

HOBO[®] Weather Station User's Guide



Contact Information

For support, please contact the company that you bought the product from: Onset Computer Corporation or an Onset Authorized Dealer.

Onset Computer Corporation
470 MacArthur Blvd.
Bourne, MA 02532

Mailing Address:
P.O. Box 3450
Pocasset, MA 02559-3450
Phone: 1-800-LOGGERS (1-800-564-4377) or 508-759-9500
Fax: 508-759-9100

Hours of Operation: 8AM and 5PM Eastern Time
E-mail: loggerhelp@onsetcomp.com
Main Onset Web site: www.onsetcomp.com
FTP site: [ftp.onsetcomp.com](ftp://ftp.onsetcomp.com)

If you purchased the products through an Onset Authorized Dealer, you can also refer to www.hobohelp.com for support information.

Safety Information – Read first



WARNING: Severe shock hazard. Before installing weather station tripod or mounting poles, ensure that there are no electrical power lines overhead. Do not install the system during any atmospheric electrical activity. Do not assemble or transport tripods, mounting poles, or other structures unless there is sufficient clearance from potential electrical sources or other obstructions.



WARNING: Do not climb on or around the weather station tripod. The weather station and any of its associated hardware, towers, poles, etc. are not designed to support the weight of a person. Injury may result.



WARNING: If using stakes to stabilize the tower, ensure that there are no underground wires or pipes under the weather station.



WARNING: Fire, Explosion, and Severe Burn Hazard. The logger may contain a lithium battery. The battery may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not attempt to recharge or heat the logger or battery above +185°F (+85°C). Do not dispose of the logger or battery in fire. Do not expose the contents of the battery to water. Dispose of the battery according to local regulations for lithium batteries.



WARNING: Do not use weather station as part of a critical control system. This system is not intended to be a fail-safe mechanism for anticipating life-threatening conditions, such as flash floods.

© The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

© 2001–2004 Onset Computer Corporation, all rights reserved.

Printed in USA.

Part # DOC-H21, Doc #: 6106-E

Onset, HOBO, BoxCar, and HandCar are registered trademarks of the Onset Computer Corporation. Palm is trademark of Palm, Inc. Other products and brand names may be trademarks or registered trademarks of their respective owners.

Table of Contents

Chapter 1 Introduction	1
Specifications	1
How to use this manual.....	2
Smart sensors supported.....	2
Chapter 2 Initial setup and logger test	5
Items required	5
Initial setup and bench test instructions	5
Chapter 3 Logger configuration and operation	7
Logger components	7
<i>Status lights</i>	8
Communicating with the logger	8
<i>Launching</i>	9
<i>Reading out data</i>	10
Selecting and installing batteries	10
<i>Estimating battery life</i>	11
<i>Checking battery status</i>	12
<i>Changing batteries</i>	12
<i>Using a 9-Volt battery</i>	13
<i>Using a 9-Volt battery eliminator</i>	14
Adding and removing sensors	14
Time accuracy.....	15
Logger memory.....	16
Chapter 4 Field setup	17
Guidelines for typical field setup	17
Guidelines for other mounting configurations	18
Field preparation checklist.....	19
Steps for setting up the Weather Station	21
<i>Step 1: Assemble, level, and stabilize the 2 or 3 m tripod/lower mast</i>	22
2 meter tripod/lower mast assembly instructions:.....	22
3 meter tripod/lower mast assembly instructions:.....	25
<i>Step 2: Install the Grounding Kit</i>	29
<i>Step 3: Temporarily install the upper mast</i>	30
<i>Step 4: Mount the cross arm and wind sensor</i>	31
To mount the cross arm:	31
To mount the wind sensor on the cross arm:	31
<i>Step 5: Install other smart sensors</i>	33
Guidelines for installing sensors.....	33
Rain gauge installation instructions.....	33
Light sensor installation instructions.....	35
Temperature or temperature/RH sensor with solar radiation shield installation instructions.....	35
Soil moisture sensor installation instructions.....	37
Mount the barometric pressure sensor.....	38
Mount the 4-20 mA or 0-5 volt input adapters	38
Mount the pulse input adapter.....	38
<i>Step 6: Mount the upper mast to the lower mast</i>	39

