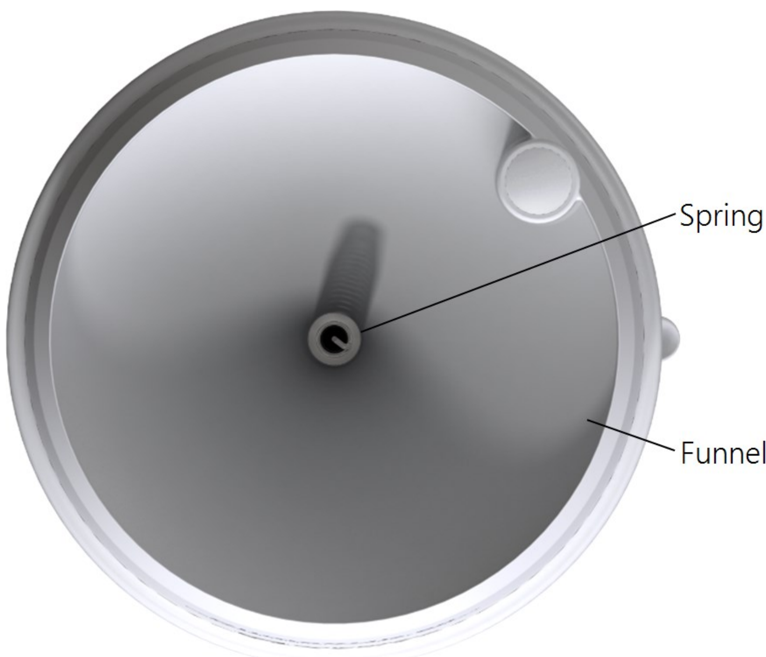



*Figure 8-2. Top view of ClimaVue 40*


*Figure 8-3. Plate*

2. Scrub the body with light to medium pressure using a warm, damp cloth.

> **CAUTION:**
> Gently clean the sonic transducers and do not allow water to enter the ultrasonic sensors (Figure 8-1 [p. 21]). Water may corrode the metal parts inside the sensors and ruin them.

