WESTERN WEATHER GROUP

Liberty Utilities

Weather Station Installation Guide

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Introduction

This Installation Guide is designed for general information on setting up your Campbell Scientific weather station from Western Weather Group. Your instrumentation may vary from what is shown in this guide.

An individual manual on each sensor purchased is available on the Campbell Scientific web site at www.campbellsci.com. You can also contact Western Weather Group for individual sensor manuals or sensor information.

Parts of your weather station are pre-wired from the CR1000X datalogger to components inside the enclosure. Refer to the sensor wiring diagram inside the enclosure to assist in correctly wiring sensors to datalogger.

Consult with Western Weather Group on any questions you may have during the installation process. Wiring a sensor incorrectly can damage the sensor.

Do not turn on the power to the datalogger until all the sensors are wired correctly. Note which direction is due south (from true north) as several sensors align to it.

Contact Western Weather Group (530-342-1700) after you have completed the installation and while you are still on-site. Western Weather Group can check the system remotely to make sure it is working correctly.

Required Tools and Supplies

The following tools and supplies are not supplied with the weather station and must be provided by the installer.

Tools:
3/16” hex wrench – For tightening set screws on cross over fitting
½” socket or box end wrench – For securing cross arm U-bolts
Phillips screwdriver – For securing solar sensor mounting plate
Small level – For ensuring the cross arm, vertical pipe, and rain gauge are level
UV resistant wire ties – For securing sensor cables to mounting cross arm and conduit
Calibrated GPS device (Garmin or accurate smart phone compass)
Grounding wire and ground rod to create an earth ground from the enclosure ground lug
Standoff/BGAN bracket and streetlight mast to secure sensor crossarm, station enclosure, solar panel
Conduit or molding to house sensor cables that run between the crossarm, enclosure, and ground

Note: Additional supplies may be required. Consult the company internal Distribution Construction Standard for more information

Enclosure

Refer to the company internal Distribution Construction Standard for bracket/enclosure placement on pole.

The enclosure will be mounted to the bracket and is held by a top and bottom U-Bolt. Two brackets and additional nuts and bolts may be required depending on the type of pole standoff bracket used at the install. The weather station enclosure top and bottom mounting rail may need to be drilled out to fit larger nuts when attaching to a standoff bracket. Inside the enclosure installation kit (provided inside enclosure packaging) there are two types of U-Bolts. The larger “V-Bolt” may be required to mount the enclosure to bracket securely.

The enclosure installation kit also includes desiccant packs, sealing putty, wire ties, screwdrivers, USB cable, extra nuts and bolts, and humidity indicator. After all wiring has been completed and communication successfully tested with Western Weather Group, place the desiccant packs inside the enclosure and leave the third spare inside the small bag for future use. Stick the humidity indicator strip on the inner enclosure door. Leave the USB cable and screwdrivers inside the enclosure for future use. Finally, seal the hole from the inside and outside using both bags of putty.

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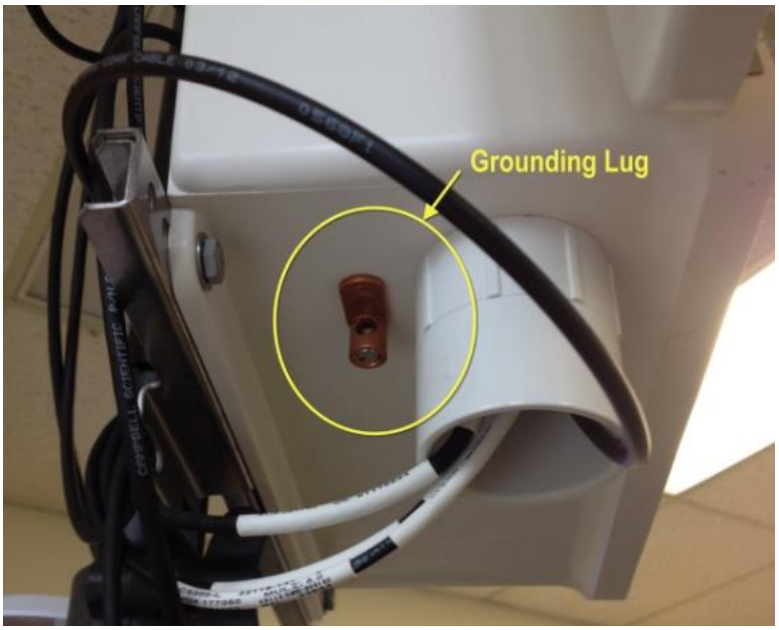
It is very important that the enclosure be properly grounded. A 12 AWG or larger wire should be connected from the copper ground connector on the bottom of the datalogger enclosure to Earth Ground via a ground rod.