<i>Step 7: Mount the logger enclosure to the upper mast</i>	40
<i>Step 8: Install the Guy Wire Kit</i>	42
<i>Step 9: Final positioning and leveling of sensors</i>	44
<i>Step 10: Plug in sensors, tie cables, and begin logging</i>	45
Chapter 5 Troubleshooting	49
Chapter 6 Maintenance, support, and service	51
Maintenance	51
<i>Performing a visual inspection</i>	51
<i>Cleaning the Weather Station</i>	51
<i>Checking the desiccant pack</i>	52
<i>Replacing the batteries</i>	52
<i>Verifying the sensor accuracy</i>	52
Who to contact for technical support	52
<i>Before calling</i>	53
<i>Onset Computer contact information</i>	53
Warranty.....	53
Returns.....	54
Repair policy	54
ASAP repair policy	54
Data-back service	54
Tune up service	54

Chapter 1

Introduction

The HOBO[®] Weather Station is a data logger designed for multi-channel climate monitoring. The Weather Station represents the next generation of data logging because it uses a network of smart sensors for taking measurements. Key features of the smart sensors include:

- **Automatic detection.** No extensive programming, wiring, or calibrating is required to set up sensors.
- **Easy expansion.** Because the logger is not pre-configured, up to 15 sensor parameters of any type or combination can be added simply by plugging them in before logging begins.
- **Digital network.** The connections between the smart sensors and the logger are digital, ensuring accurate, reliable data collection and storage.



Specifications

HOBO Weather Station	
Operating Range	-20° to 50°C (-4° to 122°F) with alkaline batteries, -40° to 70°C (-40° to 158°F) with lithium batteries
Sensor Inputs	10, expandable to 15 with optional adapters
Data Channels	Maximum of 15 (some sensors use more than one data channel; see sensor manual for details)
Communication	3.5 mm serial port or weatherproof external connector
Dimensions	23 cm H x 10 cm D x 18 cm W (9 x 4 x 7 inches)
Weight	0.9 kg (2 lbs)
Memory	512K nonvolatile flash data storage
Memory Modes	Stop when full, wrap around when full
Operational Indicators	Seven status lights provide logging and sensor network status
Logging Interval	1 second to 18 hours, user-specified interval
Battery Life	1 year typical use (up to 10 sensors with 10 minutes or longer logging interval)

HOBO Weather Station	
Battery Type	Four standard AA alkaline batteries included (for operating conditions -20° to 50°C [-4° to 122°F]); optional AA lithium batteries available for operating conditions of -40° to 70°C (-40° to 158°F)
Time Accuracy	0 to 2 seconds for the first data point and ±5 seconds per week at 25°C (77°F)
Data Type	Supports measurement averaging based on availability of supporting data from sensor
Logger Start Modes	Immediate, push-button, or delayed start options
Data Communication	Current reading while logging, offload while logging, or offload when stopped
Environmental Rating	Weatherproof
Mounting	Mast (3.8 cm [1.5 inches] maximum diameter) or wall mount
Enclosure Access	Hinged door secured by four screws
Sensor Network Cable Length	100 m (328 ft) maximum
Part Number	H21-002
 Specification	This product meets CE specification EN61326 criterion C for ESD, criterion C for Radiated Immunity, criterion B for Fast Transient, criterion A for Conducted Immunity, and criterion A for Power Frequency Magnetic Fields. To minimize measurement errors due to ambient RF, use the shortest possible probe cable length and keep the probe cable as far as possible from other cables.

How to use this manual

This manual walks you through the steps of setting up, operating, and maintaining the HOBO Weather Station. Use this manual to learn how to:

- Perform an initial test
- Operate the logger
- Set up the Weather Station in the field
- Troubleshoot problems
- Maintain the Weather Station and get service and support

It is important that you test your system using the steps in Chapter 2 before continuing with other chapters in the manual and installing the Weather Station on site.

For your convenience, this manual includes three section dividers to organize sensor manuals and hardware packing lists. It is recommended that you add all sensor manuals and hardware packing lists to this binder.

Smart sensors supported

At the time of printing, the following smart sensors and input adapters are available for use with the Weather Station:

- Temperature
- Temperature/relative humidity
- Rain
- Barometric pressure
- Soil moisture
- Wind speed
- Wind speed and direction
- Solar radiation
- Photosynthetic active radiation (PAR)
- 0-5 Volt Input Adapter
- 4-20 mA Input Adapter
- Pulse Input Adapter (contact closure and electronic switch)

Refer to www.onsetcomp.com for a current list of available sensors.

Refer to the manuals provided with the sensors for sensor specifications, mounting information, and recommended maintenance.

Chapter 2

Initial setup and logger test

Before setting up the Weather Station in the field, it is strongly recommended that you test the logger to make sure it is functioning properly.

