

INSTRUCTION MANUAL



TurfWeather Weather Station

Revision: 5/11



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TurfWeather Weather Station

1. Quick Start Guide

1.1 Computer Requirements

- Windows 2000, XP, Vista, or Windows 7 Operating System.
- Available Serial Port or USB Port (Serial-to-USB Converter Cable required)

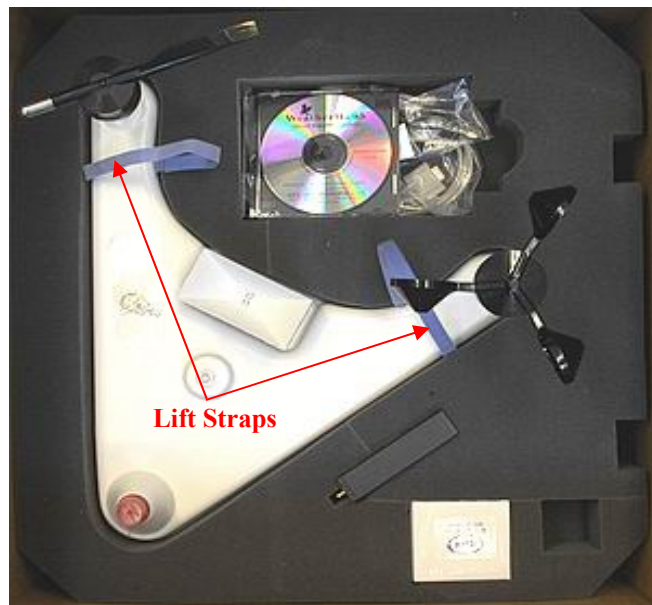


FIGURE 1-1. Box of standard and wireless equipment. The lift straps allow easy removal of the weather station from the box.

1.2 TurfWeather Setup Procedure

1. Remove the top foam packing from the TurfWeather weather station box and verify you have all ordered equipment (see Equipment List).
2. Unpack equipment.

CAUTION

- a. Use the lift straps to remove the weather station, since removing the station by lifting on the sensors may damage the sensors (see Figure 1-1).
 - b. Avoid resting the weather station on the wind speed and wind direction sensors.
 - c. Report missing or damaged equipment to Campbell Scientific Customer Service before installing your system.
-

3. Install the Campbell Scientific PC200W Software on your computer.
4. Connect the serial cable male connector to the weather station RS-232 port and the serial cable female connector to a computer serial port (Figure 1-2).

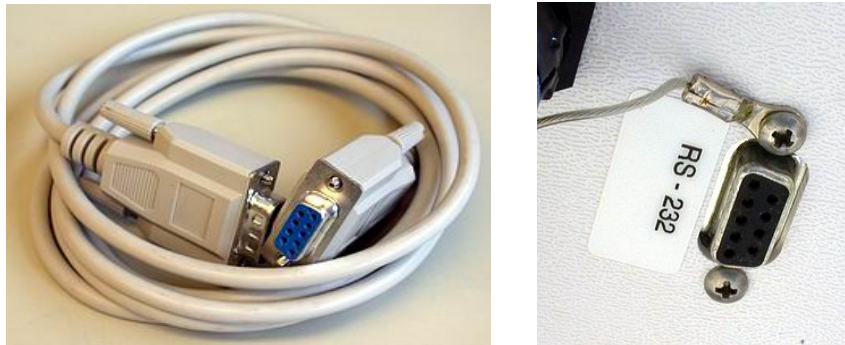


FIGURE 1-2. Serial cable (left) and the weather station serial port in which the serial cable male connector connects. A dust cover must be removed from the weather station RS-232 port before connecting the cable.

NOTE

- a. Ensure the computer serial port is not already assigned to an open program.
 - b. If you're connecting the cable to a USB port, a serial-to-USB converter cable is required and optionally available from Campbell Scientific P/N 16878,USB-AD.
-

NOTE

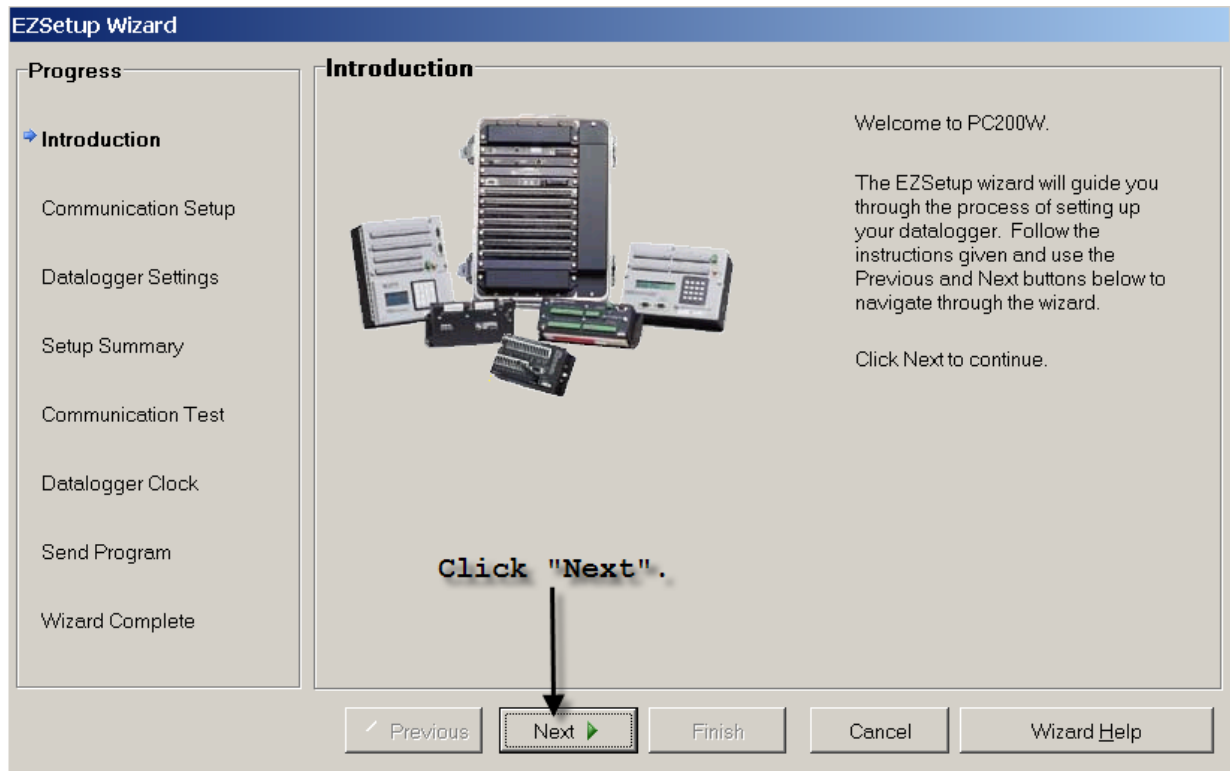
If the TurfWeather station has been configured for use with the optional external battery back, no internal battery is inside of the weather station. The station must be powered from the external battery unit prior to turning on the key in step 5. To do this, the cable (P/N 18971) should be connected to the "AUXILIARY" connector on the bottom of the TurfWeather station and to the external battery unit. Refer to Section 3.9 of the manual, but note that the internal battery has already been removed.

5. Turn the key to the on position (Figure 1-3). This is the power on/off switch for the weather station. The weather station will be running on battery power only at this point. Remember to turn this switch off whenever possible when the charging cable is not connected to prevent damaging the battery.

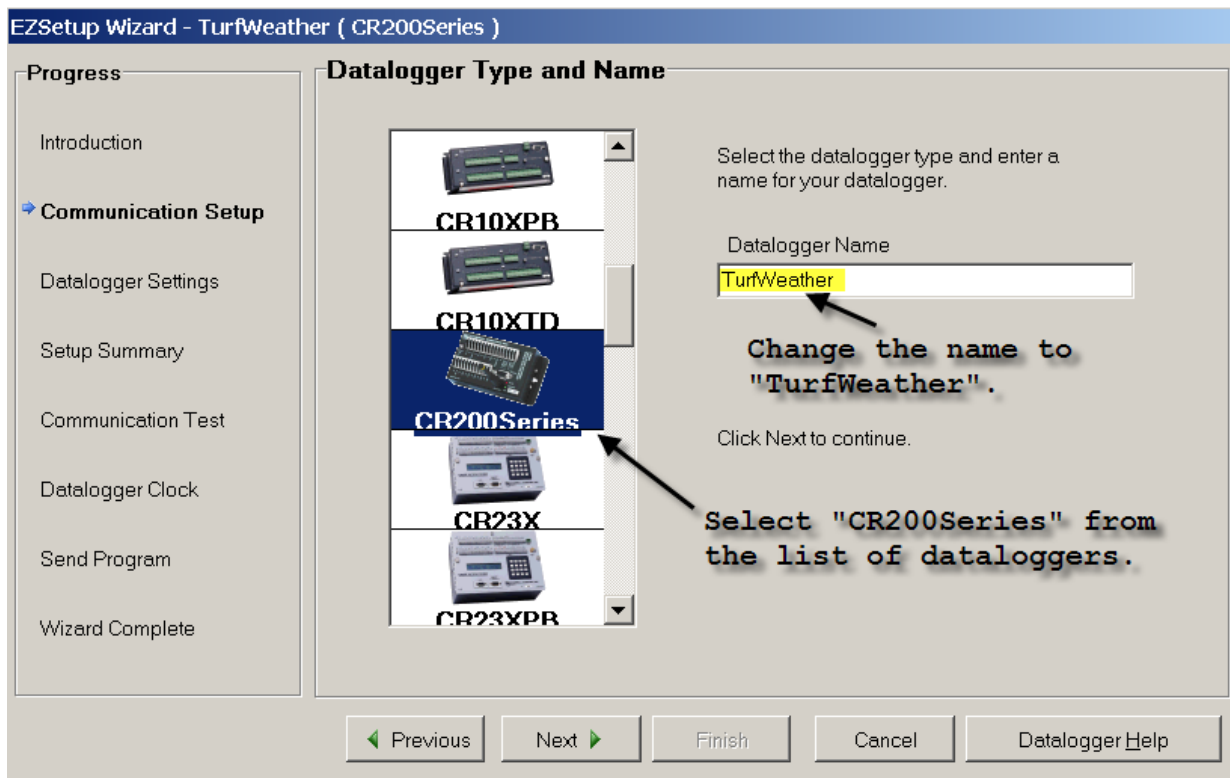


FIGURE 1-3. Keyed power switch is located on the bottom of the weather station.

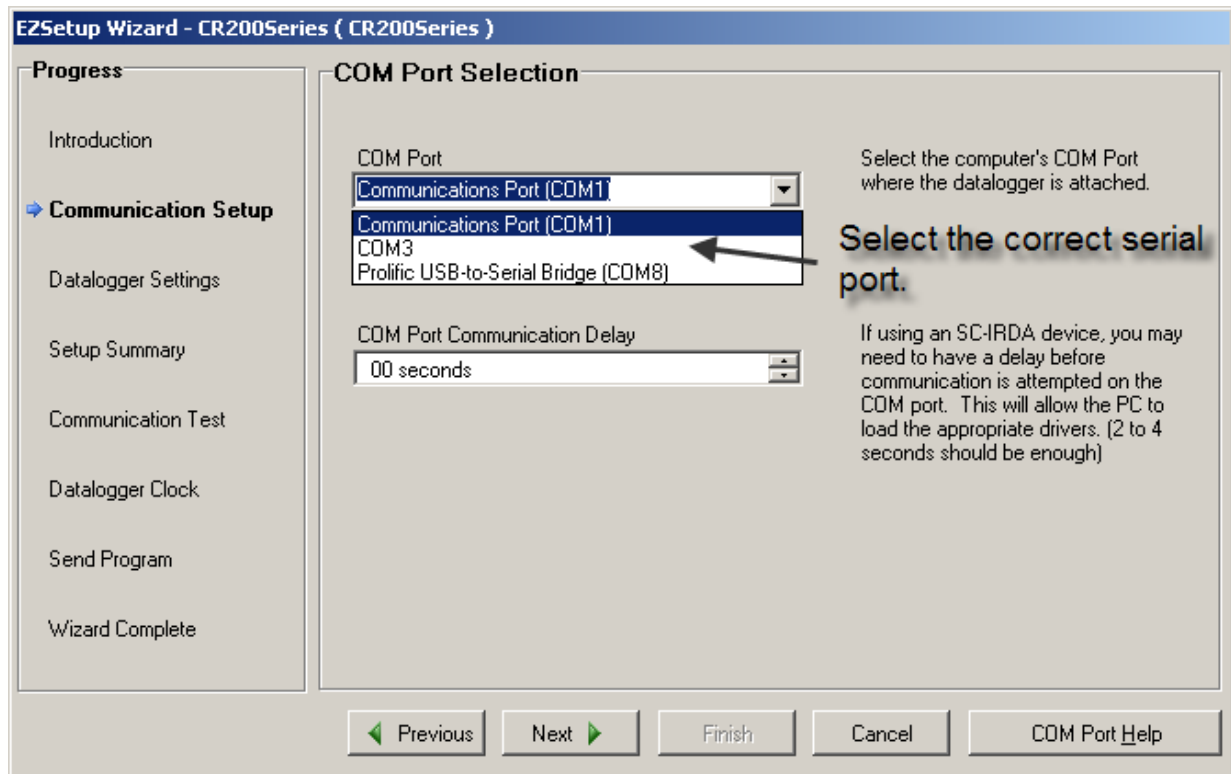
6. Load and start the Campbell Scientific PC200W software.
7. The first time PC200W opens, it will open with the “EZSetup Wizard” or it can be accessed by clicking on the *add* button. It is the green “+” in the top left area of the main screen.



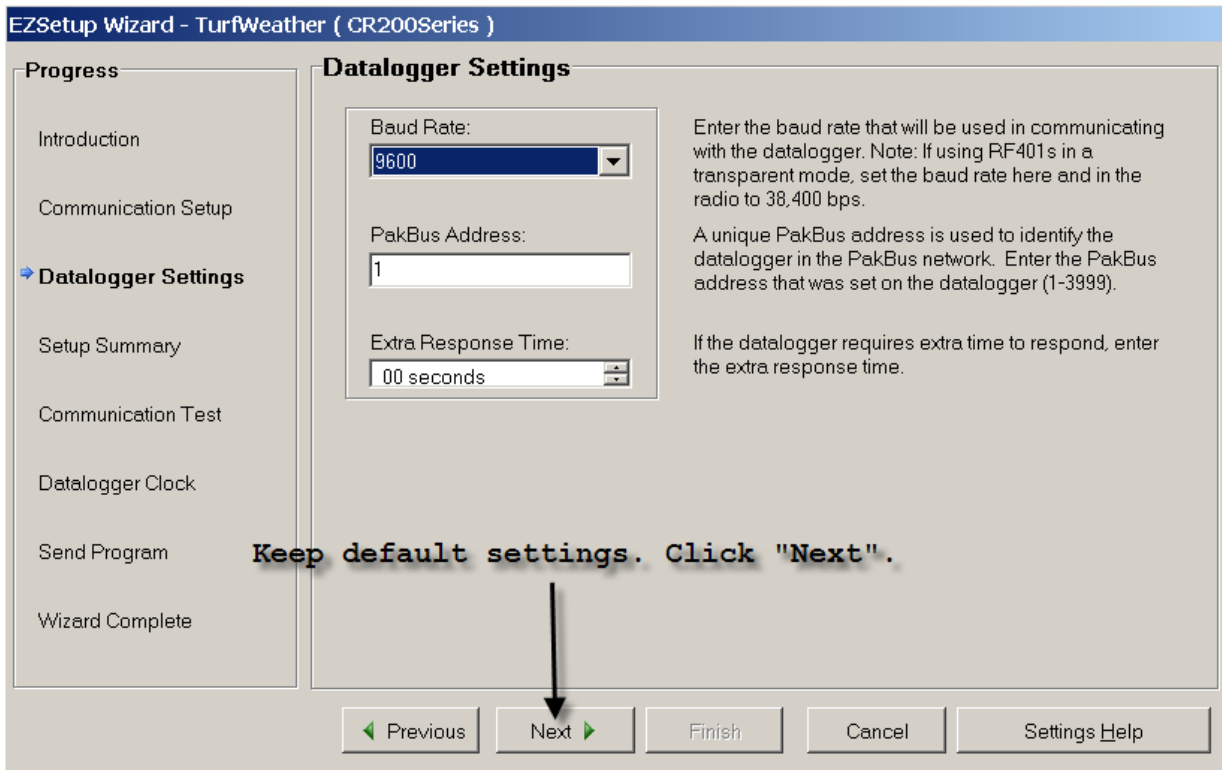
8. Click on the *Next* button on the *Introduction* window.