3. Clean around posts and between crevices using a dry brush.

4. Inspect the Teflon screen (Figure 8-4 [p. 23]) and replace if dirty.

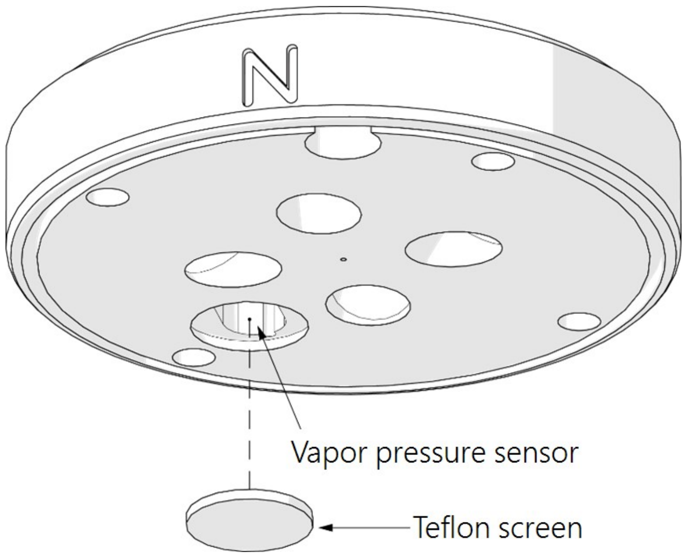



*Figure 8-4. Teflon screen*

5. Rain gauge maintenance. Routine maintenance is essential for accurate rainfall measurements. Debris blocking the inlet (funnel, spring, downspout, and flared hole) can result in under reporting of rainfall. Debris blocking the downspout screen can result in over reporting of rainfall. The funnel locks in place using two pegs on the side of the funnel. To access the inside of the rain gauge:
   a. Press the funnel down against the spring and turn counter clockwise.
   b. If necessary, remove funnel.
   c. Check the downspout for debris (Figure 8-5 [p. 24]). Use a pipe cleaner or small soft brush to clean the downspout.
   d. If needed, clean the spring after twisting it loose. Ensure the gold electrodes are free of debris and contamination.
   e. Check the downspout screen is clean and in place on the water exit downspout. If this screen gets plugged with debris, water can back up to the drip counting gold electrodes causing extra counts that can more than double the recorded rain. The screen keeps bugs out of the interior of the sensor.
   f. Replace the funnel by lining up the lock/unlock label located on the side of the funnel with the notch on the interface plate.
   g. Press the funnel down against the spring and turn clockwise until it clicks in place.

h. Check the level of the ClimaVue 40 (either with a torpedo level, bubble level, or the built-in tilt sensor).

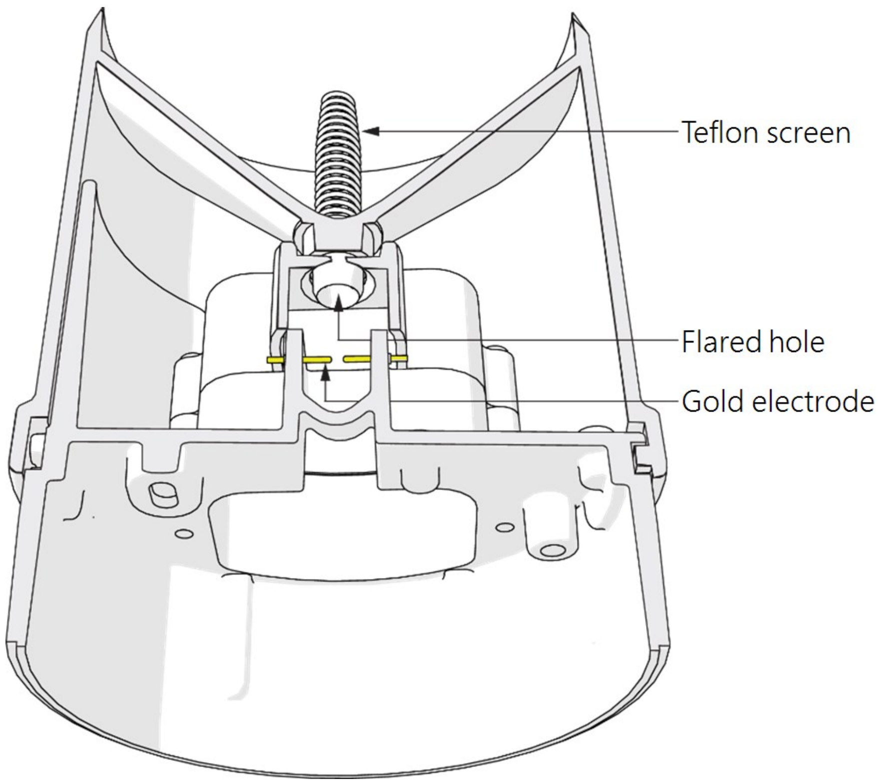



*Figure 8-5. Rain gauge cutout*

6. Relative humidity and barometric pressure maintenance. A field-replaceable module contains the barometric pressure and relative humidity sensors. This module is under the Teflon screen (Figure 8-4 [p. 23]) and should be replaced every two years.

# 8.2 Troubleshooting

Symptom: NAN readings. NAN readings indicate the data logger isn't receiving data from the ClimaVue 40.

1. Check the sensor is wired to the control terminal specified by the `ModbusClient()` instruction.
2. Check the voltage to the sensor with a digital voltage meter. If a switched 12V terminal is used and programmed using CRBasic, temporarily connect the red wire to a 12V terminal (non-switched) for test purposes.

3. Verify the probe Modbus address matches the address entered for the `ModbusClient()` instruction.

Symptom: Not reading any rain.