Items required

To test the logger, you will need the following materials:

- Flat head screwdriver
- Four AA alkaline batteries (included with the logger) or four AA lithium batteries
- One or more smart sensors
- PC interface cable (included with logger software)
- Computer with logger software installed

Initial setup and bench test instructions

Complete the following steps to test your Weather Station.

1. Use a flat head screwdriver to loosen the four screws on the front cover of the logger. Open the logger door.

2. Unscrew the two thumbscrews on the battery door cover and remove the battery door. Insert four AA alkaline or lithium batteries, observing polarity. Once the batteries are installed correctly, the status lights will blink for a second.

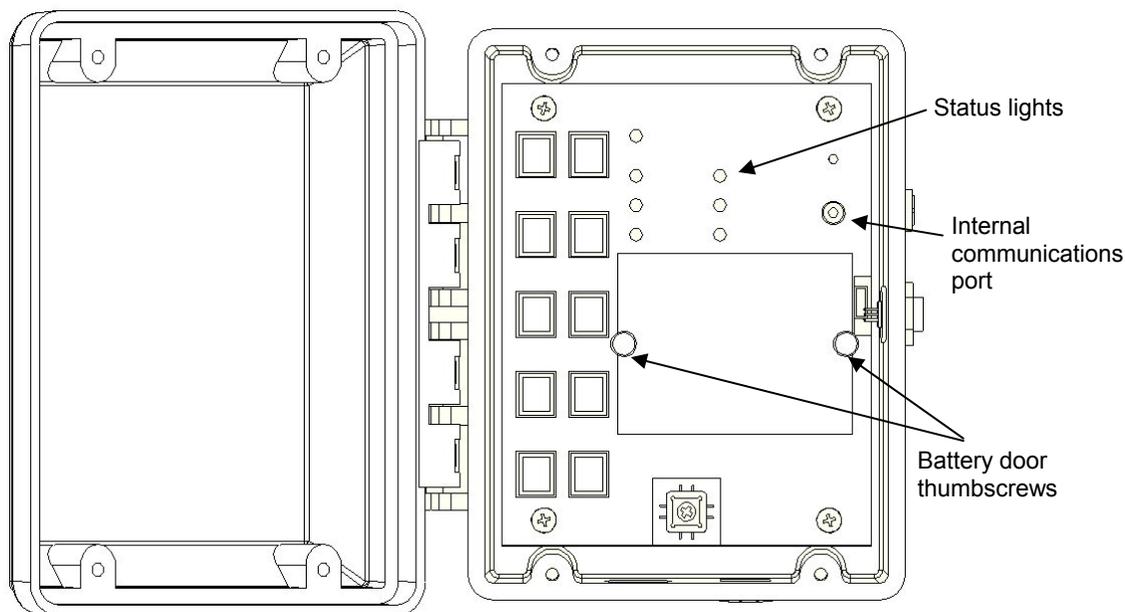


Figure 1: Logger components

3. Replace the battery door cover and thumbscrews.
4. Insert one or more sensors into the sensor ports. It is recommended that you test all sensors you plan to deploy with the logger.
5. Plug the PC interface cable into the internal communications port on the logger.
6. Using the logger software, click the Launch icon. If the logger is not found, make sure the correct COM port is selected. Refer to the software manual for details on changing the COM port.
7. Make sure all the sensors connected to the logger are visible in the Launch screen.
8. Choose a logging interval of a few seconds so that your test will yield enough data to analyze. Select the Start Logging Now option, and click the Start button to launch the logger. The “logging ok” light on the logger should blink every two seconds during logging.
9. After a couple of minutes, click the Readout icon in the logger software to offload data from the logger. You can choose to either stop the logger before reading it out, or let it continue logging while reading out.
10. Check the data and make sure it appears normal for all sensors.

Congratulations! You have now launched and offloaded the Weather Station. There are many additional features to the logger described in Chapter 3. Refer to Chapter 4 for a checklist to help you prepare for deploying the logger. Chapter 5 has detailed instructions for assembling the Weather Station system.

Chapter 3

Logger configuration and operation

This chapter explains key elements of Weather Station operation, including:

- ✓ Definition of logger components
- ✓ How to communicate with the logger, including launching and reading out
- ✓ Guidelines for selecting and installing batteries
- ✓ Time accuracy of the logger
- ✓ Logger memory

Logger components

The following diagram explains the key parts of the Weather Station.