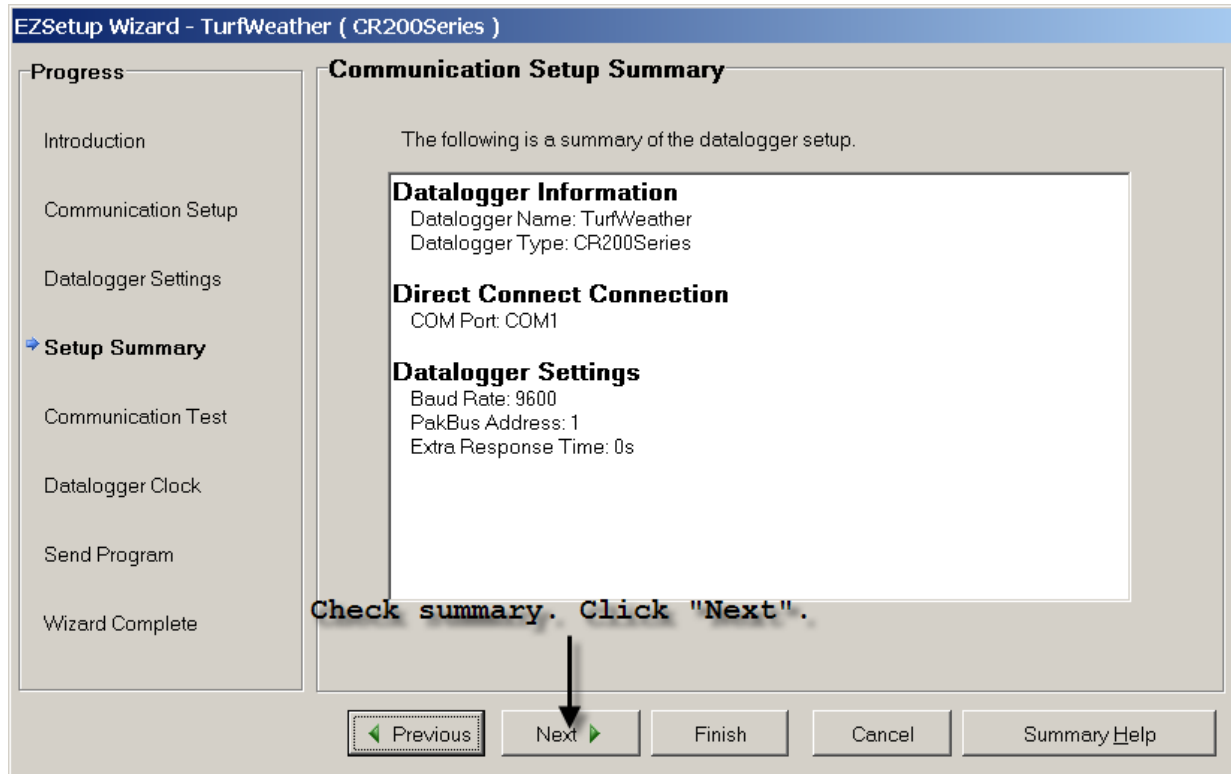
9. Select *CR200Series* from the drop down menu in the *Datalogger Type and Name* window. Highlight the *CR200Series* under the *Datalogger Name* and rename it “TurfWeather”. Click *Next*.



10. Select the COM Port used to connect to the weather station from the *COM Port* drop down box. Leave the COM Port Communication Delay set to 00 seconds, and click *Next*.

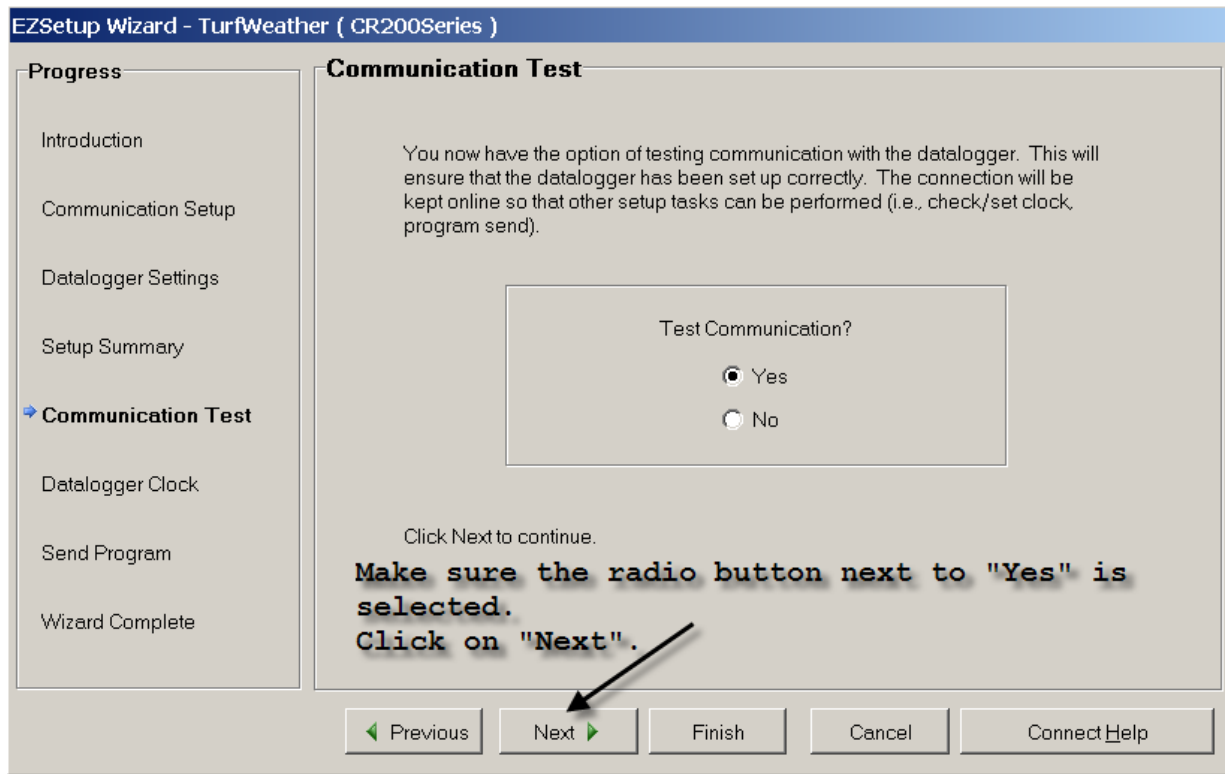


11. Select 9600 from the *Baud Rate* drop down box, the *PakBus Address* 1, and the *Extra Response Time* 00 and then click *Next*.

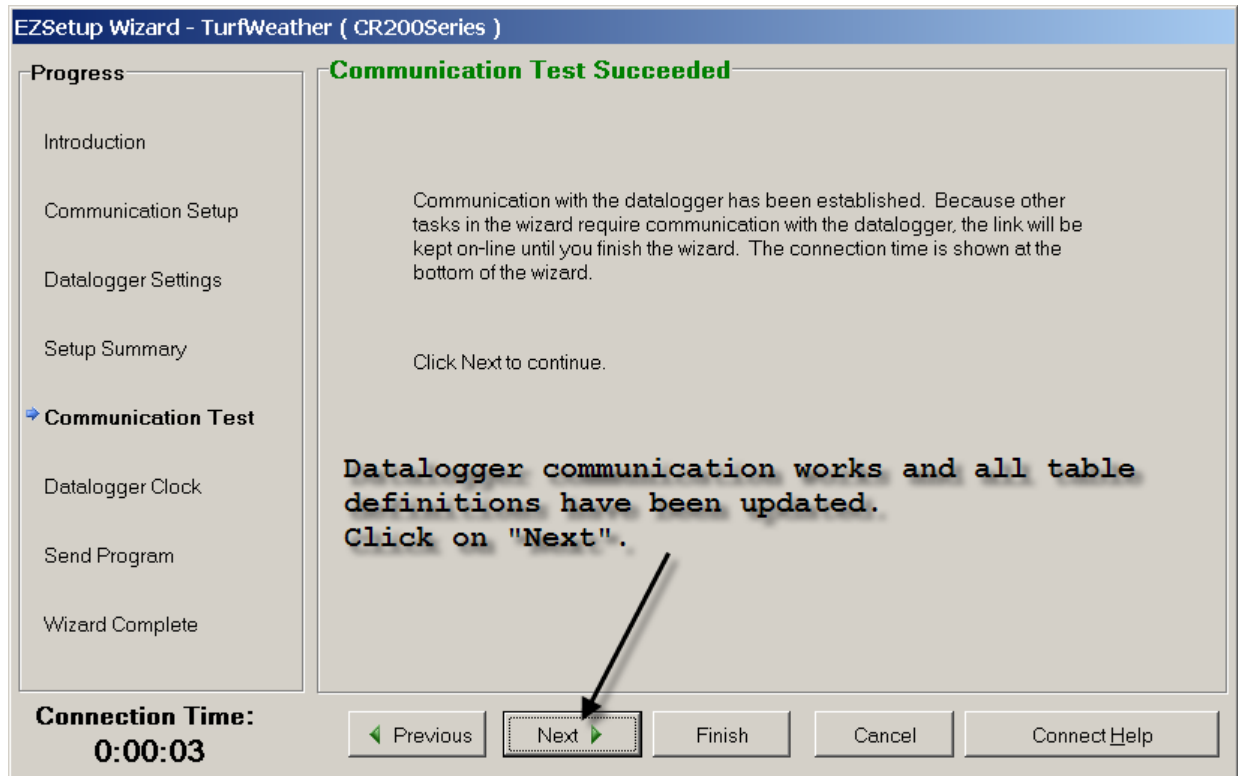


12. This will be the *Communication Setup Summary*, click on *Next*.

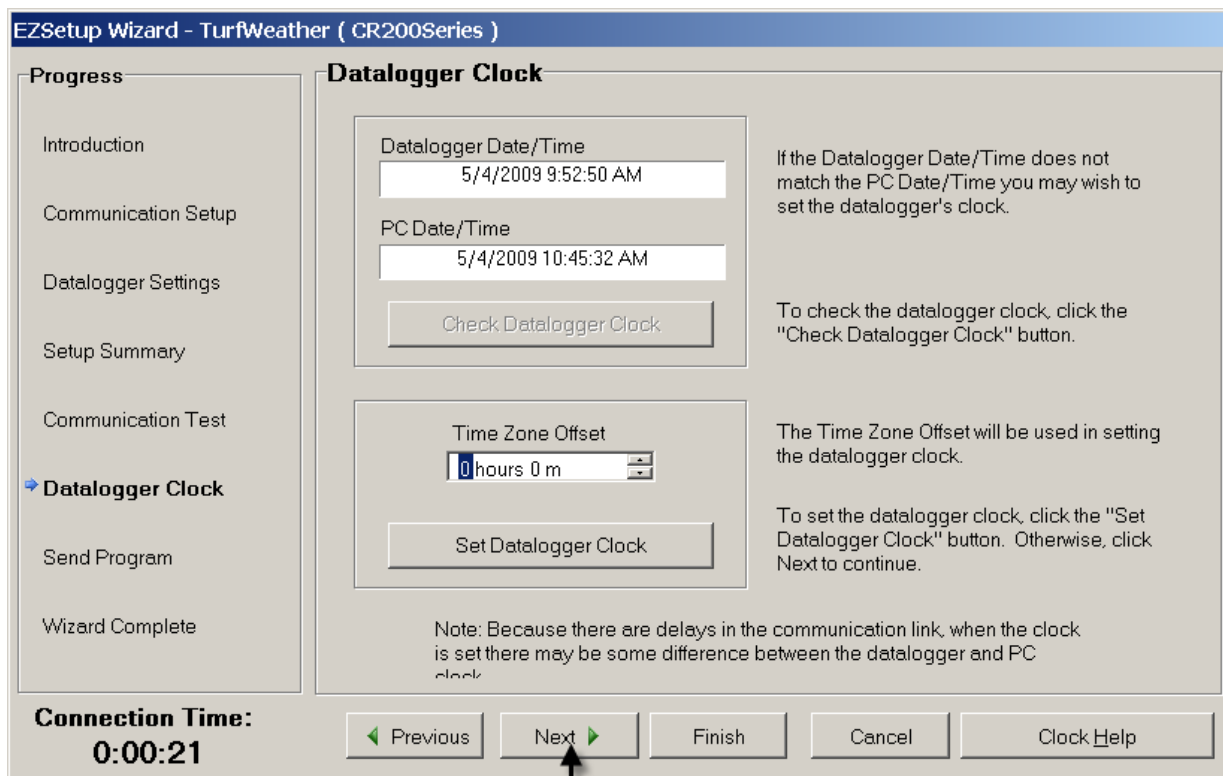
If changes need to be made, then click on Previous to go to the Correct window to make changes. Then click on Next to advance back to the Setup Summary.



13. This will be the Communication Test window. With *Yes* selected, click on *Next*.

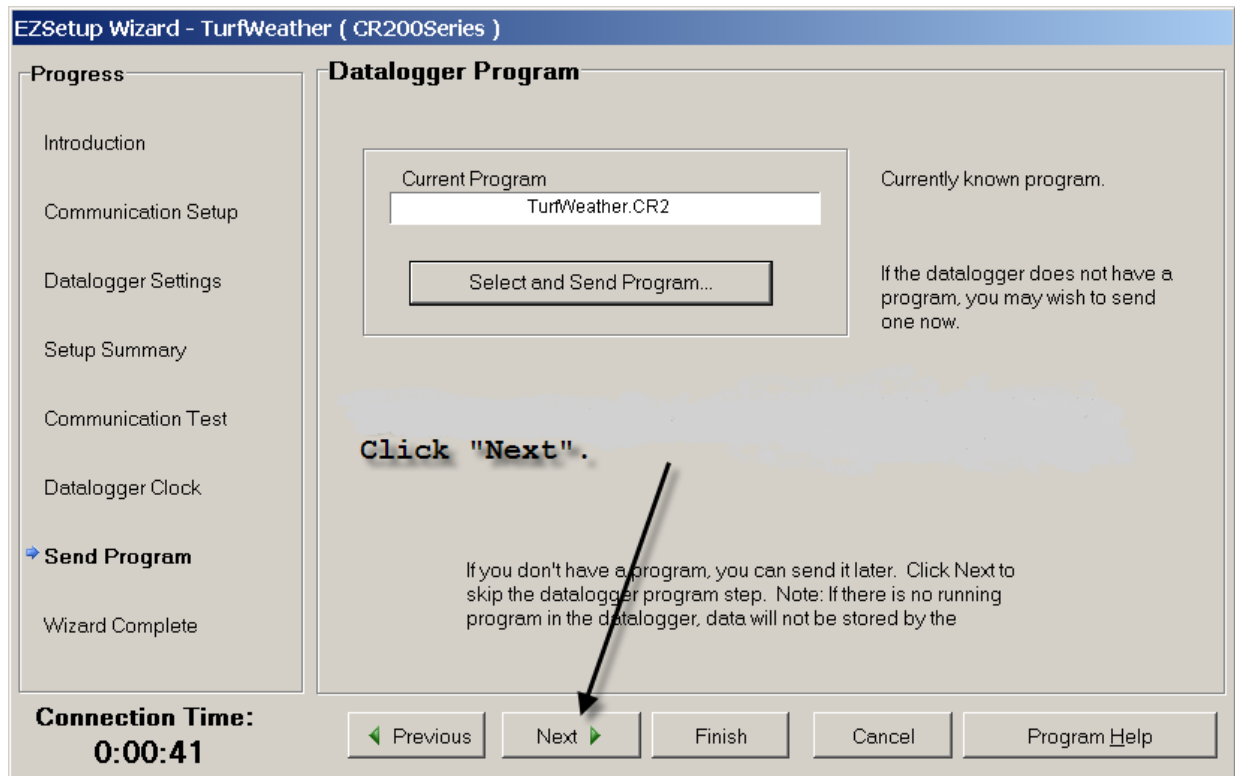


14. *Communication Test Succeeded* window will inform you after table definitions have been updated. This may take several minutes. Click *Next*.