1. Remove debris from rain gauge (see step 5 in Maintenance and calibration [p. 20]).
2. Check the sensor level. The ClimaVue 40 must be within approximately ±2 degrees of dead level (0, 0) in both the X and Y directions to accurately measure rainfall. If not within this range, drops from the flared hole can miss the gold electrodes entirely. Use a torpedo level, the bubble level, or the internal tilt measurements to confirm the ClimaVue 40 is level.

Symptom: No wind speed (–9,990, –9,999 or –7999).

1. Check anemometer pathway to ensure debris is not blocking the path of the sonic transducer measurement (between transducers and acoustic mirror on base).
2. Check the sonic transducers for water build-up. Use a dry cloth to remove moisture.
3. Check that the plate (Figure 8-3 [p. 22]) is not dirty.
   a. Clean by flushing with water and drying with a dry cloth.
4. Ensure the ClimaVue 40 is level.

Symptom: No temperature reading.

1. Check the temperature needle to be sure it is not pushed in, which will break the thermistor wires.

   > **CAUTION:**
   > Always handle the temperature sensor needle gently. It has delicate wires that can be easily damaged.

# Appendix A. Determining True North and sensor orientation

Orientation of the wind direction sensor is done after programming the data logger and determining the location of True North. True North is usually found by reading a magnetic compass and applying the correction for magnetic declination—where magnetic declination is the number of degrees between True North and Magnetic North. The preferred method to obtain the magnetic declination for a specific site is to use a computer service offered by NOAA at www.ngdc.noaa.gov/geomag. The magnetic declination can also be obtained from a map or local airport. A general map showing magnetic declination for the contiguous United States is shown in Figure A-1 (p. 27).

Declination angles east of True North are considered negative and are subtracted from 360 degrees to get True North as shown Figure A-2 (p. 27) (0° and 360° are the same point on a compass). For example, the declination for Logan, Utah is 11.78° East (11 August 2015). True North is 360° – 11.78° or 348.22° as read on a compass. Declination angles west of True North are considered positive, and are added to 0 degrees to get True North as shown in Figure A-3 (p. 28).

Orientation:

1. Establish a reference point on the horizon for True North.
2. Sighting down one pair of the ClimaVue 40 north south posts, aim the pair at True North. If the wind is blowing and a flag or banner can be used to determine the true wind direction, the data logger displayed wind direction reading can be compared to the true wind direction.