Solar Panel

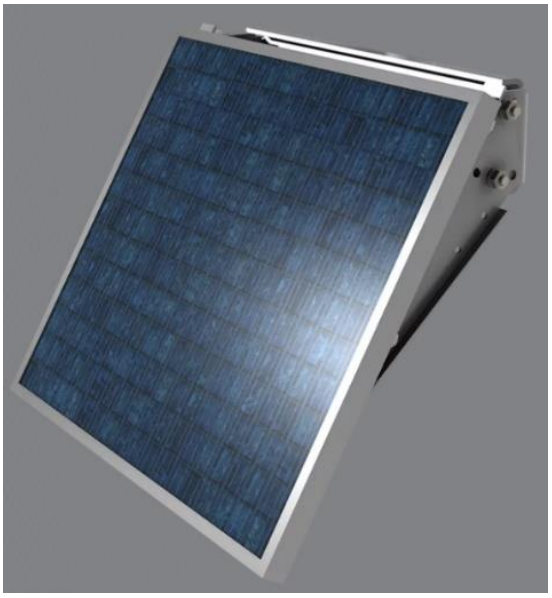
Refer to the company internal Distribution Construction Standard for bracket/solar panel placement on pole.

The solar panel will mount to the pole standoff bracket differently depending on the type of bracket used at the install. A BGAN bracket with vertical pipe will mount the solar panel (seen in the distribution standard) using the supplied U-bolts connected to the solar panel mounting bracket, or leftover U-bolts from the enclosure installation kit. Other pole standoff brackets may require drilling into the solar panel mounting bracket and additional nuts and bolts to secure to the pole.

The solar panel must face due south (from true north) and be oriented at about a 45º to 55º angle. Run the wire from the solar panel into the datalogger enclosure, going through the left conduit hole at the bottom of the enclosure. Connect the red wire to the “Solar” port of the CH200 (Black solar charge device pictured below) and connect the black wire to the “G” port above the red wire on the CH200.

****** CAUTION ******

The wires are LIVE as soon as you expose the solar panel to sunlight. DO NOT LET THE BARE WIRES TOUCH EACH OTHER. It is a good idea to tape the exposed red and black wires separately to avoid contact, or cover the panel with a piece of cardboard (the shipping box is a good choice) until you have the wires connected to the charging regulator.



Battery

The battery can now be connected to the charger/regulator. If not already secured inside the enclosure, insert the battery into the bracket and tighten the strap until secure. Plug the connector on the battery cable to the “BAT” connector on the CH200 solar charge controller. When the solar panel and battery are connected properly the CHG LED on the CH200 will flash green indicating that there is a valid charge source and the battery is charging. *If this does not occur contact Western Weather Group (530-342-1700).*

Do not turn station on until all sensor connections have been made.

Installation of the Mounting Cross Arm

A 4ft aluminum cross arm as well as a 12” aluminum pipe with a cross over fitting are supplied for mounting the sensors. An additional 2ft and 1ft cross arm, as well as rain gauge will be mounted to the 4ft cross arm as well (not pictured). These parts are best preassembled on the ground, and it is up to the installer if the sensor crossarm will be mounted to the streetlight mast on the ground prior to installation of streetlight mast on pole. Use the individual sensor sections for detailed crossarm installation.