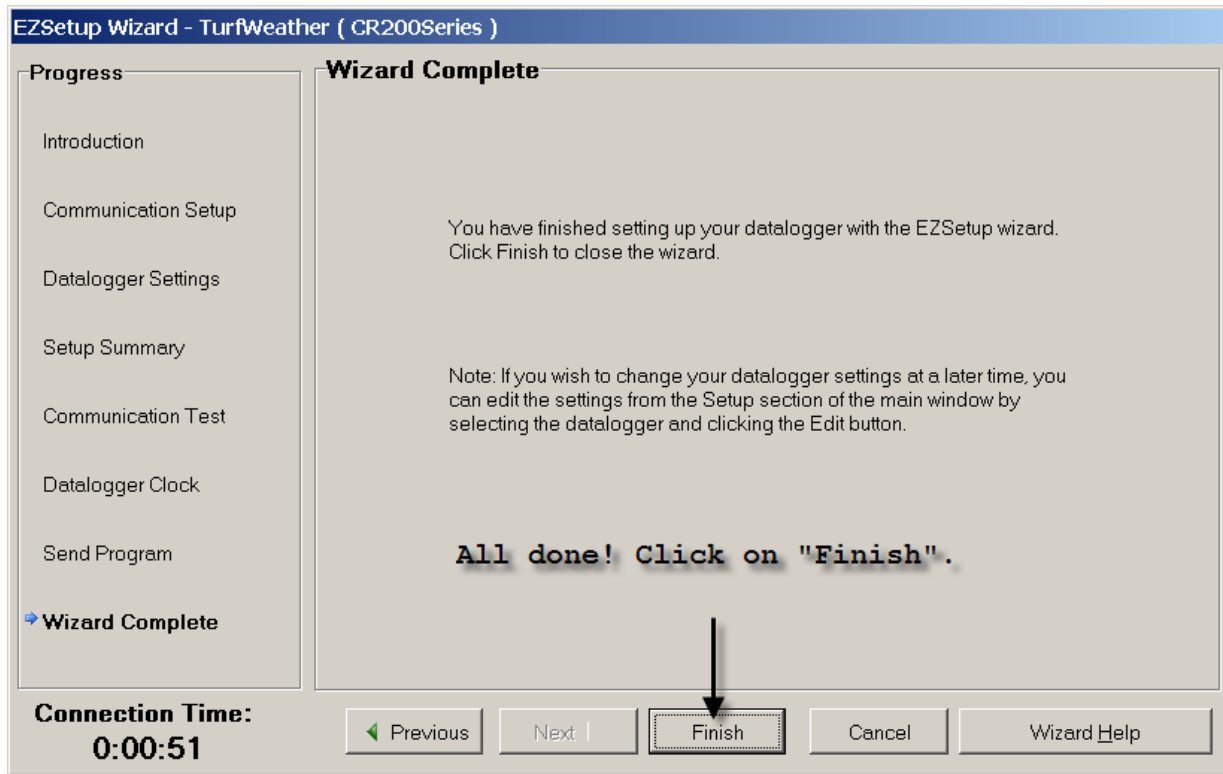


Check computer and datalogger clocks. Set datalogger clock if necessary. Click on "Next".

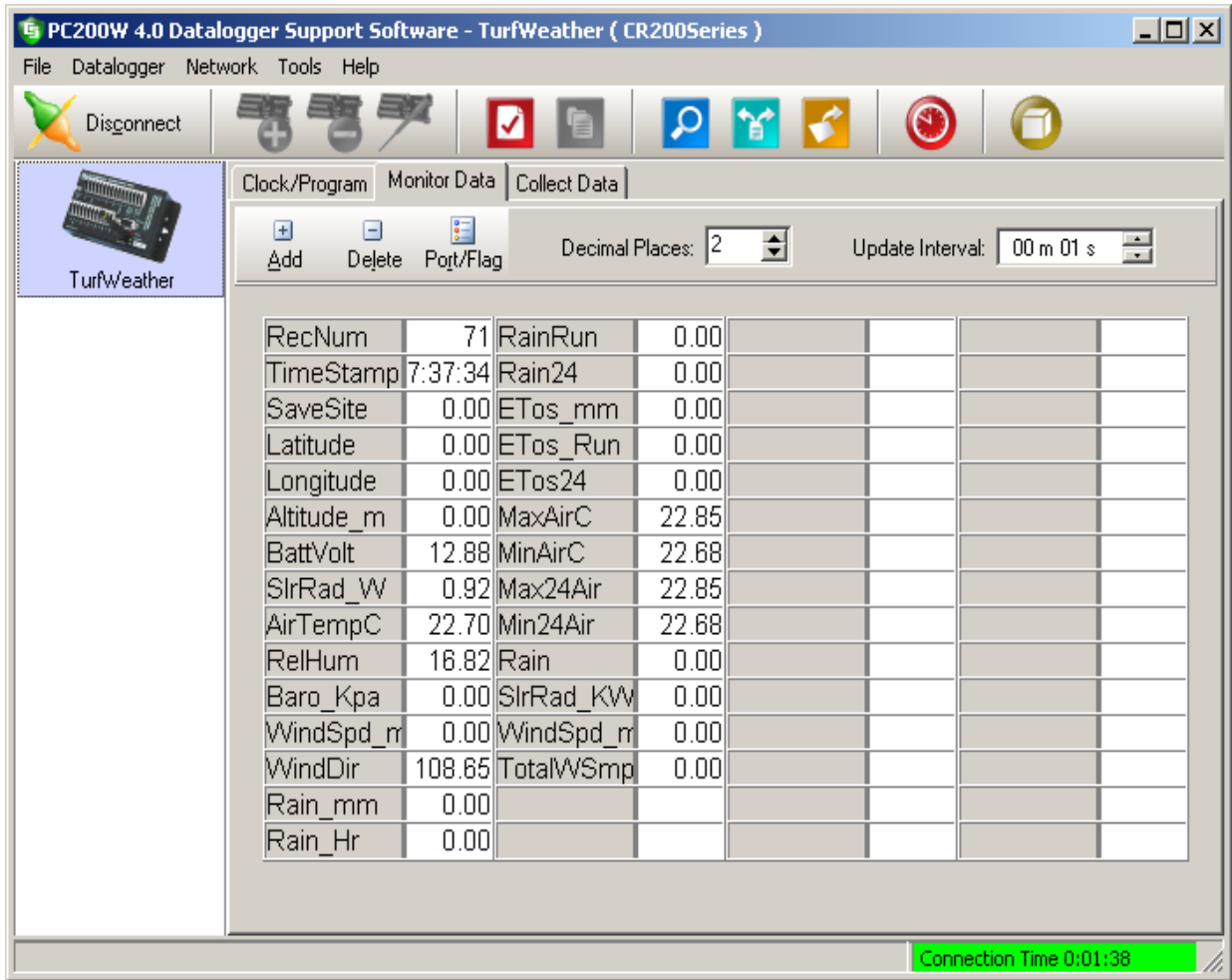
15. The *Datalogger Clock* window will display the PC clock and the Datalogger clock. Click on the *Set Datalogger Clock* to sync the Datalogger date and time with the PC if needed then click *Next*.



16. The *Datalogger Program* window will display the current program. Verify the correct program for application is shown as Current Program. Click *Next*.



17. The *Wizard Complete* window is now displayed. Click on *Finish* This will bring you to the main PC200W window
18. From this Main Screen, click on the *Monitor Data* tab at the top.



19. This screen will display the measurements from the TurfWeather weather station. The weather station is communicating and making measurements if the screen readings being displayed look accurate and are updating.
20. Click on *Disconnect*. PC200W can also be used to verify communication with radios after setting them up using the following instructions.
21. Proceed to Radio Setup (Section 1.3) if using radio communication. If the TurfWeather weather station is a direct connect, Turn off key switch on weather station and proceed to the TurfWeather Site Installation Guide.

NOTE

If the weather station does not function properly, contact your local distributor to solve the problem before continuing to the next steps.

1.3 Radio Setup

1. Attach the antenna or cable to the radio connector marked Antenna (Figures 1-4 and 1-5).



FIGURE 1-4. The radio antenna may be a surface mount antenna (left), a whip antenna(right) that connects directly to the radio, or other optional antennas (not shown).



FIGURE 1-5. The connector marked Antenna on an RF401-series radio is where the antennas attach.

2. Connect the serial cable male connector to the radio connector marked RS232 and the female connector to a computer serial port (Figure 1-6).



FIGURE 1-6. Radio connections. The serial cable (left) connects to the port marked RS232 and the AC adapter connects to the port marked DC Pwr input.

3. Plug the RF401 AC Adapter into a grounded AC wall outlet.
4. Connect the other end of the AC adapter to the RF401 connector marked DC Pwr input (Figure 1-6). The red Pwr/Tx status light should illuminate.
5. Start the Campbell Scientific PC200W software. Click on *Connect*. Click on the *Monitor Data* tab to confirm communication.
6. Monitor the sensor displays. After a few minutes, numeric values should appear if the weather station and radio are communicating. Also indicator lights on the RF401-series radio will blink.

NOTE

If the radio is not communicating properly, you may be experiencing interference from nearby equipment such as wireless phones, other spread spectrum radios, or another TurfWeather weather station. Changing some settings on your radio and weather station should rectify this situation. Contact your local distributor for assistance.

7. If your radio is working properly, close the Campbell Scientific PC200W software and turn the key to the off position. You are now ready to install your weather station at the site. Turn off key switch on weather station and Proceed to the TurfWeather Site Installation Guide.

1.4 Help and Support

NOTE The latitude, longitude, and altitude of your site is entered into the location area when setting up the station in Weather Station software. A GPS unit, Google Earth or NOAA web sites can help provide this information. This information is used in the formula by the software to calculate Evapotranspiration.

- TurfWeather Site Installation Guide
- Campbell Scientific customer support 435-752-2342

2. Installation

This guide includes procedures for installing your TurfWeather weather station on a tripod or pole and for installing our associated mounting/installation kits as required. Before installing your weather station at your site, read over the sections on power sources, site selection, and communications considerations. The installation procedures start in Section 2.4.

2.1 Power Sources

TurfWeather weather stations are provided with an internal sealed rechargeable lead acid battery that must be recharged to assure continued system function. For recharging the battery, Campbell Scientific offers solar panels or an AC/DC converter (see Appendix A: TurfWeather Equipment). If no power supply has been ordered, you must provide an external DC power source that has an output rating of 18 V.

CAUTION Connecting an incompatible power source to your weather station voids your Warranty. It is advisable for you to check with your local distributor before connecting a power source not purchased with weather station.

2.2 Site Selection

The ideal weather station site is level and well away from obstructions such as buildings, trees, and steep slopes. If obstructions exist, use the “Ten Times the Height Rule”, which is illustrated in Figure 2-1 below.

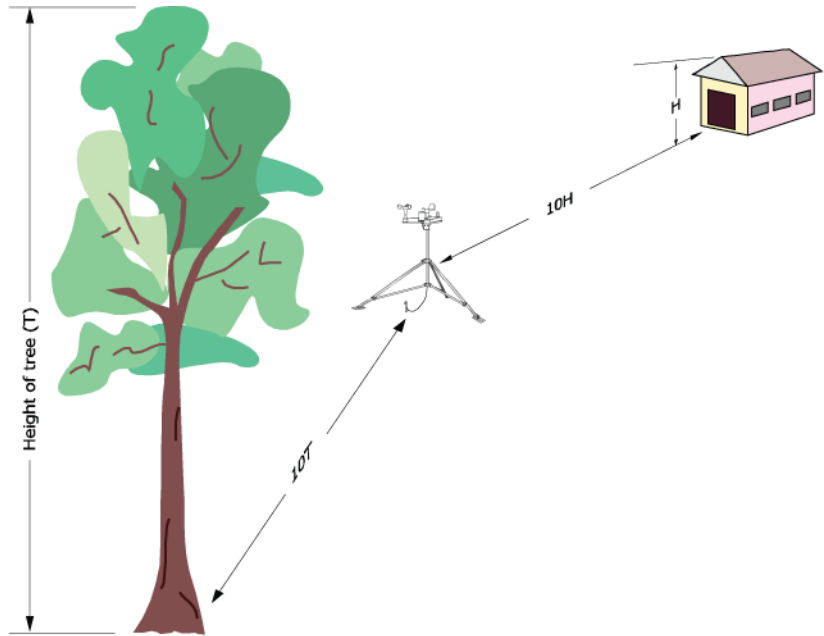


FIGURE 2-1. Ten Times the Height Rule. If the height of the tree, T , is 8 feet and the height of the shed, H , is 7 ft then the weather station should be placed at least 80 ft away from the tree (i.e., $10T = 10 \times 8 = 80$ ft) and 70 ft away from the shed (i.e., $10H = 10 \times 7 = 70$ ft).

Another option when obstructions exist is to raise the weather station height above the obstruction by using mast extensions.

NOTE

- a. If your weather station will be inside a fence to discourage vandalism, the fence top must be lower than the wind sensors even if the fence is chain-link.
 - b. Accurate wind measurements require your weather station to be located at the highest point in a particular region.
 - c. The tripod/mast height cannot exceed 10 feet (312 cm).
-

2.3 Communications Considerations

2.3.1 Direct Communications

Short-haul modems enable communication between the weather station and computer over two twisted pairs of wires. This communication requires the DCE/DTE switch on the modem to be in the DTE position at the weather station, and in the DCE position at the computer.

2.3.1.1 Cable Lengths

The maximum distance between modems is determined by baud rate and wire gage. At 9600 baud, the approximate range is 2 miles using 24 AWG wire.

2.3.1.2 Grounding Issues

Outdoor cables may be subject to induced currents due to lightning or other environmental factors. Therefore proper grounding is imperative to avoid damage to the weather station and/or the Host computer.

CAUTION

To minimize the possibility of equipment damage or personal hazard, we strongly recommend a qualified electrician design and install the grounding and data isolation components of a directly wired installation.

2.3.2 Wireless Communications

2.3.2.1 Transmission Ranges

Site your TurfWeather weather station within the spread spectrum radio transmission range. Typical transmission ranges are listed below:

- Up to ½ mile (0.8 km) for the weather station 916MHz and weather station 922MHz
- Up to ¼ mile (0.4 km) for the weather station 2.40GHz
- Up to 7 miles if an optional higher gain antenna is installed on both the weather station and the RF401 Base Station

NOTE

a. The transmission ranges assume standard weather station antennas are used at the computer site. User-supplied, higher gain antennas at the base station or on the weather station can increase the transmission range.

b. The ranges assume no obstructions are in the line-of-sight. Line-of-sight is defined and described below.

2.3.2.2 Line-of-Sight

Line-of-sight is defined as a straight path between a transmitting and receiving antenna that is unobstructed by intermediate topography or obstructions (see Figure 2-2). A clear line-of-sight is required to achieve the optimum transmission range. The affect of obstructions on the transmission range can vary. Therefore if obstructions lie within the line-of-sight, you should test your radio transmissions before permanently installing your weather station (see Testing Radio Transmissions (Section 2.3.2.3).