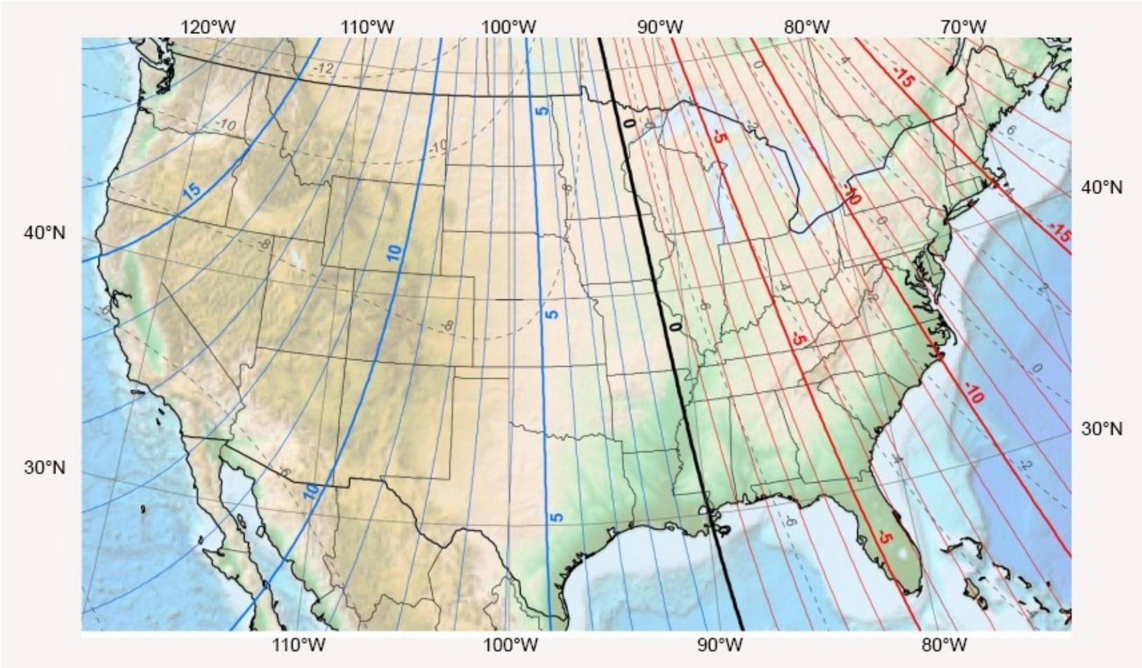



*Figure A-1. Magnetic declination for the conterminous United States (2015)*

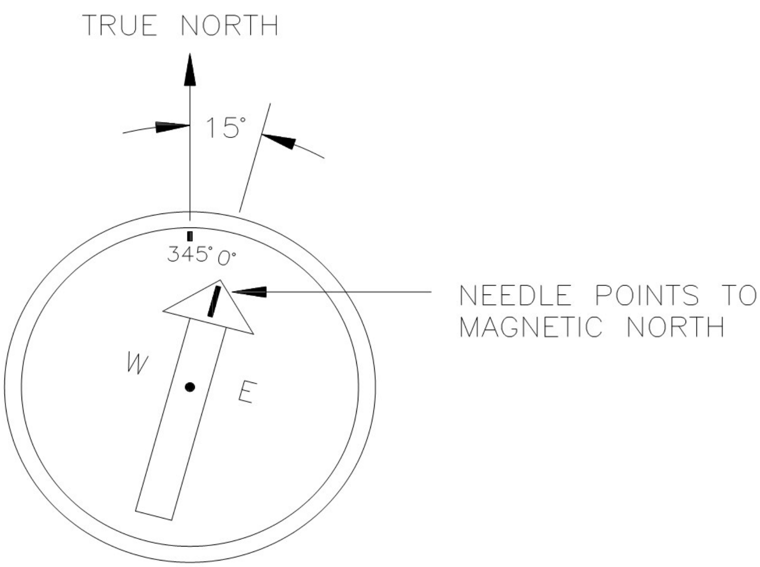



*Figure A-2. Declination angles east of True North are subtracted from 360 to get True North*

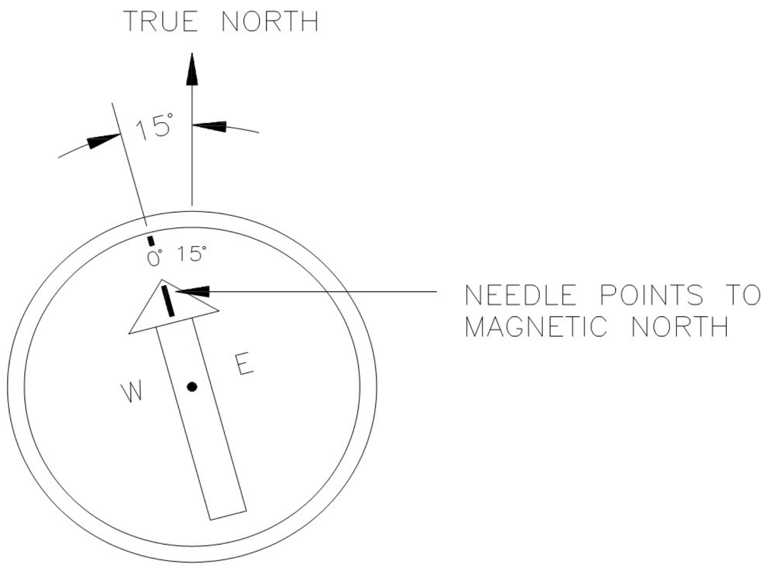



*Figure A-3. Declination angles west of True North are added to 0 to get True North*