Mount the 4ft cross arm on the streetlight are using the supplied U-bolts found in the enclosure installation kit. Both the vertical 12” pipe and the 4ft cross arm must be as level as possible. If either are out of level the wind direction and rain gauge readings may have errors.

Additional 2ft crossarm and Rain Gauge not pictured. Pyranometer not applicable to Liberty Utilities Weather Stations. Above picture does not accurately represent final Liberty Utilities weather station crossarm

Temperature and Humidity Sensor

Mount the white **Radiation Shield** (which houses Temperature and Relative Humidity sensor) to the cross arm as shown in the Assembly Layout Illustration, and below.

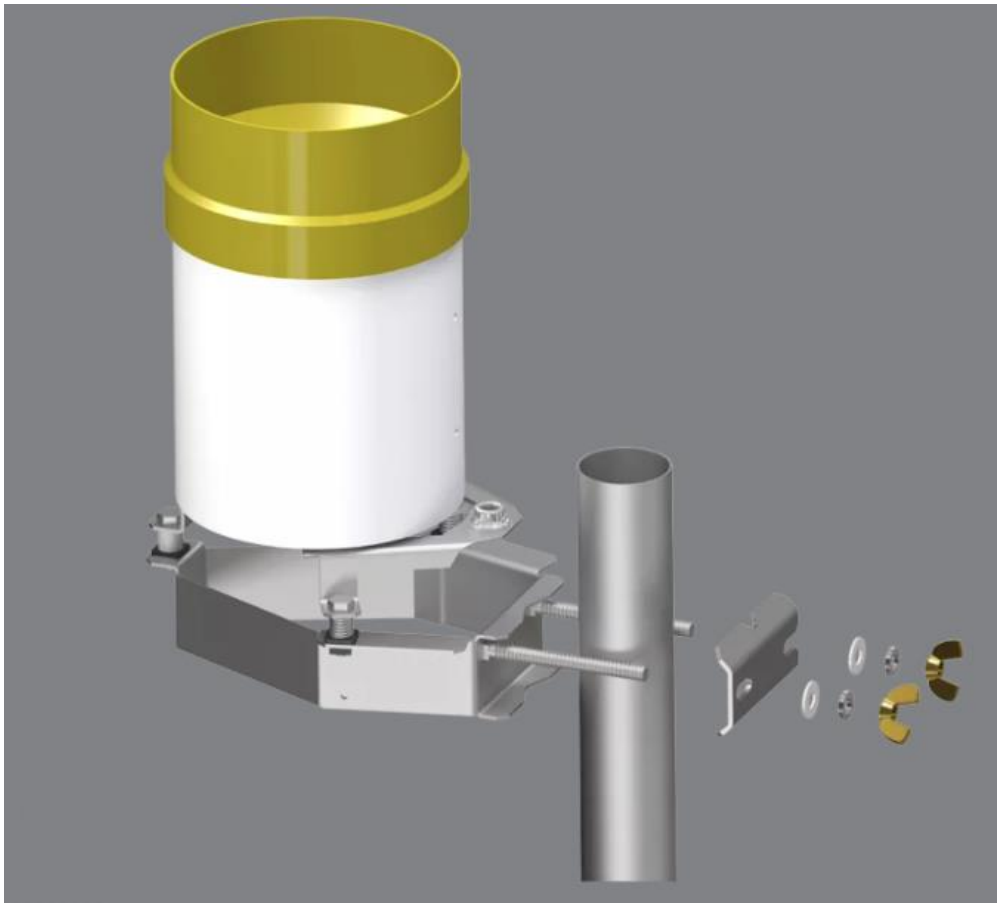
Insert sensor cable into probe and twist connector to make tight connection, do not bend prongs in connector. Please note that the sensor connection is keyed so care must be taken to orient the two parts of the connection correctly. Only hand tighten, do not overtighten.