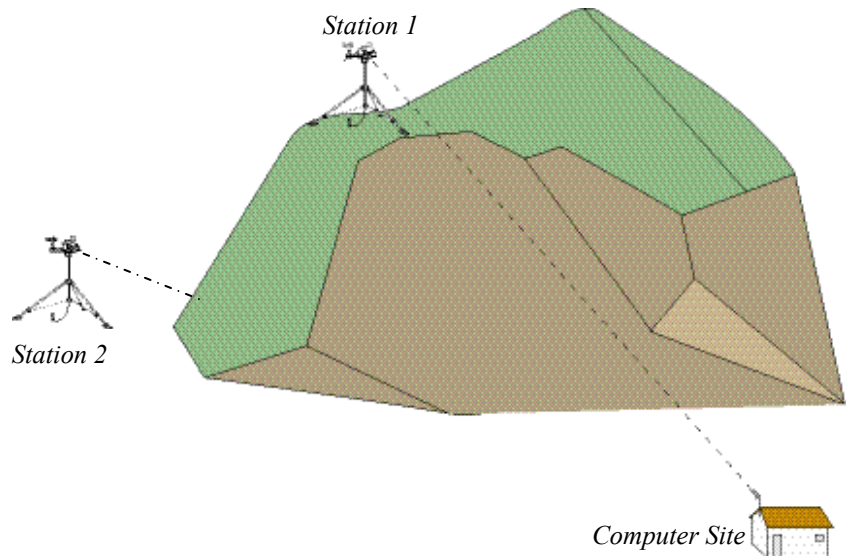


FIGURE 2-2. Line-of-sight examples. As the dotted line indicates, Station 1 has a clear line-of-sight with the Computer Site. The mountain obstructs Station 2's line-of-sight and would reduce or possibly prevent wireless communications.

2.3.2.3 Testing Radio Transmissions

To test the radio transmission of your weather station, carry the weather station to the site attached to the tripod or mounting pole then attempt to communicate with the weather station using the host computer. See the TurfWeather Quick Start Guide section for instructions. Only turn key switch on during testing when charging cable is not connected to avoid battery damage.

If obstructions in the line of sight are preventing the weather station from communicating, try the following:

- Relocate your weather station away from obstructions.
- Remove the obstructions.
- Mount the computer base station antenna outside of the building by running the antenna cable through a window or cable run.
- Use a higher gain antenna (optional) at the computer site.
- Install a higher gain antenna (optional) on the roof of the computer site's building and align it above the obstructions.

NOTE

If you are still experiencing problems communicating, you can contact your distributor. To allow us to effectively help you, please be prepared to describe, in detail, your installation and site conditions.

APPLICATION NOTES

Wireless TurfWeather weather station systems utilize industrial grade spread spectrum radios. Update rates for wireless systems should not be set below 10 seconds for extended periods due to power budget limitations. Externally powered systems that do not use solar panels for battery recharge have no update limitations.

TurfWeather weather station wireless systems located above 40 degrees North/South Latitude should set the update interval for 60 seconds, or greater, during periods of limited solar incidence. Monitor battery voltage to determine power drain in your application, and do not allow the battery voltage to drop below 12 volts. Adjust the update interval as needed to prevent battery discharge and communication failure.

2.4 Installation Procedures

Many installation configurations for the weather station are possible. This document describes standard installation configurations. For questions about installation configurations not described in this document, contact your local distributor.

2.4.1 Tripod Installation Procedures

2.4.1.1 Procedure 1a: 16776 Tripod Preparation for Installation

1. Attach tripod feet to the legs of the tripod using the bolts and self-locking nuts provided (see Figure 2-3 below).



FIGURE 2-3. The 16776 Tripod Kit includes the nut and bolt (left) used to attach each foot to the tripod.

2. If using mast extension(s), pound extension(s) into the mast by inserting the tapered end of the extension into the top of the mast and striking the extension top with a wooden block or hard rubber mallet (Figure 2-4).

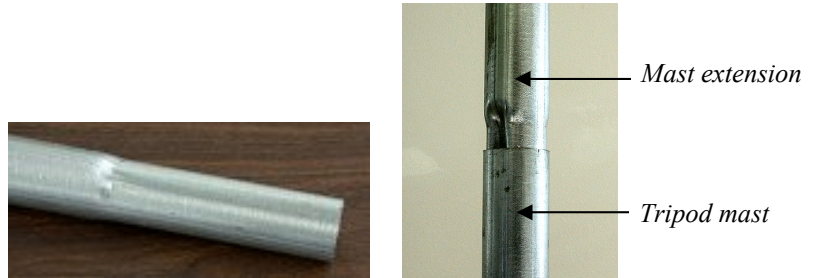


FIGURE 2-4. Pound the tapered end of the mast extension (left) into the tripod mast. If using two extensions, pound the tapered end of the second extension into the top of the first extension.

CAUTION

Do not use a metal hammer to pound in the mast extension since this will deform the top of the mast extension.

3. If using the guy-wire kit, loosely install the guy-wire kit by following Procedure 2: Guy-wire Kit Installation (Section 2.4.1.3).

NOTE

Do not tighten the turnbuckles yet. The turnbuckles will be tightened in step 5 of Procedure 3: Mounting the weather station on a Tripod or Pole (Section 2.4.1.4).

4. Install the mast in the tripod and adjust mast height if necessary (Figure 2-5).

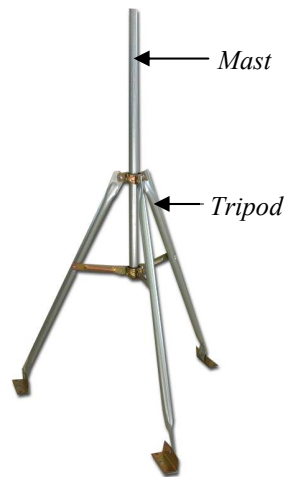


FIGURE 2-5. The mast fits in the center of the tripod. The mast height is adjusted by moving the tripod legs or removing the mast cup and sliding the mast up or down in the collars.

5. Once the mast height has been set, tighten all six collar bolts.
6. Install the tripod at the site. Refer to “Procedure 1b: Ground Installations”.

2.4.1.2 Procedure 1b: Ground Installations

1. If needed, prepare the site. A temporary site may require brush or tall weeds to be removed and footings dug if the site is not level. A permanent site may require pouring a concrete pad or fabricating some other form of a permanent base.
2. Use a rubber band to attach a level device, such as the one in the 16770 Tripod Installation Kit, to the midpoint of the tripod mast.
3. Place the tripod on the site.
4. Adjust tripod footings until the mast is level. Some adjustment is available by loosening/tightening the upper and lower collar bolts. If more adjustment is required, then for temporary sites, remove or replace soil under the feet. For permanent installations, use shims to adjust the foot foundation height.

NOTE

For temporary sites, ensure the soil under the tripod feet is well compacted. Otherwise the tripod may not remain level after the tripod feet have been secured to the ground.

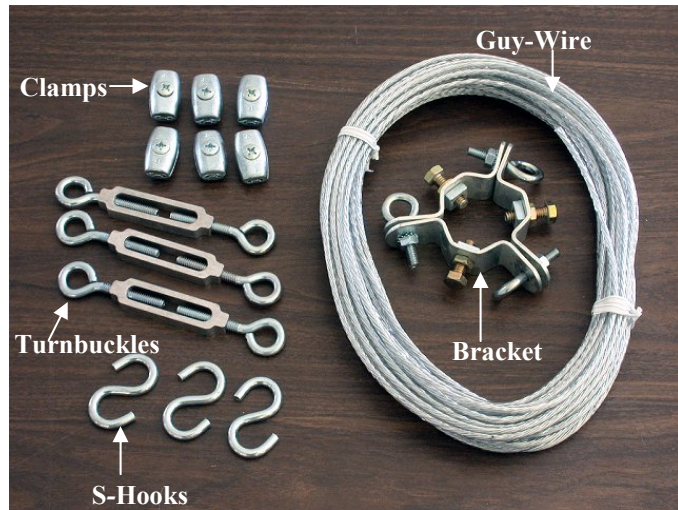
5. Secure the tripod feet to the ground (Figure 2-6).



FIGURE 2-6. For temporary sites, drive the stakes of the 16773 Tripod Stake Kit (left) through the center hole in each tripod foot (right). The stakes should be driven in until they barely contact the foot surface. For permanent sites, install user-supplied bolts through the holes in each tripod foot.

6. Follow Procedure 3: Mounting the weather station on a Tripod or Pole (Section 2.4.1.4).

2.4.1.3 Procedure 2: 16772 Guy-Wire Kit Installation



1. Cut the guy-wire cable into three equal length pieces.
2. Loop one end of each guy-wire through a Bracket eye-bolt and clamp the guy-wire using one of the Clamps provided.
3. Install the Bracket on the tripod mast about six inches (15 cm) from the top of the mast then loosely tighten the bracket bolts that lock it to the mast.
4. Insert the mast into the Tripod and rotate the mast assembly until the bracket eye-bolts all line-up with a tripod leg then loosely tighten the mast collar bolts on the tripod.
5. Tighten the guy-wire Bracket bolts until they deform the mast by dimpling the surface to assure the Bracket does not slide when the turnbuckles are tightened.
6. Unscrew the turnbuckle until approximately 80% of both eye bolt threads extend beyond the turnbuckle body.
7. Hook an S-hook to an eyelet on each of the tripod feet. Alternatively, the S-hooks can be connected to user-supplied eye-bolts set into a concrete pad or another fixed structure.
8. One at a time, grasp a guy-wire and loop it around its corresponding S-hook to roughly determine its correct length then cut the guy-wires to eliminate any excess length.
9. Hook the unattached end of each S-hook to an eyebolt on the end of a turnbuckle.
10. Loop the free end of each guy-wire through its respective turnbuckle eye-bolt and pull it tightly then clamp the guy-wire using one of the Clamps provided.

NOTE

a. The guy-wires need to remain loose until after the weather station assembly has been properly oriented. The turn-buckles are tightened in step 5 of Procedure 3: Mounting the weather station on a Tripod or Pole (Section 2.4.1.4).

b. Guy-wires will stretch for a few weeks after installation. You should periodically check them for tension and re-tighten the turnbuckles as required until they stop stretching.

2.4.1.4 Procedure 3: Mounting the TurfWeather Station on a Tripod or Pole

NOTE

This procedure assumes the weather station has been setup and tested at the computer location (see Quick Start Guide), and that a tripod or pole has been installed at the site.

1. Place your weather station assembly on top of the mast or pole with the base firmly seated on the top edge of the mast or pole (Figure 2-7).

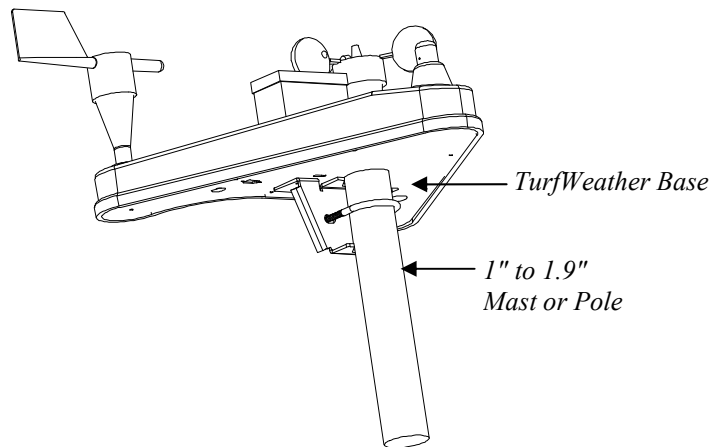


FIGURE 2-7. The TurfWeather weather station assembly properly seated on a mast or pole

- Loosely tighten the U-bolt nuts so that the weather station is stable but can be rotated on the mast or pole (Figure 2-8).

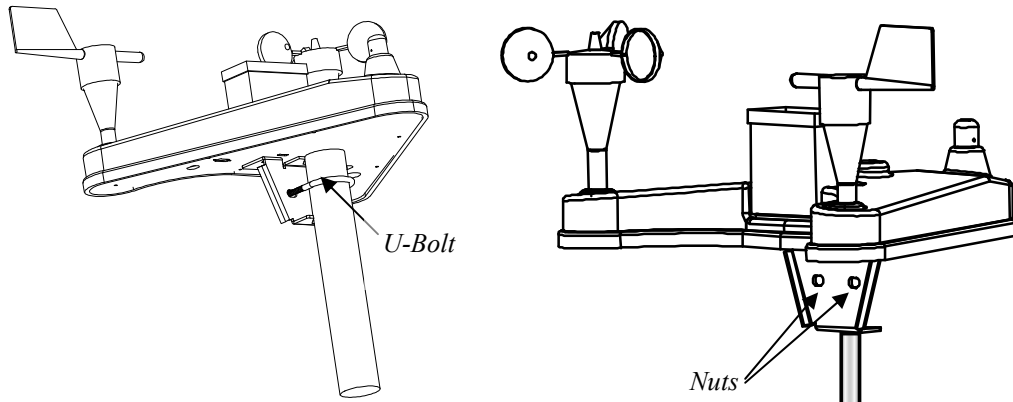


FIGURE 2-8. Two views of the TurfWeather station. The U-bolt and nuts are shown.

- As a reference, use a magnetic compass (supplied in the optional Tripod Installation Kit) and rotate the weather station assembly until the reference line on the wind direction sensor is aligned with Magnetic North (Figure 2-9).



FIGURE 2-9. Accurate wind direction measurements require the reference line on the wind direction sensor (right) to be aligned with Magnetic North.

- Firmly tighten the U-bolt nuts.
- If the Guy-wire Kit has been installed, assure that its orientation will not interfere with the solar panel (if one is installed) then evenly tighten the turnbuckles to tension the guy-wires.
- Confirm the weather station is level by viewing the bubble level on top of the weather station (Figure 2-10). Minor adjustments can be made by tightening or loosening the appropriate guy-wire turnbuckle, placing shims between the weather station base and the top of the mast or pole, or loosening the mast bolts at the top and bottom of the tripod and shifting the vertical orientation.

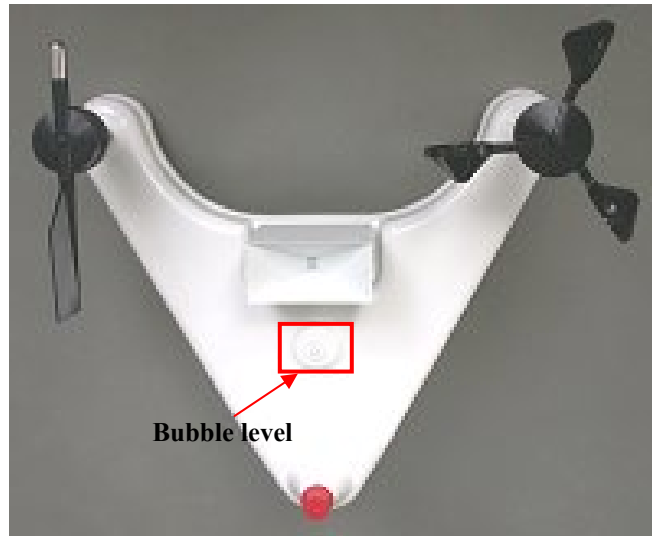


FIGURE 2-10. The bubble level (in red box) confirms the station is level, which is required for accurate rainfall and solar radiation measurements.

7. Connect the power source that will recharge the internal sealed rechargeable battery. If using a solar panel, follow Procedure 4: Solar Panel Installation (Section 2.4.1.5). If using an external power supply, you need to assure it was purchased with the weather station or, if not, that it has an output of 18 VDC and that all connections are weatherproof.