# Appendix B. Example program

CRBasic Example 1: CR1000X program that measures the ClimaVue 40

```
'CR1000X Series Datalogger

'This example program reads the ClimaVue 40 All-in-One
'weather sensor using a CR1000X data logger and the Modbus RTU protocol
'over half-duplex RS-485.

'This program runs a scan every 1 Min and stores the data in a 1 Min table.

'Wiring ClimaVue 40:
'Red (power) -> 12V
'Green (RS-485-A) -> C5
'White (RS-485-B) -> C6
'Black (power ground) -> G
'Clear (shield) -> G

'Constants
Const ADDR=1 'Default ClimaVue 40 Modbus server address
Const RETRIES=1 'Number of times to retry Modbus client request
Const MB_TO=15 '150ms request timeout (value * 0.01 sec)

'Public Variables
Public PTemp, Batt_volt
Public MBstat  'used for monitoring the Modbus poll request status
Public CV40(22) 'ClimaVue 40 input register data
'Twenty-two (22) 32-bit values (44 input registers total)
'Private Variables

'Aliases
Alias CV40(2) = Precipitation : Units Precipitation=mm
Alias CV40(3) = PrecipDrops : Units PrecipDrops=counts
Alias CV40(4) = PrecipTips : Units PrecipTips=counts
Alias CV40(5) = PrecipitationEC : Units PrecipitationEC=uS/cm
Alias CV40(6) = Strikes : Units Strikes=count
Alias CV40(7) = StrikeDistance : Units StrikeDistance=km
Alias CV40(8) = WindSpeed : Units WindSpeed=m/s
Alias CV40(9) = WindDirection : Units WindDirection=degrees
Alias CV40(10) = GustWindSpeed : Units GustWindSpeed=m/s
Alias CV40(11) = AirTemperature : Units AirTemperature=DegC
Alias CV40(12) = Vapor_Pressure : Units Vapor_Pressure=kPa
Alias CV40(13) = AtmPressure : Units AtmPressure=kPa
Alias CV40(14) = RelHumidity : Units RelHumidity=percent/100
```

CRBasic Example 1: CR1000X program that measures the ClimaVue 40

```
Alias CV40(15) = RelHumidityTemp :  Units RelHumidityTemp=DegC
Alias CV40(16) = SingleOrientation : Units SingleOrientation=degrees
Alias CV40(17) = Tmin :  Units Tmin=DegC
Alias CV40(18) = Tmax :  Units Tmax=DegC
Alias CV40(19) = NorthWindSpeed : Units NorthWindSpeed=m/s
Alias CV40(20) = EastWindSpeed : Units EastWindSpeed=m/s
Alias CV40(21) = XOrientation : Units XOrientation=degrees
Alias CV40(22) = YOrientation : Units YOrientation=degrees

'Data Tables
'Set table size to # of records, or -1 to autoallocate.
DataTable (CV40_Table,1,-1)
  DataInterval (0,1,Sec,10)
  Minimum (1,Batt_volt,FP2,False,False)
  Sample (1,PTemp,FP2)
  'Sample (1,Solar,IEEE4)
  Sample (1,Precipitation,IEEE4)
  Sample (1,PrecipDrops,UINT4)
  Sample (1,PrecipTips,UINT4)
  Sample (1,PrecipitationEC,IEEE4)

  'Sample (1,Strikes,UINT4)
  'Sample (1,StrikeDistance,IEEE4)
  Sample (1,WindSpeed,IEEE4)
  Sample (1,WindDirection,IEEE4)
  Sample (1,GustWindSpeed,IEEE4)
  Sample (1,AirTemperature,IEEE4)
  Sample (1,Vapor_Pressure,IEEE4)
  Sample (1,AtmPressure,IEEE4)
  Sample (1,RelHumidity,IEEE4)
  Sample (1,RelHumidityTemp,IEEE4)
  Sample (1,SingleOrientation,IEEE4)
  Sample (1,Tmin,IEEE4)
  Sample (1,Tmax,IEEE4)
  Sample (1,NorthWindSpeed,IEEE4)
  Sample (1,EastWindSpeed,IEEE4)
  Sample (1,XOrientation,IEEE4)
  Sample (1,YOrientation,IEEE4)
EndTable

'Main Program
BeginProg
  '9600 baud, even parity, 100us TX delay, 120 byte buffer, RS-485 half-duplex
  SerialOpen(ComC5,9600,2,100,120,4)
  Scan (1,Sec,0,0) 'Read data from sensor and log every 1 minute
    PanelTemp (PTemp,15000)
    Battery (Batt_volt)
```