Route the cable through the streetlight mast and back to the enclosure (running through conduit between crossarm and enclosure) and run it through the left side conduit opening of enclosure. The cable should be free of kinks and sharp bends. If necessary, use zip-ties to hold cable in place along route. Wire the temperature and relative humidity sensor to the wire terminals according to the Sensor Wiring Diagram found on the inside of the enclosure or at the end of this document.

Rain Gauge

Mount the 2ft aluminum cross arm to extend further outward between the middle of the 4ft crossarm and temperature/humidity radiation shield. Attach the 1ft aluminum cross arm to this to create a vertical mount for the rain gauge. Mount the rain gauge to the vertical arm using the rain gauge bracket. Make sure the rain gauge is secured and leveled for accurate measurements. Be sure to unscrew the lid to remove the rubber band holding the tipping gauge inside of the rain gauge, and then replace the lid. Western Weather group will ask you to tip the internal rain gauge mechanism 5 times to test the sensor.

Route the cable along the cross arm and back to the enclosure (going through streetlight mast and conduit) and run it through the left side conduit opening in the bottom. The cable should be free of kinks and sharp bends. Use zip-ties to hold cable in place along route. Wire the rain gauge to the wire terminals according to the Sensor Wiring Diagram on the inside of the enclosure or end of this document. Attach bird spikes around the lid perimeter and secure with zip tie. Bend bird spikes slightly if needed.



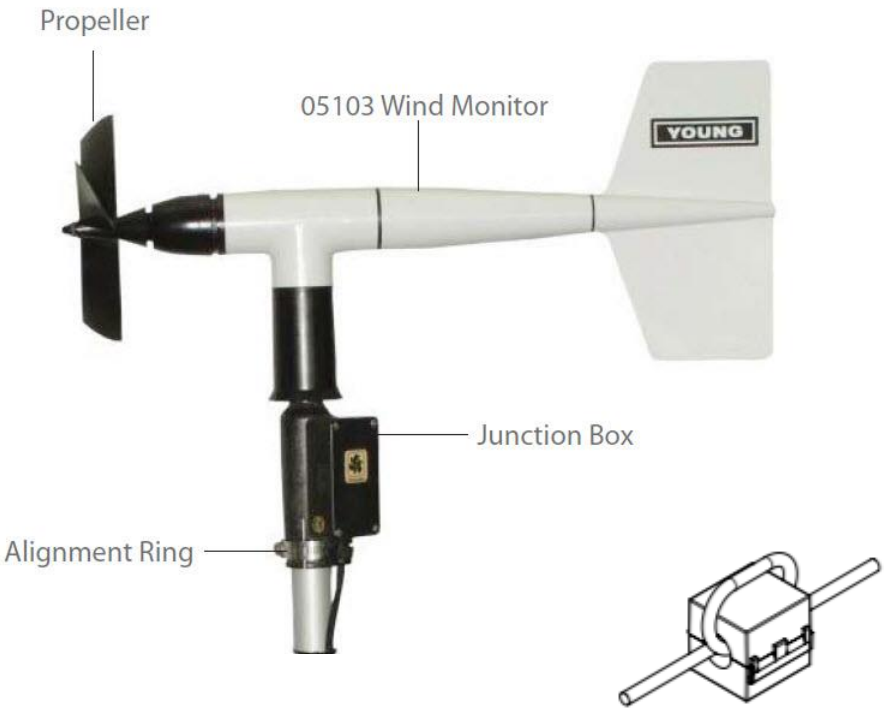
Wind Speed and Direction Sensor

First, attach the 1ft vertical crossarm to the 4ft horizontal crossarm, opposite the side of the radiation sensor and rain gauge. Next, Mount the **Wind Monitor** to the top of the 1” pipe by first placing the alignment ring on the 1” vertical pipe with the small black nub pointing upwards. Next place the sensor on the 1” vertical pipe and orient the black junction box so that it faces due south (from true north).