CAUTION

- a. The internal sealed rechargeable battery must be recharged to assure continued system function.
 - b. Connecting an incompatible power source to your weather station negates your Warranty. Therefore it is recommended you check with your local distributor before connecting a power source not purchased with the station.
 - c. 16876 AC Converter when used must be installed in a non-condensing environment or a weatherproof enclosure.
-

8. Remove the red or green cap from the solar radiation sensor (Figure 2-11)



FIGURE 2-11. The red or green cap protects the solar radiation sensor while the weather station is being shipped and installed. Accurate measurements require the cap to be removed

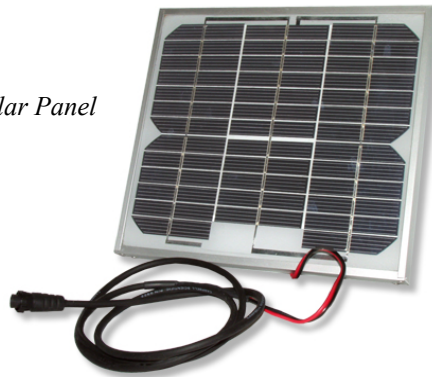
9. Properly ground the weather station. If using the Ground Kit, refer to Procedure 5: Ground Kit Installation (Section 2.4.1.6).
10. Turn the weather station key to the on position and return to the computer site to confirm the weather station is working properly.

CAUTION

- a. The Ground Kit is for ground located installations only.
 - b. Because proper grounding of the system is required for both personal safety and reliable system function, we recommend a qualified electrician install the grounding system.
-

2.4.1.5 Procedure 4: SP5 Solar Panel Installation

5 W Solar Panel



1. Place the solar panel on the mast below the station not to exceed the maximum distance allowed by the solar panel cable.

2. Loosely tighten the U-bolt so that the solar panel is stable but can be rotated on the mast or pole.
3. Use a compass (supplied in the optional Tripod Installation Kit) to properly align the solar panel. If your installation site is in northern hemisphere locations such as the United States and China, the glass surface of the panel should face south. If your installation site is in southern hemisphere locations such as Brazil and Australia, the glass surface of the panel should face north.
4. Connect the solar panel cable to the connector on the bottom of the weather station marked “Solar/DC Charger”.

2.4.1.6 Procedure 5: 16775 Ground Kit Installation

CAUTION

- a. Because proper earth grounding of the system is required for both personal safety and reliable system function, we recommend a qualified electrician install the grounding kit.
- b. If the station is not properly grounded and isolated from the Host computer, the Host computer can also be damaged by environmentally induced electrical surges.
- c. This kit is for ground installations only.



1. Connect the lug of the 14 AWG copper wire to the connector labeled Ground Lug on the bottom of the weather station (Figure 2-12).

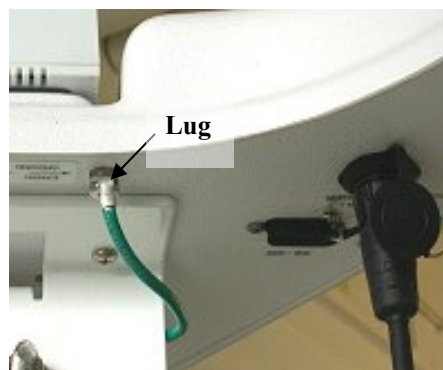


FIGURE 2-12. The ground lug connected to the bottom of the weather station.



FIGURE 2-13. The right close up is the 14 AWG wire and the #4 cable attached to the tripod coupling.

2. Mount the tripod coupling on the tripod mast so that it clamps the 14 AWG wire against the tripod (1 of Figure 2-13).
3. Drive the ground rod into the soil using a fence post driver or sledge hammer leaving about 3 inches (7.5 cm) above the ground.
4. Loosen the middle screw in the tripod coupling.
5. Place one end of the #4 cable in the tripod coupling hole then tighten the screw (2 of Figure 2-13).
6. Attach the other end of the #4 cable to the ground rod using the ground rod coupling (Figure 2-14).



FIGURE 2-14. The #4 cable connected to the ground rod.

2.4.1.7 Procedure 6: Base Radio and standard antenna installation

Picture of ½ whip antenna installed on w/s here

1. Install the ½ whip antenna onto the bottom of the weather station. This will thread onto the connector marked “antenna”.
2. Attach to RPSMA connector on the window mount antenna to the RF401 or RF416 base radio. Remove the strip covering the adhesive on the antenna and stick it vertically to a window.
3. Attach the serial cable from the calling computer’s serial port to the port marked “RS232” on the RF401 or RF416 base radio.
4. Plug the wall adapter into a wall outlet and plug the barrel connector into the RF 401 or RF416 base radio connector marked “DC Pwr”. You should see the lights on the radio come on.



FIGURE 2-15. The Base RF401 and RF416 installation

2.4.1.8 Procedure 7: 17342 Short-Haul Modem installation



1. Attach the enclosure from 17342 kit onto the tripod or mounting pipe under the TurfWeather weather station using the U-Bolts supplied. Mount this underneath or opposite of the solar panel if used to prevent shadowing on the solar panel. See Figure 2-16.
2. Connect 17326 cable to the connector on the bottom of the enclosure marked "Weather Station". Connect the other end of this cable to the bottom of the weather station marked "RS232" and thread the thumb screws into the connector to secure cable connector to weather station. See Figures 2-17 and 2-18.
3. Connect the 12002 cable to the connector on the bottom of the enclosure marked "Computer". The other end of this cable has four wires that are labelled as follows: Red "+RCV", Black "-RCV", Green "+XMT", White "-XMT". Connect these wires to the customer supplied cable using the direct burial splice kits. The wire used from the user supplied cable to connect to the Red "+RCV" wire should be connected to the terminal marked "+RCV" on the short haul modem used on the computer end of cable run. The remaining wires should follow the same procedure so that each wire is connected to the corresponding terminal on the short haul modem. Black to "-RCV", etc.
4. On the computer end of the user supplied cable connect the wires as described above to the SRM-5A short haul modem. The connector marked "+RCV" should be connected to the wire in the user supplied cable that connects to the Red wire on the 12002 cable and so on.
5. Connect the 15751 9 to 25 pin adapter to the SRM-5A short haul modem.
6. Connect the serial cable to the 15751 adapter
7. Connect the other end of the serial cable to the computer.

CAUTION

a. 18 AWG is recommended for the user supplied cable, and must have at least 4 conductors plus shielding with a bare wire. This bare wire and any unused conductors should be connected to an earth ground on one end or the other to help prevent electrical noise from interfering with communication. Cable lengths exceeding ½ mile are not recommended due to additional splices, and increased probability of cable becoming damaged. Maximum of 2 miles.

b. The DCE/DTE switches on the SRM-5A short haul modems are set to DCE for the computer, and DTE at the weather station (Inside enclosure). 9600 baud rate should be used with weather software and PC200W settings.



FIGURE 2-16. The Short Haul Enclosure Mounted



FIGURE 2-17. The Cables Connected to Enclosure



FIGURE 2-18. The Cables Connected to Weather Station

3. Maintenance

Proper maintenance of the TurfWeather weather station is essential to obtain accurate data. Equipment must be in good operating condition, which requires a program of regular inspection and maintenance. Routine and simple maintenance can be accomplished by the person in charge of the weather station. Inspect the weather station weekly when first installed to get an understanding of how often cleaning and inspecting should be performed. Keep the weather station level for accurate solar radiation and rain measurements. Use the level bubble located on top of weather station for reference. More difficult maintenance such as sensor replacement can be accomplished with instructions included in this manual, or weather station can be sent to Campbell Scientific if preferred.

3.1 Solar Panel P/N SP5

An occasional cleaning of the glass on the solar panel will improve its efficiency. Use warm mildly soapy water and a clean cloth. Rinse with clean water.

3.2 Battery Pack P/N 14159

The Battery pack is a 12 Volt, 0.8 AHr battery with a special connector. It has a life expectancy of 3 to 5 years. It is located inside the weather station. It is a sealed lead acid battery design, and if it is discharged below 11.0 volts it may become damaged and no longer accept a charge regardless of the age of the battery. PC200W and most weather software will display the weather station battery voltage. Typical measurements should be between 12.5 and 13.5 volts. See Section 3.11 'Battery Pack Removal and Replacement Procedure' for instructions on replacement.

3.3 Temperature/Relative Humidity sensor P/N 14144

The Temperature/Relative Humidity sensor has a life expectancy of 18 months. The Relative Humidity measurement will begin to drop off as the sensor ages. It is located on the bottom of the weather station inside the slotted cylinder shaped protector. Take care not to expose this sensor to overspray from pesticides, fertilizers, etc. Use a soft brush to remove dust and cob webs from sensor area. See Section 3.12 'Temperature/Relative Humidity Sensor Assembly Removal and Replacement Procedure' for instructions on replacement.

3.4 Solar Radiation sensor P/N 14009

The Solar Radiation sensor has a life expectancy of approximately 5 years at an expected 2% per year degradation rate. This sensor is replaced rather than recalibrated. It is the small round sensor located on the opposite end from the wind sensors. Keep this sensor clean using a soft cloth and very mild soapy water, and follow up with a clean damp cloth with water only. See Section 3.13 'Solar Radiation Sensor Removal and Replacement Procedure' for instructions on replacement.

3.5 Rain Gauge P/N 25585

The Rain Gauge has a life expectancy of 5 years or more. It is the box shaped sensor on top of the weather station. Keep the funnel area clean from leaves, pine needles etc. Keep the tipping mechanism spoon clean by removing accumulated dirt build up. The spoon can be accessed by removing the top funnel from the main body of the Rain Gauge. Hold the body with one hand while removing the funnel. The body, base, and funnel all just press together with no fasteners holding them. 1 tip of the spoon will result in 1 mm being measured. 1 mm is equal to 0.03937008 inch. See Section 3.14 'Rain Gauge Removal and Replacement Procedure' for instructions on replacement.

3.6 Wind Speed Sensor P/N 14010

The Wind Speed sensor has a life expectancy of 5 years or more. It is the black sensor with three cups that rotate as the wind blows. To check the wear of this sensor gently rotate the sensor using your thumb and forefinger on the top point of the sensor. The sensor should move freely and feel very smooth. See Section 3.15 'Wind Speed Sensor Removal and Replacement Procedure' for instructions on replacement.

3.7 Wind Direction Sensor P/N 14011

The Wind Direction sensor has a life expectancy of 5 years or more. It is the black sensor with a tail on one end and a stainless steel nose on the other end. To check the sensor for wear gently rotate the sensors top half. The sensor should move freely and feel very smooth. See Section 3.16 'Wind Direction Sensor Removal and Replacement Procedure' for instructions on replacement.

3.8 Memory Battery P/N 15598

The Memory Battery is a small coin cell type battery that will keep the clock time correct and the stored data when the power supply and battery pack are not supplying power to station. Life expectancy is 5 years or more. This battery voltage should be above 3 volts, and can be displayed using PC200W software. The battery manufacturer's model number is the CR1016. See Section 3.17 'Memory Battery Removal and Replacement Procedure' for instructions on replacement.

3.9 Auxiliary Battery Unit Installation Procedure

The installation of a TurfWeather weather station Auxiliary Battery Unit does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person performing this procedure should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver
- ✓ Small wire cutter

P/N 18914 Auxiliary Battery Unit kit components:

- ✓ Enclosure with 7AHr battery
- ✓ 18971 Battery Cable
- ✓ U-bolt, washers and brass nuts



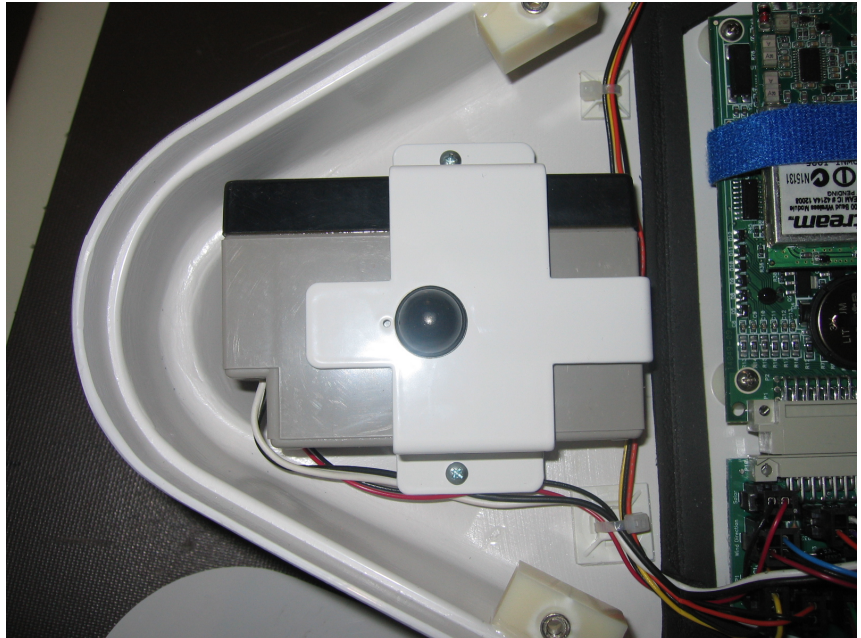
1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts securing the weather station to its mast. Make note of the orientation of weather station. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.

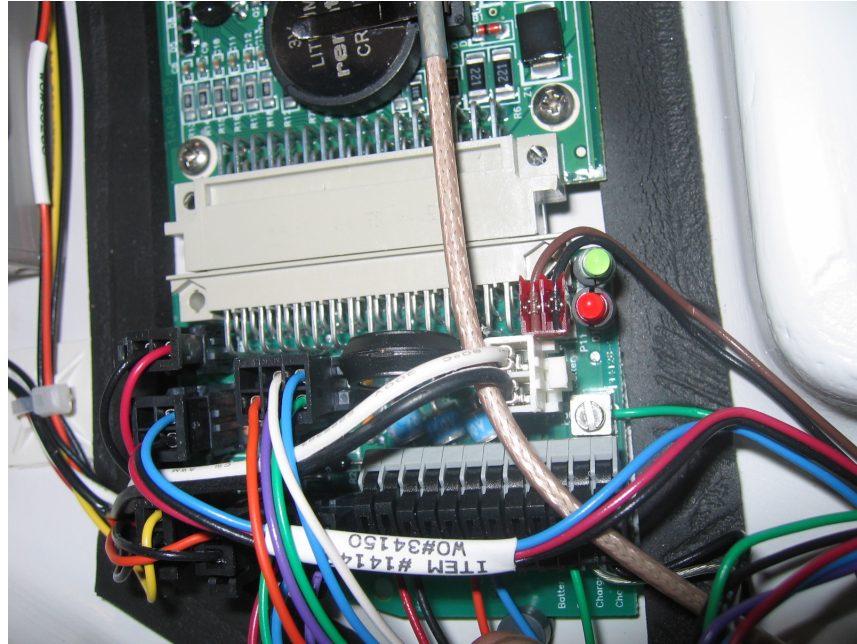
2. Battery Pack Removal:

- a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.

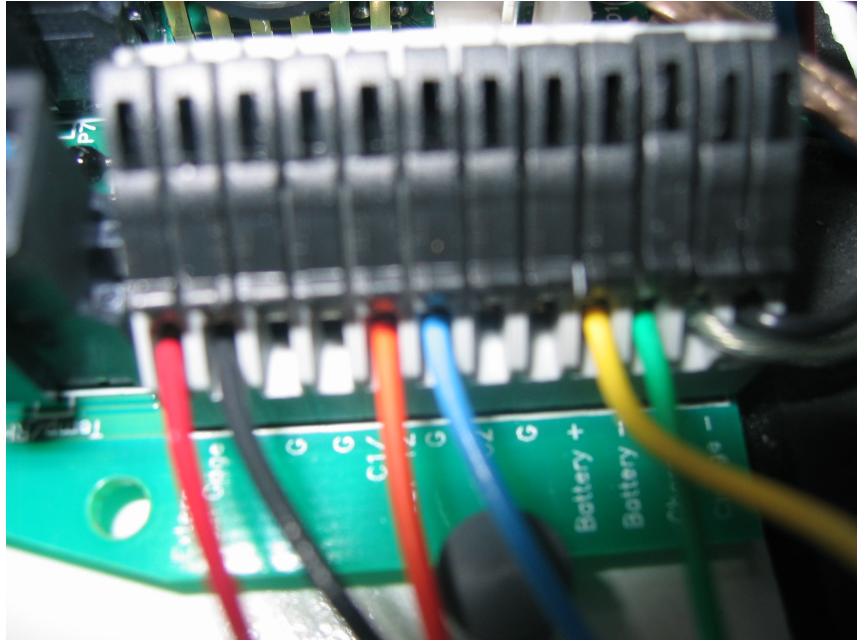
- b. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screws along the end with the wind sensors are shorter than the remaining four screws.
- c. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
- d. Rest the base section next to the electronics section and locate the battery pack within the electronics section. It is a gray and black rectangular component at the front of the electronics section. It is retained by a white metal bracket that is held in place with two Phillips head screws. There is a cable, consisting of a red and a black wire, or a white and black wire that connects the battery pack to the main electronics board.