CRBasic Example 1: CR1000X program that measures the ClimaVue 40

```
    'Read 22 32-bit big-endian data values from ClimaVue 40,
    'starting at input register address 1000
    ModbusClient(MBstat,ComC5,9600,ADDR,4,CV40(),1001,22,RETRIES,MB_TO,2)

    'Call Output Tables
    CallTable CV40_Table
  NextScan
EndProg
```

# Appendix C. Sensor configuration using CRBasic

Parameters can be configured using a CRBasic program. The following CRBasic example program toggles the baud rate. This program assumes the ClimaVue 40 is connected to the **C5** terminal of the CR1000X data logger. The example program can also be downloaded at www.campbellsci.com/downloads/climavue40-example-programs

**CRBasic Example 2: Baud rate toggle CR1000X program**

```
'CR1000X Series Datalogger
'This example program reads the ClimaVue 40
'weather sensor using a CR1000X data logger and the Modbus RTU protocol
'over half-duplex RS-485.

'This program runs a scan every 1 Min and stores the data in a 1 Min table.

'Wiring ClimaVue 40:
'Red (power) -> 12V
'Green (RS-485-A) -> C5
'White (RS-485-B) -> C6
'Black (power ground) -> G
'Clear (shield) -> G

'Constants
Const ADDR=42 'Default ClimaVue 40 Modbus server address
Const RETRIES=1 'Number of times to retry Modbus client request
Const TIMEOUT=15  '150ms request timeout (value * 0.01 sec)

'Public Variables
Public PTemp, Batt_volt
Public stat1, stat2, stat3, stat4, stat5
'used for monitoring the Modbus poll request status
Public CVData(22) 'ClimaVue 40 input register data

'Twenty-two (22) 32-bit values (44 input registers total)
Public sensorFW As Long
Public MBcomms(4) As Long
Public change_baud As Boolean
Public current_baud As Long

'Private Variables
```

### CRBasic Example 2: Baud rate toggle CR1000X program

```
'Aliases
Alias MBcomms(1) = MBaddr
Alias MBcomms(2) = MBbaud
Alias MBcomms(3) = MBparity
Alias MBcomms(4) = MBstop
Alias CVData(2) = Precipitation : Units Precipitation=mm
Alias CVData(3) = PrecipDrops : Units PrecipDrops=counts
Alias CVData(4) = PrecipTips : Units PrecipTips=counts
Alias CVData(5) = PrecipitationEC : Units PrecipitationEC=uS/cm
Alias CVData(6) = Strikes : Units Strikes=count
Alias CVData(7) = StrikeDistance : Units StrikeDistance=km
Alias CVData(8) = WindSpeed : Units WindSpeed=m/s
Alias CVData(9) = WindDirection : Units WindDirection=degrees
Alias CVData(10) = GustWindSpeed : Units GustWindSpeed=m/s
Alias CVData(11) = AirTemperature : Units AirTemperature=DegC
Alias CVData(12) = Vapor_Pressure : Units Vapor_Pressure=kPa
Alias CVData(13) = AtmPressure : Units AtmPressure=kPa
Alias CVData(14) = RelHumidity : Units RelHumidity=percent/100
Alias CVData(15) = RelHumidityTemp : Units RelHumidityTemp=DegC
Alias CVData(16) = SingleOrientation : Units SingleOrientation=degrees
Alias CVData(17) = Tmin : Units Tmin=DegC
Alias CVData(18) = Tmax : Units Tmax=DegC
Alias CVData(19) = NorthWindSpeed : Units NorthWindSpeed=m/s
Alias CVData(20) = EastWindSpeed : Units EastWindSpeed=m/s
Alias CVData(21) = XOrientation : Units XOrientation=degrees
Alias CVData(22) = YOrientation : Units YOrientation=degrees

'Data Tables
'Set table size to # of records, or -1 to autoallocate.
DataTable (CV40_Table,1,-1)
  DataInterval (0,1,Sec,10)
  Minimum (1,Batt_volt,FP2,False,False)
  Sample (1,PTemp,FP2)
  Sample (1,Precipitation,IEEE4)
  Sample (1,PrecipDrops,UINT4)
  Sample (1,PrecipTips,UINT4)
  Sample (1,PrecipitationEC,IEEE4)
  'Sample (1,Strikes,UINT4)
  'Sample (1,StrikeDistance,IEEE4)
  Sample (1,WindSpeed,IEEE4)
  Sample (1,WindDirection,IEEE4)
  Sample (1,GustWindSpeed,IEEE4)
  Sample (1,AirTemperature,IEEE4)
  Sample (1,Vapor_Pressure,IEEE4)
  Sample (1,AtmPressure,IEEE4)
  Sample (1,RelHumidity,IEEE4)
  Sample (1,RelHumidityTemp,IEEE4)
```