A magnetic compass can be used to help orient the sensor. Be sure to consider the magnetic declination error for your location, i.e. you want the sensor aligned to true north/south as opposed to magnetic north/south. Included in the wind monitor box is a ferrite choke (see picture below). Install this choke on the cable within 1 to 2’ of the sensor. Be sure to pass the cable through the core twice.

****** CAUTION ******

Failure to properly orient the wind monitor junction box will give incorrect readings for wind direction. *Make sure junction box faces true south*.



Route the cable back to the enclosure and run it through the left side conduit opening in the bottom. The cable should be free of kinks and sharp bends. Use zip-ties to hold cable in place. Wire the wind sensor according to the wire terminals according to the Sensor Wiring Diagram on the inside of the enclosure or end of this document.

Soil Moisture

Liberty Utilities weather stations will also include soil moisture sensors. This sensor cable will run from station datalogger to the base of the pole, with the sensor itself buried near the base of the structure. Follow the instructions below to install soil moisture sensors:

Installation

If you are programming your datalogger with *Short Cut*, skip Section 7.3, *Datalogger Wiring* (p. 9), and Section 7.4, *Programming* (p. 10). *Short Cut* does this work for you. See Section 4, *QuickStart* (p. 1), for a *Short Cut* tutorial.

7.1 Orientation and Placement

The CS650 measures the bulk dielectric permittivity, average volumetric water content, and bulk EC along the length of the rods, which is 30 cm for the CS650 and 12 cm for the CS655. The sensor rods can insert vertically into the soil surface or buried at any orientation to the surface. Install the sensor horizontal to the surface to detect the passing of wetting fronts or other vertical water fluxes.

The sensitive volume depends on the surrounding media. In soil, the sensitive volume extends approximately 7.5 cm (3 in) from the rods along their length and 4.5 cm (1.8 in) beyond the end of the rods. Consequently, if the sensor is buried horizontally closer than 7.5 cm from the soil surface, it includes air above the surface in its measurements and underestimates soil water content.

The thermistor used to measure temperature is in contact with one of the stainless steel rods at the base of the epoxy sensor body. Because of the low

thermal conductivity of stainless steel, the thermistor does not measure the average temperature along the rod, but instead provides a point measurement of the temperature within the epoxy. For a valid soil temperature reading, the sensor body must be in thermal equilibrium with the soil. Also bury the sensor head in the soil so that it is insulated from diurnal temperature fluctuations.

7.2 Proper Insertion

The method used for sensor installation affects the accuracy of the measurement. Insert the sensor rods as close to parallel as possible. The sensor is more sensitive to permittivity close to the rods. Air voids around the rods result in reduced measurement accuracy. Most soils recover from disturbances caused by installation.

Fuel Moisture

Liberty Utilities weather stations will also include fuel moisture sensors. These are two different sensors which attach in the same mount on the ground near the base of the structure. **Liberty Utilities weather stations do not include a fuel temperature sensor, so diagrams and install instructions may vary from necessary install steps.** Follow the instructions below to install the fuel moisture sensor and ground mount:

CS506 Fuel Moisture Sensor

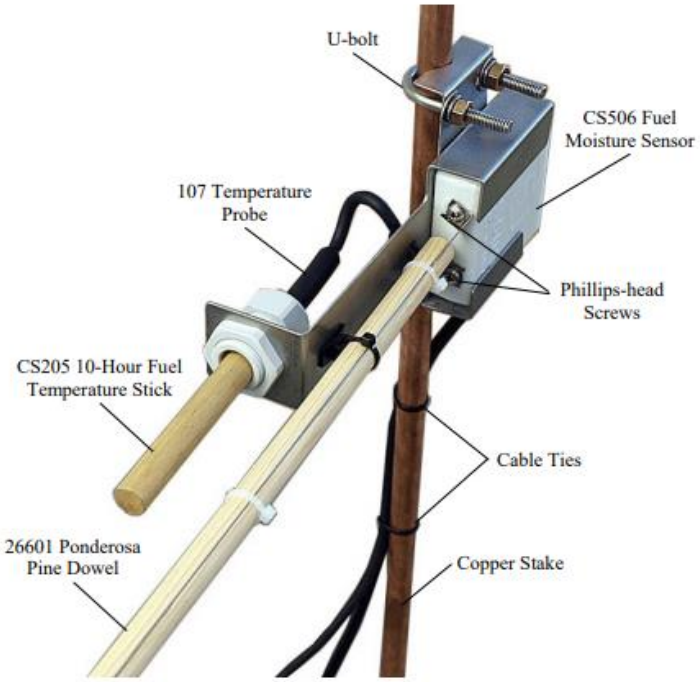


FIGURE 6-1. Front view of the 26817 fuel moisture/temperature mounting stake

1. Choose a site that is representative of the forest-floor duff layer.
2. Carefully hammer the copper stake into the ground so that it is secure and vertical.
3. Place the mounting bracket on the copper stake so that the probes will be approximately 30 cm (12 in) above the ground and pointing south (northern hemisphere) or north (southern hemisphere).
4. Tighten the nuts on the U-bolts.
5. Insert the CS506 electronics into the bracket.
6. Secure the 26601 10-hour fuel moisture stick to the CS506 using the Phillips screws.

CAUTION Wear gloves to avoid touching the dowel with your bare hands. Your hands can contaminate the dowel with oils and dirt that can affect the measurements.

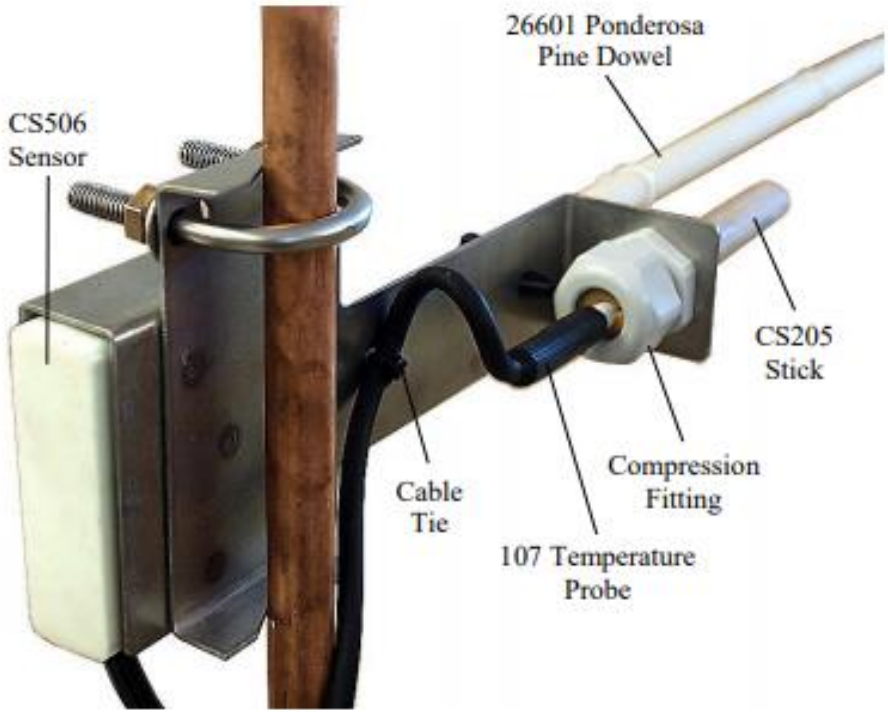


FIGURE 6-2. Back view of the 26817 fuel moisture/temperature mounting stake

Cellular Modem

Liberty Utilities weather stations will have a pre-installed and wired cellular modem that communicate and transmit data. All installation and configuration have been previously completed and the device should be mounted in the weather station enclosure.