- e. Locate the other end of the battery pack cable on the main electronics board. It terminates in a white connector plugged into the main electronics board marked "Battery". The wires are restrained along their length with either plastic cable ties, or with reusable cable restraints. Determine which type your weather station has and then release the wires by either cutting the cable ties with the small wire cutter, or by releasing the cable restraints. NOTE: Do not cut the wires to remove the battery pack.



- f. Disconnect the white battery pack cable connector from the main electronics board. NOTE: Maintain ESD isolation by not touching any electronics boards or components on the boards inside the weather station.
 - g. Use the Phillips screwdriver to remove the two screws holding the battery pack bracket into the electronics section, and remove the bracket.
 - h. Lift the battery pack from the weather station. NOTE: The weather station uses a maintenance free lead-acid battery and must be properly disposed of. Do not dispose of this battery pack in a municipal landfill, or by burning it. If you do not know where to dispose of a battery pack, then contact your local solid waste disposal site for instructions. Reinstall bracket and screws without battery.
3. Wiring modifications:
- a. Locate the yellow wire marked “Batt +” and remove protective tape from the end.
 - b. Locate the terminal marked “Battery +” on the circuit board and open the connector lever. Install the yellow wire marked “Batt +” into this connector and close the lever.



- c. Use new cable ties to capture the cable as it was before you clipped the original cable tie(s), or reuse the original ties if possible.
 - d. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges, or by the seven housing screws when the sections are secured.
 - e. Reinstall and tighten the seven screws that hold the weather station main body sections together.
 - f. Reinstall TurfWeather weather station in original location and orientation. Reconnect Solar/Charger cable as before.
4. Enclosure Installation:
- a. Locate the enclosure underneath or opposite of the solar panel to prevent shadowing on the solar panel.
 - b. Attach the enclosure to TurfWeather weather station mounting pole using the U-bolt, flat washers, locking washers, and brass nuts supplied. Using the ½ inch wrench tighten the two U-bolt nuts.
 - c. Attach the 18971 cable's 2 pin connector end to the bottom of the enclosure.
 - d. Attach the 18971 cable's 6 pin connector to the bottom of the TurfWeather weather station's Auxiliary connector.



3.10 High Gain Base Station Antenna Installation Procedure

The physical installation of a TurfWeather weather station high gain base station antenna system does not require training or special tools. However, assurance that the antenna system is properly grounded should be confirmed by a qualified RF systems technician or engineer. Failure to properly ground the antenna system will invalidate the Warranty of the antenna and any attached equipment, and it will expose equipment attached to the antenna to a high risk of damage from environmental electrostatic discharge, including lightning.

WARNING

Under no circumstances should installation be accomplished during inclement weather to avoid personal hazard due to lightning. Please read this entire procedure before beginning work.

Tools required:

- ✓ ½ inch wrench
- ✓ 3/8 inch wrench
- ✓ #2 Phillips screwdriver

Customer supplied materials required:

- ✓ Antenna mounting pole – 1 ¼ - 2 inch O.D. metal pipe, or tripod assembly
- ✓ Pole/tripod mounting hardware
- ✓ Spade or ring lug connector (00 gage)

Antenna kit components required:

- ✓ High gain Yagi-directional antenna (900MHz, P/N 14205 or 2.4GHz, P/N 22072)
- ✓ Antenna mounting bracket
- ✓ NTN-L50 or -L100 low loss antenna cable
- ✓ Polyphaser impulse suppressor module (900MHz, IS-50NX-C2 p/n 14462; or 2.4GHz, LCU2.4 p/n 16982)
- ✓ COAX RPSMA Polyphaser-to-RF401 cable (included with p/n 14462 and p/n 16982)
- ✓ Weather station grounding kit

P/N 16775 Weather station grounding kit components:

- ✓ Copper clad grounding rod
- ✓ Heavy gage (00) ground cable
- ✓ Ground rod-to-cable clamp – brass
- ✓ Mast ground clamp (discard - not required for antenna installation)
- ✓ Weather station ground wire – green (discard – not required for antenna installation)

NOTE

The P/N 16775 Grounding kit contains basic components used for grounding either a tripod, or a buss bar. This kit may need to be supplemented by the user to meet the requirements of any specific site.

1. Location Preparation:
 - a. Determine the best location for the antenna, assuming that the distance from the antenna to the RF401 base station is equal to, or less than, the length of the NTN-Lxx antenna cable.
 - b. Assure that the ground rod is installed into the soil as close to the location of the Polyphaser as is possible. NOTE: A ground wire (00 gage) is supplied but it may not be long enough for all installations. If a longer ground cable is required, purchase a continuous length to meet the site requirement but always use the minimum length necessary. Do not reduce the gage of this wire if a longer length is required. An alternate method of earth grounding may be employed but should be confirmed by a qualified RF technician before use.
 - c. Mount the Polyphaser within 5 feet of the location of the RF401 base station on a ground plane, or ground buss bar, inside a weatherproof enclosure or building. Mounting recommendations are supplied with the Polyphaser. NOTE: The ground plane or buss bar will also be the connection point for the earth ground cable to the exterior ground rod, or interior earth ground connection.
 - d. Connect the heavy gage (00 gage) ground wire to the ground plane or buss bar using a 00 bolted ring or spade lug connector (not supplied). Connect the other end of the heavy gage ground wire to the ground rod using the brass rod clamp supplied, or connect to the alternate interior earth ground point.
 - e. Verify connection to the earth ground from the case of the Polyphaser.
2. Component Installation:
 - a. Mount the antenna in the proper orientation, with the connector at the bottom.
 - b. Connect one end of the antenna cable to the antenna and install the cable up to the location of the Polyphaser. Assure that a drip loop is maintained in the cable at the base of the antenna, and at the point where the cable will enter a weatherproof enclosure or building. The drip loops will minimize the amount of rainwater that will run down the cable to the enclosure or building. NOTE: The minimum bend radius of the antenna cable is 6 inches. Tight bends in the antenna cable, or clamps that crush the cable, will damage the internal insulation and compromise the cable. Handle the antenna cable with care.
 - c. Connect the antenna cable to the Polyphaser module connector marked ANTENNA.
 - d. Connect one end of the short COAX RPSMA Polyphaser-to-RF401 cable to the EQUIPMENT side of the Polyphaser module, and the other end to the antenna connector on the RF401.

3. Principle of Operation:
 - a. A Yagi high gain antenna is a directional RF device designed to minimize signal attenuation at the base station location, thereby providing the maximum available energy at the antenna for communication with the remotely located equipment (i.e.: the weather station). This antenna does need to be aimed and the best result is obtained with a clear line of sight to the remote transceiver. If you can see the weather station, the system has a clear line of sight.
 - b. The Polyphaser senses the presence of a high voltage electrostatic energy pulse and passes it to earth ground before it can damage the RF401.
4. System Test:
 - a. Initiate the system software and verify that the RF401 will communicate with the weather station. See “TurfWeather Quick Start Guide”

NOTE

IMPROPER GROUNDING OF THE SYSTEM WILL COMPROMISE ALL PROTECTIVE COMPONENTS AND RESULT IN SYSTEM DAMAGE IN THE EVENT OF AN ELECTROSTATIC DISCHARGE EVENT. THE GROUND SYSTEM SHOULD BE REVALIDATED ON AN ANNUAL BASIS TO ASSURE THAT CORROSION AT CONNECTORS HAS NOT COMPROMISED THE GROUND SYSTEM.

3.11 Battery Pack (P/N 14159) Removal and Replacement Procedure

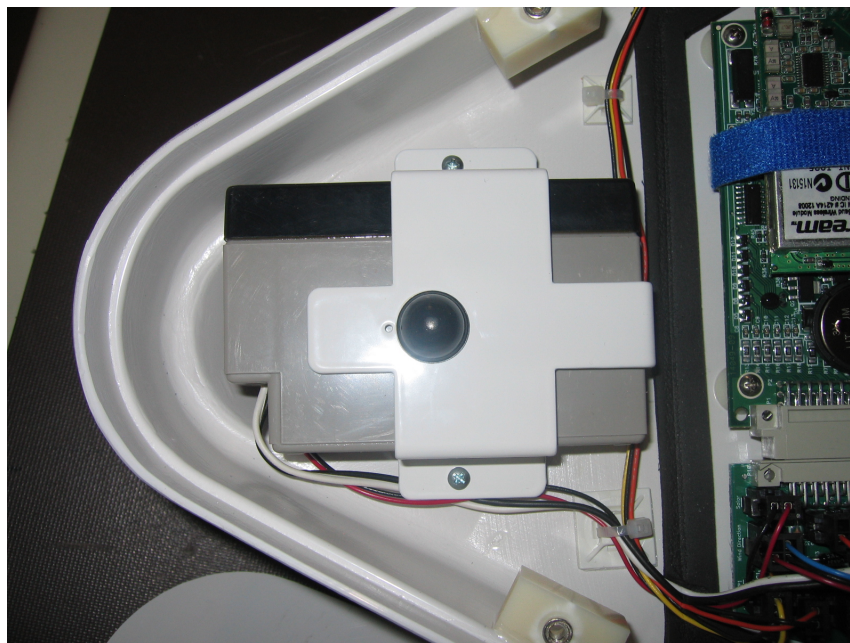
The removal and replacement of a TurfWeather weather station battery pack does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person replacing this battery should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

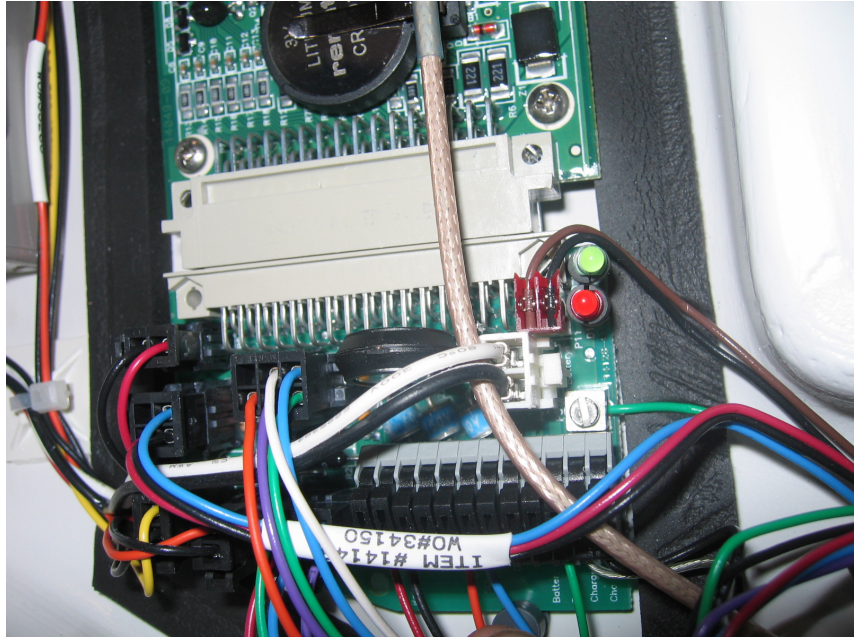
- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver
- ✓ Small wire cutter

1. Preparation:
 - a. Turn the power switch on the weather station to the “OFF” position.
 - b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.

- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts securing the weather station to its mast. Make note of the orientation of weather station. NOTE: Do not remove the mast bracket from the weather station.
 - d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.
2. Battery Pack Removal:
- a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
 - b. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screws along the end with the wind sensors are shorter than the remaining four screws.
 - c. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
 - d. Rest the base section next to the electronics section and locate the battery pack within the electronics section. It is a gray and black rectangular component at the front of the electronics section. It is retained by a white metal bracket that is held in place with two Phillips head screws. There is a cable, consisting of a red and a black wire, or a white and black wire that connects the battery pack to the main electronics board.

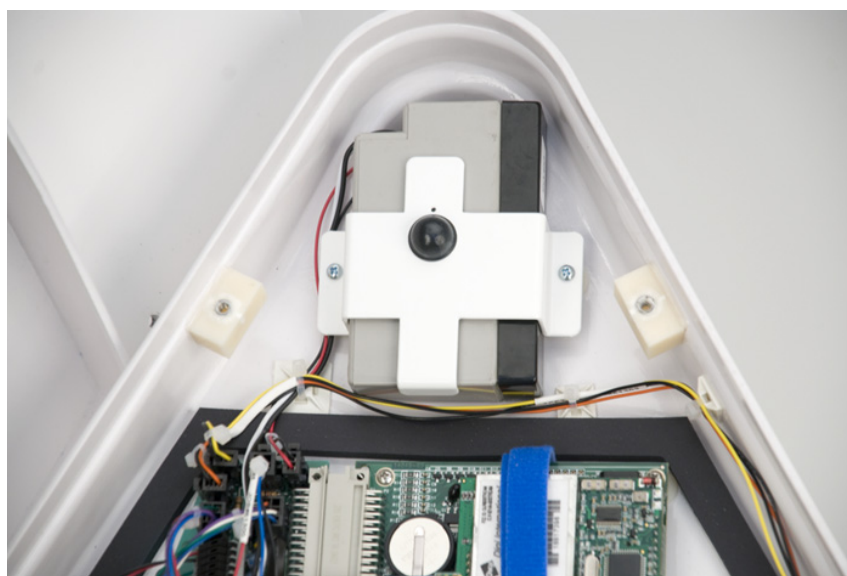


- e. Locate the other end of the battery pack cable on the main electronics board. It terminates in a white connector plugged into the main electronics board marked “Battery”. The wires are restrained along their length with either plastic cable ties, or with reusable cable restraints. Determine which type your weather station has and then release the wires by either cutting the cable ties with the small wire cutter, or by releasing the cable restraints. NOTE: Do not cut the wires to remove the battery pack.



- f. Disconnect the white battery pack cable connector from the main electronics board. NOTE: Maintain ESD isolation by not touching any electronics boards or components on the boards inside the weather station.
 - g. Use the Phillips screwdriver to remove the two screws holding the battery pack bracket into the electronics section, and remove the bracket.
 - h. Lift the battery pack from the weather station. NOTE: The weather station uses a maintenance free lead-acid battery and must be properly disposed of. Do not dispose of this battery pack in a municipal landfill, or by burning it. If you do not know where to dispose of a battery pack, then contact your local solid waste disposal site for instructions.
3. Battery Pack Replacement:
- a. Insert the new battery pack into the weather station where the previous battery pack was located.
 - b. Replace the battery pack retainer and tighten the Phillips head screws that hold it into the electronics section. Take care not to crimp the cable from the battery pack under the battery pack, or the retainer.

- c. Carefully connect the white cable connector to the main electronics board, taking care not to touch the board or any components on electronics boards inside the weather station.
- d. Align the battery pack cable in the cable restraints and again clamp them around the entire cable bundle. If your weather station uses cable ties, then use the ties supplied with the new battery pack and capture the cable as it was before you clipped the original cable tie(s).
- e. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges, or by the seven housing screws when the sections are secured.
- f. Reinstall and tighten the seven screws that hold the weather station main body sections together.