CRBasic Example 2: Baud rate toggle CR1000X program

```
  Sample (1,SingleOrientation,IEEE4)
  Sample (1,Tmin,IEEE4)
  Sample (1,Tmax,IEEE4)
  Sample (1,NorthWindSpeed,IEEE4)
  Sample (1,EastWindSpeed,IEEE4)
  Sample (1,XOrientation,IEEE4)
  Sample (1,YOrientation,IEEE4)
EndTable

'Main Program
BeginProg
  'Change this to set the beginning baud rate
  current_baud = 19200
  'current_baud = 9600
    Scan (1,Sec,0,0) 'Read data from sensor and log every 1 minute
    PanelTemp (PTemp,15000)
    Battery (Batt_volt)

    If current_baud = 9600
      SerialOpen(ComC5,9600,0,100,120,4)
      ModbusClient(stat1,ComC5,9600,ADDR,4,CVData,1001,22,RETRIES,TIMEOUT,2)
      ModbusClient(stat2,ComC5,9600,ADDR,4,sensorFW,3404,1,RETRIES,TIMEOUT,3)
      ModbusClient(stat3,ComC5,9600,ADDR,3,MBcomms(),4401,4,RETRIES,TIMEOUT,3)
      ModbusClient(stat3,ComC5,9600,ADDR,6,42,4401,1,RETRIES,TIMEOUT,3)
      Delay (1,100,mSec)
      SerialClose (ComC5)
    ElseIf current_baud = 19200
      SerialOpen(ComC5,19200,0,100,120,4)
      ModbusClient(stat1,ComC5,19200,ADDR,4,CVData,1001,22,RETRIES,TIMEOUT,2)
      ModbusClient(stat2,ComC5,19200,ADDR,4,sensorFW,3404,1,RETRIES,TIMEOUT,3)
      ModbusClient(stat3,ComC5,19200,ADDR,3,MBcomms(),4401,4,RETRIES,TIMEOUT,3)
      ModbusClient(stat3,ComC5,19200,ADDR,6,42,4401,4,RETRIES,TIMEOUT,3)
      Delay (1,100,mSec)
      SerialClose (ComC5)
    EndIf

    'Set change_baud to true to initiate a baud rate toggle
    If change_baud = true
      change_baud = false
      If current_baud = 9600
        current_baud = 19200
        ModbusClient(stat4,ComC5,9600,ADDR,6,1,4402,1,RETRIES,TIMEOUT,3)
      ElseIf current_baud = 19200
        current_baud = 9600
        ModbusClient(stat5,ComC5,19200,ADDR,6,0,4402,1,RETRIES,TIMEOUT,3)
      EndIf
   EndIf
```

CRBasic Example 2: Baud rate toggle CR1000X program

```
    'Call Output Tables
    CallTable CV40_Table
  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.

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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

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