After the device is powered on, the RV50X modem will boot up for 1-2 minutes, and then LED's will display colors based on network and signal conditions. These modems have an LED power savings mode applied to them, so you will only see a solid green power light if the modem is working currently. Network and signal lights may blink amber or red if the cell modem is having trouble connecting to Verizon network.

Liberty Utilities is supplying an external cellular antenna that connects to the RV50X. This will connect to the "Primary Cellular" antenna port on the top of the modem. This antenna will need to be installed on the sensor crossarm or enclosure bracket and by pointed correctly for the weather station to communicate data.

Western Weather Group may ask what the LED's on the modem are displaying if connection cannot be made.

Sensor Wiring Diagram

EE181 Temp/RH Sensor

Yellow -	SE1 / 1H
Blue -	SE2 /1L
Red -	12V
Black, White, Clear -	Any G or Ground Port

05108-45 RM Young Wind Monitor Wind Alpine HD Speed & Direction Sensor

Green -	SE3 / 2H
White -	VX1
Red -	P1
Black, Blue, Shield -	Any G or Ground Port

TE525WS Rain Gauge

Black -	P2
White, Clear -	Any G or Ground Port

CS506 Fuel Moisture Sensor

Red -	12V
Green -	SE6 / 3L
Orange -	C2
Black, Clear-	Any G or Ground Port

CS655 Water Content Reflectometer (Soil Moisture)

Green -	C1
Red -	12V
Clear, Black -	Any G or Ground Port
Orange -	(Not Used)

20W solar panel

Red -	CH200 Solar
Black -	CH200 (Solar) G

After wiring all sensors to datalogger, pull test each wire gently to make sure they are secure in the datalogger wire terminals. Once all the wires are securely connected to the datalogger, group the instrument wires together and zip tie them to the left side of the enclosure using zip tie stickers and zip ties. Don’t pull the zip tie completely closed on the wires. Insert grey putty into each of the conduits to provide for an insect barrier.

Powering up the System and Calling WWG

Turn on power to the system using the toggle switch on the CH200 solar charge controller. The system will boot up and the cellular modem/satellite terminal will power on and search for a signal. This may take several minutes during which the indicator lights will turn on and turn off several times.

Once the system is on and the modem appears to be connected to the network, call Western Weather Group to ensure that we can remotely connect to the station. During this time Western Weather Group will ensure that all sensors are reporting data correctly. You may be asked to Re-wire sensors, tip rain gauge buckets, adjust solar panel alignment, etc.

Please be ready to supply the following information when calling Western Weather Group:

1. **Location Name: What the station should be called.**
2. **System Serial Number (Format: 3XXX, located on the outer lower left of the enclosure door, or inside the door to the bottom right)**
3. **Location: Latitude and Longitude of the station in decimal degree form**
4. **Elevation (optional): If available the elevation of the weather station**
5. **If there are soil moisture/fuel moisture sensors installed**
6. **The structure # as well as district or circuit**

Western Weather Group 530-342-1700

If Western Weather Group is not available to assist the installation, the following must be checked before leaving the site.

1. Ensure that the CH200 charge controller is switched on and that the CHG LED is flashing green (device is on the right side)
2. Ensure that the CR1000X datalogger is on by verifying that the power light is flashing every 10 seconds
3. Ensure that the Sierra Wireless RV50X cellular modem is powered on and connected to the network (device is on the left side)
    a. The power light must be green
    b. The signal light must be amber or off (indicates 2 to 5 bars)
    c. The network light is amber or off (3G=amber, 4G=green)
4. Once these have been verified an email should be sent to info@westernwx.com
    a. Please provide the serial number of the system (2XXX) and station name
    b. Please provide the lat/long & structure number
    c. Please provide if this is a cellular or satellite station, and if fuel moisture sensors are included in this install.