4. System Test:
 - a. Turn on the weather station power switch.
 - b. Look into the small window on the bottom of the weather station marked “Scan – Receive” and confirm that the LED flashes every ten seconds.
 - c. Re-install the weather station on its mast, and reconnect the ground and power wires.

3.12 Temperature/Relative Humidity Sensor Assembly (P/N 14144) Removal and Replacement Procedure

Please read this entire procedure before beginning work.

The removal and replacement of a TurfWeather weather station temperature/relative humidity (Temp/RH) sensor assembly does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person replacing this sensor

should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ small wire cutter
- ✓ #2 Phillips screwdriver

Time Required: 15-30 minutes

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect your solar panel or your DC power supply input cable from the weather station.
- c. Disconnect the ground wire connections from the weather station, using the 5/16 inch wrench.
- d. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- e. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.

2. Sensor Removal:

- a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
- b. Remove the two Phillips head screws on the base of the main body that hold the mounting cover over the tube that covers the temperature/relative humidity sensor.
- c. Gently separate these components and pull out the temp/RH sensor until the connector is exposed.

3. Sensor Replacement:

- a. Do not contaminate either of the sensor elements by exposing them to solvents.
- b. Unplug the old sensor, and plug in the new sensor.

4. Reassemble the mounting cover and tube assemble with the new sensor onto the main body.
5. System Test:
 - a. Connect the weather station to the Host computer using the short RS-232 test cable (if a wired system) and turn on the weather station power switch. Initiate communications with the weather station using PC200W or T.Weather.
 - b. Verify that the temperature and relative humidity sensors are reporting values. Gently blow air into the sensor protective screen on the bottom of the weather station and verify that both the temperature and relative humidity values increase. Stop blowing air on the sensors, and after a brief period the values should slowly decrease until the sensors return to equilibrium with the surrounding environment.
 - c. Re-install the weather station on its mast, and then reconnect power and earth ground cables.



3.13 Solar Radiation Sensor (P/N 14009) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station solar radiation sensor does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person replacing this sensor should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.

2. Solar Radiation Sensor Removal:

- a. Locate the solar radiation sensor on the front of the weather station. It is the gray plastic knob shaped protrusion on the top, front of the weather station. It is stamped on its side with the words “CSI APOGEE PYRC(number)”.
- b. Locate the Phillips head screw on the side of the sensor. Remove the screw but do not pull on, or attempt to remove the sensor at this time.
- c. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
- d. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screw along the end with the wind sensors are shorter than the remaining four screws.
- e. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
- f. Rest the base section next to the electronics section and locate the battery pack within the electronics section. It is a gray and black rectangular component at the front of the electronics section. It is retained by a white metal bracket that is held in place with two Phillips head screws.

- g. Use the Phillips screwdriver to remove the two screws holding the battery pack bracket into the electronics section, and remove the bracket.
 - h. Lift the battery pack from the electronics section and rest it next to the weather station.
 - i. Locate the two wires that come from solar radiation sensor and follow them to their end connector on the weather station main electronics board. Cut, or disconnect any cable retaining ties along the length of the wires.
 - j. Locate the screws on the corners of the main electronics board (largest green electronics board) and touch one finger to one of the screws on a corner of the board, then carefully disconnect the black solar radiation cable connector. NOTE: Touching a screw will ground any electro-static energy difference between you and the main electronics board. Do not be concerned, as this will not shock you or create a spark.
 - k. Remove the solar radiation sensor by gently pulling it off its mounting post as you feed the wires through the hole in the top of the weather station module.
3. Solar Radiation Sensor Replacement:
- a. Insert the wire cable from the new solar radiation sensor into the weather station electronics module through the mounting post hole where the previous solar radiation sensor was located.
 - b. Again touch a finger to a screw on a corner of the main electronics board and then carefully reconnect the black solar radiation sensor connector. NOTE: Touching the screw will ground any electro-static energy difference between you and the weather station main electronics board. Do not be concerned, as this will not shock you or create a spark.
 - c. Align the solar radiation sensor cable in the cable restraints and again clamp them around the cable bundle. If your weather station uses cable ties, then use the ties supplied with the new solar radiation sensor and capture the cable as it was before you clipped the original cable tie(s).
 - d. Replace the battery pack in its original location.
 - e. Replace the battery pack retainer and tighten the Phillips head screws that hold it into the electronics section. Take care not to crimp the cable from the battery pack or the solar radiation sensor under the battery pack, or the retainer.
 - f. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges or by the seven housing screws when the two sections are secured with screws.

- g. Reinstall and tighten the seven screws that hold the weather station main body sections together.
 - h. Press the solar radiation sensor down onto its mounting post until it is firmly seated, then tighten the Phillips head screw on the side until you cannot pull the sensor off of the post. Take care not to over-tighten the screw as over-tightening could crack the sensor post.
4. System Test:
- a. Connect the weather station to the Host computer using the short RS-232 test cable (if a wired system) and turn on the weather station power switch. Initiate communications using PC200W or T.Weather.
 - b. Point a strong flashlight directly at the top of the solar radiation sensor and verify that the solar radiation sensor is reporting a value. NOTE: When the weather station is reinstalled at its permanent location the solar radiation sensor should report a value near to 1000 W m^{-2} , on a clear day, with a bright sun directly overhead.
 - c. Re-install the weather station on its mast, and reconnect the ground and power wires.



3.14 Rain Gauge (P/N 25585) Removal and Replacement Procedure

Introduction: The removal and replacement of a TurfWeather weather station rain gauge does not require training, special tools, or test equipment. The main body of the weather station does not need to be opened, there is no electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ Small needle nosed pliers

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface.

2. Sensor Removal:

- a. Identify the rain gauge as the white rectangular box located in the center, on top of the weather station.
- b. Grasp the main body of the rain gauge and gently pull it off of the weather station. This will expose two wires, leaving the rain gauge base attached to the weather station.
- c. Remove the wires from their connections inside the rain gauge. The wires are screwed to a terminal strip, then loosen the screws and remove the wires.

3. Sensor Replacement:

- a. Connect the wires to the replacement rain gauge. Tighten the terminal screws. It does not matter which wire is attached to which pin, this connection is not polarity sensitive.
- b. You will notice that the rain gauge wires pass through a small indented location on one side of the rain gauge base. When you replace the rain gauge back onto its base you must make sure that the wires are within the indent to assure they will not be crushed or crimped by the rain gauge.
- c. Locate the rain gauge on its base and gently press it down until it is firmly seated.

4. System Test:
 - a. Connect the weather station to the Host computer using the short RS-232 test cable (if a wired system) and turn on the weather station power switch; or initiate communications if your weather station is wireless.
 - b. Gently remove the top portion (catch basin) of the rain gauge and identify the black spoon shaped tipping bucket inside the rain gauge.
 - c. Using your index finger, gently press the spoon down until you hear a faint “click” sound. This is the tip counting switch responding to the tiny magnet on the side of the spoon shaped tipping bucket. Repeat this action several times and look for a change in the rain values reported by the PC200W or T.Weather. Each click is equal to 0.04 inches (1 mm) of rain. NOTE: Every rain gauge is factory calibrated before it is shipped. If you want to validate calibration please refer to the calibration instructions for the rain gauge and complete the calibration before you reinstall the weather station on its mast.
 - d. Replace the catch basin on the rain gauge and re-install the weather station on its mast.



3.15 Wind Speed Sensor (Anemometer) (P/N 14010) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station wind speed sensor does not require training, special tools, or test equipment. The main body of the weather station does not need to be opened, there is no electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ ¼ inch wrench
- ✓ #2 Phillips screwdriver.

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface.

2. Sensor Removal:

- a. Identify the wind speed sensor as the sensor with three cups that rotate around the main sensor body. It is located on the top, rear of the weather station main body. NOTE: Do not twist or place side pressure on either the wind speed or wind direction sensors at any time during this sensor removal/replacement process as it may cause them to break off of the weather station main body.
- b. Just below the sensor rotating cups, there is a flexible “boot” that will peel down from the top. Without using tools, peel the boot down, folding it back upon itself and the sensor mounting post. This will expose two wires connected to two separate threaded terminal studs, retained by ¼ inch nuts. NOTE: Take care not to place side pressure on the sensor itself, and do not place downward pressure on the weather station main body as this may damage the Temp/RH sensor cage on the underside of the weather station.
- c. Using the ¼ inch wrench, loosen the nuts and remove the wires.
- d. Locate the single Phillips head screw on the side of the sensor body. NOTE: This is not either of the screws next to the threaded terminal studs. Using the Phillips screwdriver, remove the screw.
- e. Remove the sensor from its post by gently twisting and pulling it away from the post.

3. Sensor Replacement:

- a. Press the new wind speed sensor on the post until it is seated on the top of the mounting post. NOTE: Orientation of this sensor is not important but it must be firmly seated on its mounting post.

- b. Install and tighten the Phillips head screw on the side of the sensor body one half turn beyond when it is initially tight in the hole (after it has bottomed against the sensor post). Gently pull on the sensor body to assure it is firmly attached to the sensor post. If not, then tighten the screw until the sensor cannot be removed.
 - c. Re-attach the two wires to the correct threaded terminal studs and tighten the nuts using the ¼ inch wrench. NOTE: It does not matter which wire is connected to which terminal stud. These connections are interchangeable.
 - d. Unroll the rubber protective boot and assure that it completely covers the lower portion of the wind speed sensor, just as it did when you started this process.
4. System Test:
- a. Connect the weather station to the Host computer using the RS-232 test cable (if a wired system) and turn the weather station power switch to the ON position. Initiate communications with your weather station using PC200W or T.Weather.
 - b. Manually spin the sensor cups for a minute or two to verify that the wind speed sensor is reporting a value.
 - c. Turn the weather station power switch to the OFF position.
 - d. Re-install the weather station on its mast; then reconnect power and ground wires before turning the weather station power switch to the ON position.



3.16 Wind Direction Sensor (P/N 14011) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station wind direction sensor does not require training, special tools, or test equipment. The main body of the weather station does not need to be opened, there is no electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ ¼ inch wrench
- ✓ #2 Phillips screwdriver.

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface.

2. Sensor Removal:

- a. Identify the wind direction sensor as the black vane (arrow shaped) sensor located on the top, rear of the weather station main body.
NOTE: Do not twist or place side pressure on the wind direction or wind speed sensors at any time during this sensor removal/replacement process as it may cause them to break off of the weather station main body.
- b. Just below the sensor moveable vane, there is a flexible “boot” that will peel down from the top. Without using tools, peel the boot down, rolling the edge back upon itself and the sensor mounting post. Take care not to place side pressure on the sensor itself. This will expose three wires connected to three separate threaded terminal studs, held tight by ¼ inch nuts.
- c. Using the ¼ inch wrench, loosen the nuts and remove the wires, taking care to note which wires go on which threaded terminal studs.
- d. Locate the single Phillips head screw on the side of the sensor body.
NOTE: This is NOT either of the screws next to the threaded terminal studs. Using the Phillips screwdriver, remove the screw.

- e. Remove the sensor from its post by gently twisting and pulling it away from the post.
3. Sensor Replacement:
 - a. Press the new wind direction sensor on the post until it is seated firmly on the top of the post.
 - b. Gently twist the sensor body until the raised North reference is properly aligned. NOTE: Refer to the Quick Start Guide delivered with the weather station for a picture of a properly aligned wind direction sensor.
 - c. Install and tighten the Phillips head screw on the side of the sensor one half turn beyond when it is initially tight in the hole (after the screw has bottomed against the sensor post). Gently pull on the sensor body to assure it is firmly attached to the sensor post. If not, then tighten the screw until the sensor cannot be moved.
 - d. Re-attach the three wires to the correct threaded terminal studs and tighten the nuts using the ¼ inch wrench. NOTE: If you did not note the correct threaded terminal studs, look at the base of the sensor and count clockwise from the embossed “N” reference mark. The first stud will take the black wire, the second the blue wire and the third the red wire.
 - e. Unfold the rubber protective boot and assure that it completely covers the lower portion of the wind direction sensor, just as it did before you started this process.
 4. System Test:
 - a. Connect the weather station to the Host computer using the RS-232 test cable (if a wired system) and turn on the weather station power switch. Initiate communications with your weather station using PC200W or T.Weather.
 - b. Verify that the wind direction sensor is reporting a position. The position number should be -0- when the tail of the sensor vane is aligned with the North reference. Confirm that the wind direction number increases when the vane is rotated clockwise.
 - c. Re-install the weather station on its mast.



3.17 Memory Battery (P/N 15598) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station memory battery does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person replacing this electronics board should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

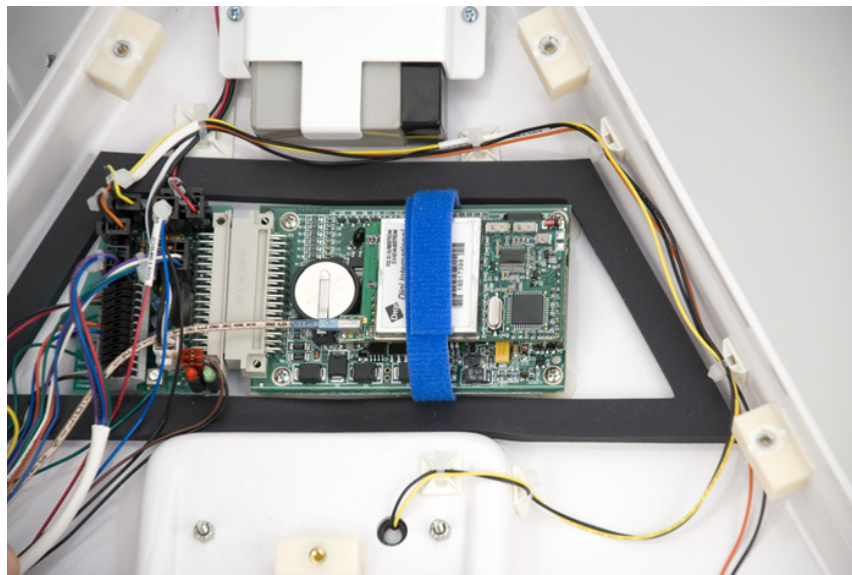
- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver
- ✓ Wooden toothpick or non-metallic tweezers

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.

- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.
2. Memory Battery Removal:
 - a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
 - b. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screws along the end with the wind sensors are shorter than the remaining four screws.
 - c. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
 - d. Rest the base section next to the electronics section and locate the main electronics board within the electronics section. It is the largest green rectangular electronics board in the weather station electronics section. Locate the screws at the corners of the main electronics board and touch one of them with a finger to discharge any electrostatic difference between you and the electronics. NOTE: Touching the screw(s) will not shock you or create a spark.
 - e. Locate the small disc shaped memory battery in the center of the main electronics board and, using a fingernail, gently lift the battery retaining clip; then use your wooden toothpick or non-metallic tweezers to extract the battery from the battery holder.
 3. Memory Battery Replacement:
 - a. Determine which side of the new battery is the positive side. This will have a "+" stamped into the surface. This is the side that must be up (visible) when the battery is installed in the battery holder.
 - b. Lift the battery retaining clip slightly and slip the battery into the battery holder insuring that it is correctly seated and tightly held in place by the battery retaining clip.
 - c. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges or by the seven housing screws when the two sections are secured with screws.
 - d. Reinstall and tighten the seven screws that hold the weather station main body sections together.

4. System test:
 - a. Turn on the weather station
 - b. Look into the small window on the bottom of the weather station marked “Scan – Receive” and confirm that the LED flashes every ten seconds.
 - c. Re-install the weather station on its mast, and reconnect the ground and power wires.



3.18 Main Electronics Board (Motherboard) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station main electronics board does not require training, special tools, or test equipment. However, it is not a user repairable item and must be returned to an authorized local Toro distributor for evaluation and repair. Additionally, the main body of the weather station does need to be opened, and the person replacing this electronics board should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

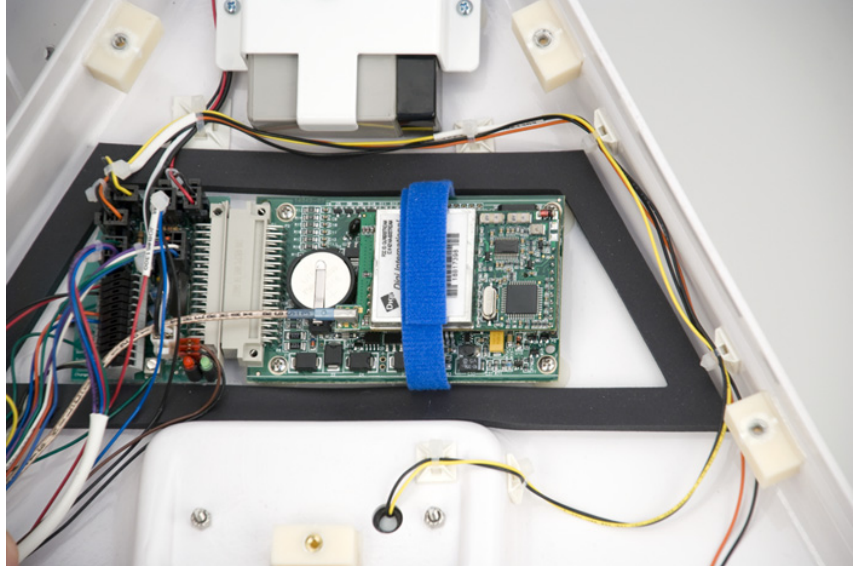
Tools Required:

- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver

1. Preparation:
 - a. Turn the power switch on the weather station to the “OFF” position.
 - b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
 - c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
 - d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.

2. Main Electronics Board Removal:
 - a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
 - b. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screws along the end with the wind sensors are shorter than the remaining four screws.
 - c. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
 - d. Rest the base section next to the electronics section and locate the main electronics board within the electronics section. It is the largest green rectangular electronics board in the weather station electronics section.
 - e. Locate the screws at the corners of the main electronics board and touch one finger to one of the screws. NOTE: Touching the screw will ground any electro-static energy difference between you and the weather station main electronics board. Do not be concerned, as this will not shock you or create a spark.
 - f. Remove the four Phillips head screws that attach the main electronics board to the weather station electronics section.
 - g. Note the gray plastic connector on one end of the main electronics board. This connects the board to the adjacent sensor connector board. Grasp both the main electronics board and the sensor connector board near the connector and gently pull them apart at the mating connector. You may need to use a slight side-to-side motion to separate the connector.

- h. If you received a replacement main electronics board, it was shipped in a special ESD protective bag. Remove the replacement main electronics board from this bag and put the board you removed from your weather station into the same ESD bag.
3. Main Electronics Board Replacement:
- a. If your weather station is wireless, the replacement main electronics will have a spread spectrum radio board attached to it. The main carrier frequency for the radio board is printed on the white label with the word MaxStream. It will be either 900 MHz or 2.4 GHz. Verify that the carrier frequency is the same as that indicated on the spread spectrum radio you removed before proceeding further. If it is not, and you are not intentionally changing the radio frequencies in both the weather station and the RF401 base station (they must be the same frequency), then contact your local Toro distributor immediately.
 - b. Orient the main electronics board so that the connector will mate with the connector on the sensor connector board. Press the two connectors together until they are firmly seated.
 - c. If your weather station is wireless, verify that the Velcro board retaining strap is tightly secured around the radio module.
 - d. Replace and tighten the four Phillips head screws that attach the main electronics board to the weather station electronics section.
 - e. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges or by the seven housing screws when the two sections are secured with screws.
 - f. Reinstall and tighten the seven screws that hold the weather station main body sections together.
4. System test:
- a. Connect the weather station to the Host computer using the short RS-232 test cable (if a wired system) and turn on the weather station power switch; or initiate communications if your weather station is wireless.
 - b. Verify that the sensors are reporting values.
 - c. Re-install the weather station on its mast, and reconnect the ground and power wires.



3.19 Spread Spectrum Radio (all frequencies) Removal and Replacement Procedure

The removal and replacement of a TurfWeather weather station spread spectrum radio does not require training, special tools, or test equipment. However, the main body of the weather station does need to be opened, and the person replacing this radio module should observe basic electro-static discharge (ESD) precautions (described below) to avoid damage to the radio module and/or the weather station electronics inside the main body of the weather station. There is no personal electrical hazard involved, and this procedure can be accomplished by anyone possessing basic mechanical skills. Please read this entire procedure before beginning work.

Tools Required:

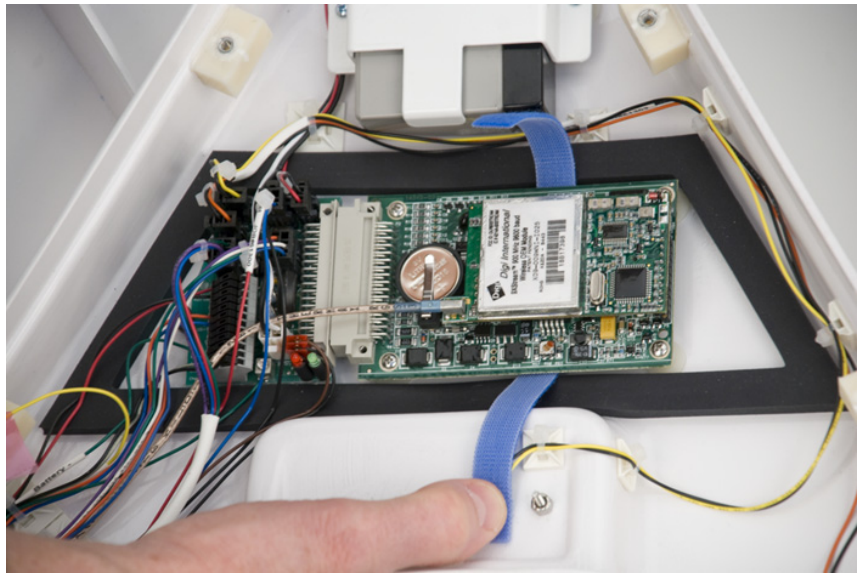
- ✓ ½ inch wrench
- ✓ 5/16 inch wrench
- ✓ #2 Phillips screwdriver

1. Preparation:

- a. Turn the power switch on the weather station to the “OFF” position.
- b. Disconnect the power input cable and ground wire connections from the weather station, using the 5/16 inch wrench for the ground wire connection.
- c. Remove the weather station from its location by using the ½ inch wrench to loosen the two U-bolt nuts that secure the weather station to its mast. NOTE: Do not remove the mast bracket from the weather station.
- d. Bring the weather station to an enclosed location, preferably near the Host computer, and place it on a flat stable surface with an area of at least three times the size of the weather station base.

2. Spread Spectrum Radio Removal:
 - a. Invert the weather station main body and rest it on a support that eliminates any stress on the wind speed or wind direction sensors, and/or the rain gauge. A rolled bath towel placed in the center of the main body, next to the rain gauge will generally suit the purpose.
 - b. Remove the seven Phillips head screws on the base of the main body that hold the base section to the electronics enclosure section. Do not remove the Phillips head screws that connect the mast bracket to the weather station base. Notice that the three screws along the end with the wind sensors are shorter than the remaining four screws.
 - c. Gently separate the electronics enclosure and base sections of the weather station main body, taking care not to place any stress on the wires that connect the two sections.
 - d. Rest the base section next to the electronics section and locate the spread spectrum radio module within the electronics section. It is a green and white rectangular electronics board positioned on top of the weather station main electronics board. It has the word MaxStream on its top surface. It is retained on the main electronics board by a green Velcro strap.
 - e. Locate the screws on the corners of the main electronics board and touch one finger to one of the screws. NOTE: Touching the screw will ground any electro-static energy difference between you and the weather station main electronics board. Do not be concerned as this will not shock you or create a spark.
 - f. Carefully remove the Velcro strap from the spread spectrum radio board but do not pull it from under the main electronics board. The board is additionally retained by connector tension at two connectors below the board. Grasp the edges of the spread spectrum radio board with your free hand and carefully pull it off of the main electronics board.
 - g. Your replacement spread spectrum radio was shipped in a special ESD protective bag. Remove the replacement radio from this bag and put the radio you removed into the same ESD bag.
3. Spread Spectrum Radio Replacement:
 - a. The replacement radio will have the main carrier frequency printed on the white label with the word MaxStream. It will be either 900 MHz or 2.4 GHz. Verify that the carrier frequency is the same as that indicated on the spread spectrum radio you removed before proceeding further. If it is not, and you are not intentionally changing the radio frequencies in both the weather station and the RF401 base station (they must be the same frequency), then contact your local Toro distributor immediately.

- b. Once the radio frequency has been verified, orient the spread spectrum radio board so that the main electronics board connectors will mate with the proper pins on the bottom of the radio board. Presses the spread spectrum radio board into its mating connectors until it is firmly seated, and then tightly attach the Velcro board retaining strap.
 - c. Place the two sections of the weather station main body together, making sure that none of the wiring bundles will be crushed by the edges or by the seven housing screws when the two sections are secured with screws.
 - d. Reinstall and tighten the seven screws that hold the weather station main body sections together.
4. System Test:
- a. Turn on the weather station power switch and initiate communications with your weather station.
 - b. Verify that the sensors are reporting values.
 - c. Re-install the weather station on its mast, and reconnect the ground and power wires.



Appendix A. TurfWeather Equipment

The following equipment is available from Campbell Scientific. Contact Customer Service for questions concerning the use of the following equipment.

A.1 Communications Options

A.1.1 17394 Serial-to-USB Adapter

The 17394 Serial-to-USB Adapter is required if your computer has a USB port to communicate with the TurfWeather weather station. The 17394 is a Universal Serial Bus (USB) converter that provides a plug and play RS-232 serial connection to a USB input on a computer. Data rates up to 230 kbps are supported.



The 17394 includes:

- Universal Serial Bus (USB) Converter with a 1 meter cable
- Software (supports Windows 98/98SE/ME/2000/XP & Linux operating systems)

NOTE

This product is commercially produced and may not always be available in this specific configuration. Campbell Scientific may substitute a part of equal or greater value if this device is discontinued by the manufacturer.

A.2 Power Supplies

A.2.1 16851 5 W Solar Panel Kit

This solar panel recharges the weather station internal battery (see Section 2.4.1.5 'Procedure 4: Solar Panel Installation'). It has a 72 sq inch surface area and produces 5 watts, at a peak of 17.1 volts.



The 16851 includes:

- 5 W solar panel
- Mounting hardware

NOTE

This solar panel is recommended if your site Latitude is greater than 40°, and/or the site experiences extended periods of night, evening, or overcast skies. Contact Customer Service if there are questions regarding the selection of the proper solar panel kit to use with your weather station.

A.2.2 16876 AC Converter

The 16876 recharges the weather station battery by converting 110-220 VAC, 50/60 Hz power to 18 VDC. The 16876 must be installed in a non-condensing environment or a weatherproof enclosure.



The 16876 includes

- UL-approved, AC/DC converter with US Standard plug prongs
- 20 foot (6.2 meter), UV resistant waterproof cable with an environmental connector for connecting to the weather station.

A.3 Mounting/Installation Kits

A.3.1 16776—Tripod/Mast Assembly

The 16776 tripod/mast assembly provides a stable support for the weather station and is suitable for ground installations (see Section 2.4.1.1 for 16776 installation procedures).



The 16776 includes:

- Tripod
- Mast that places the weather station wind sensors at a height of 38” to 60” (99 to 156 cm)
- Kit that includes (3) tripod feet with hardware, (6) lag bolts (used for rooftop installations only), and (3) sealing pads (used for rooftop installations only)

A.3.2 16770—Tripod Installation Kit

This kit includes equipment that helps you install the weather station to the correct 3-axis vertical orientation and to align the station to the magnetic North (see Section 2.4.1.1 for 16776 installation procedures). Using the 16770 to properly orient the weather station helps assure accurate measurements.



The 16770 includes:

- Multi-axis bubble level
- Compass
- Rubber band for attaching the bubble level to the tripod mast

A.3.3 16773—Tripod Stake Kit

The 16773 is for anchoring the tripod to the soil. It is intended for temporary installations and sites that experience light to moderate wind speeds (see Section 2.4.1.2 for 16776 tripod ground installation procedure).



The 16773 includes:

- (3) ½” (1.27 cm) diameter solid steel spikes with a welded hammer cap on one end

CAUTION

Sites that may experience high wind speeds should not use this kit. For those sites, anchor the tripod with bolts and guy-wires fastened to a concrete pad or other permanent base.

A.3.4 16771—Tripod Mast Extension

The 16771 extension fits into a ¼” diameter post and is used to increase the height of the weather station wind sensors (see Section 2.4.1.1 for 16776 installation procedures). When used with the 16776, one extension provides a wind sensor height of 69” to 89” (179 to 231 cm). A second 16771 can be used to provide a wind sensor height of 98” to 120” (255 to 312 cm).



The 16771 includes:

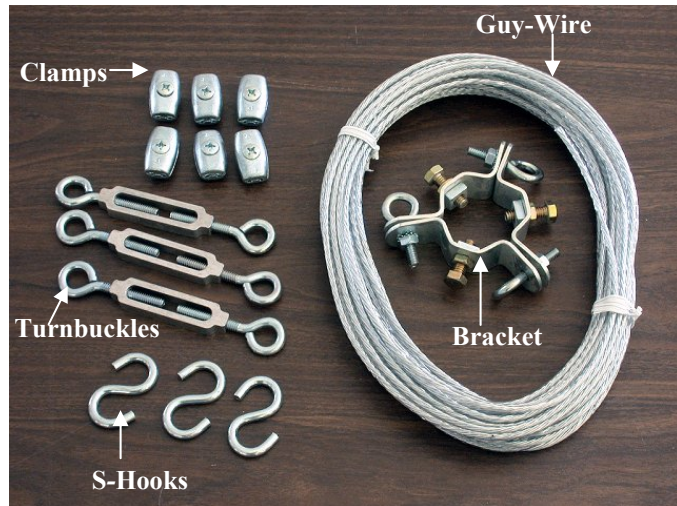
- ¼" (32.5 cm) OD, 35" (89 cm) long steel post with one end crimped

CAUTION

- Do not use more than two 16771 extensions with the 16776 Tripod Assembly.
- When two 16771 extensions are used, the 16772 Guy-wire Kit should also be used.

A.3.5 16772—Tripod Guy-wire Kit

The 16772 is used to increase the tripod's stability (see Section 2.4.1.3 'Procedure 2: Guy-wire Kit Installation'). It is intended for permanent installations, installations subject to consistently high wind speeds, or 16776 tripods using two mast extensions.



- The 16772 includes:
- Plastic-coated, steel guy-wire cable
- Bracket for securing guy-wires to the 16776 mast
- (3) S-hooks
- (3) turnbuckles
- (6) clamps

A.3.6 16775—Tripod Grounding Kit

The 16775 provides hardware needed to properly ground the weather station and tripod. Properly grounding the station prevents electrical surges and lightning from damaging the weather station (see Section 2.4.1.6 ‘Procedure 5: 16775 Ground Kit Installation’).



The 16775 includes:

- 36” (91.4 cm) long copper sheathed steel electrical ground rod
- Electrical couplings for connection to the ground rod and tripod
- 5 ft length of plastic-coated, #4 stranded copper cable
- 3 ft length of 14 AWG stranded copper wire with a connection lug on one end

CAUTION

- a. Because proper grounding of the system is required for both personal safety and reliable system function, we recommend a qualified electrician install the grounding kit.
 - b. If the station is not properly grounded, a computer connected to the weather station can also be damaged by electrical surges.
 - c. This kit is for ground installations only. A qualified electrician should design and install and the grounding system for a roof mounted station.
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