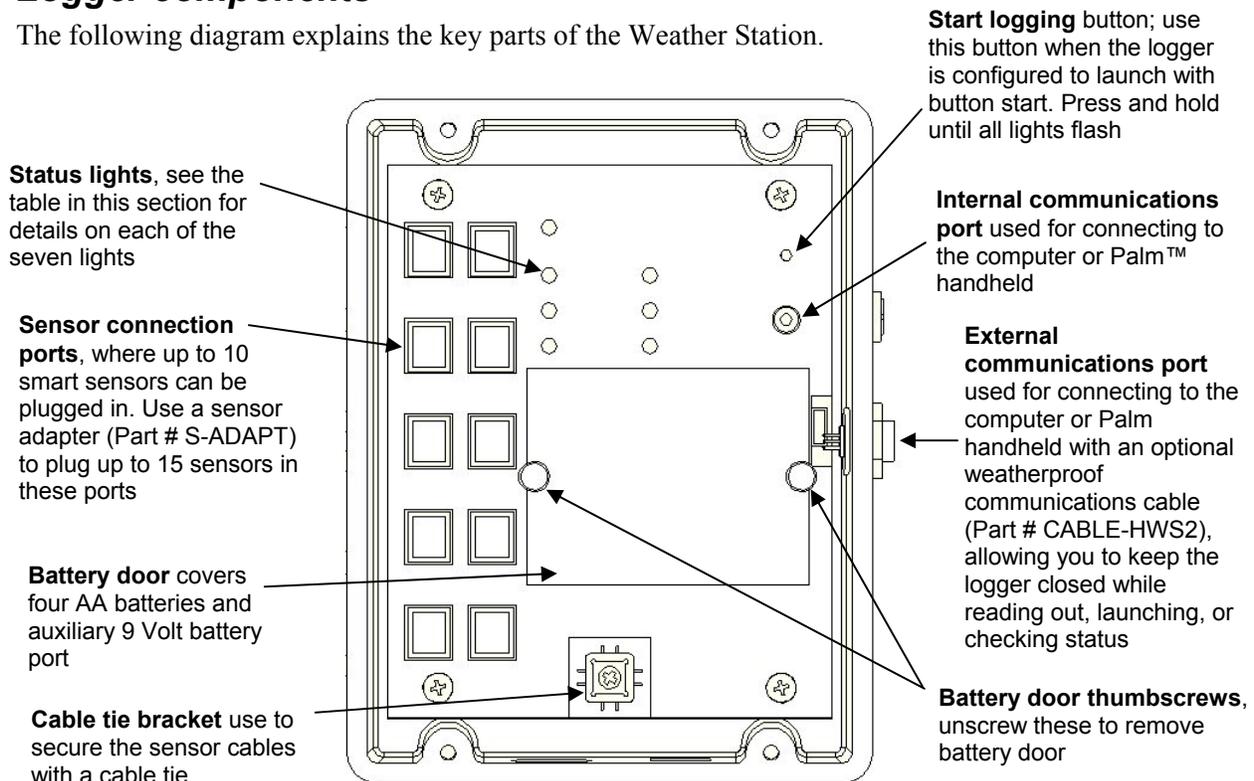


Figure 2: All logger components

Status lights

There are seven lights on the Weather Station that indicate logger activity and status. The following table explains the function of these lights.

This light:	Blinks when:	Notes
Sensor Activity	There is activity on the sensor network.	Network activity is defined as communication from the logger to the sensor or vice versa.
Delay Start	The logger has been configured to launch with a delayed start; will continue blinking until the defined start date/time.	The logger will not record measurements while this light is blinking. Sensors can be added at this time.
Button Start	The logger has been configured to start with a button start; will continue blinking until you press and hold the button on the logger for a couple of seconds.	The logger will not record measurements while this light is blinking. Sensors can be added at this time.
OK	Every two seconds while the logger is recording data from sensors.	Sensors <i>cannot</i> be added at this time.
Bat Low	The battery power is less than 25% capacity.	The logger will continue to run. However, you should read out the logger and then replace the batteries soon.
Mem Low	Less than 25% of memory is available for saving data.	The logger will continue to run until all memory is used. This light will only blink if the launch parameter "Wrap Around When Full" is not selected (see the <i>Launching</i> section on page 9 for details on the Wrap Around When Full setting).
Error	There is or has been a sensor communication failure.	<p>If this light is blinking in conjunction with the OK light, there was a communication failure. The system has recovered, but you may have an intermittent problem.</p> <p>If this is the only blinking light, then at least one sensor is currently not communicating. Immediate investigation is recommended.</p> <p>In general, it is recommended that you read out any data when this light is blinking, investigate the problem, and re-launch the logger.</p>

Communicating with the logger

You can launch, read out, or check the status of the Weather Station with logger software on the computer. You can also use HandCar[®] software to launch the logger, read out, and check status with a Palm[™] handheld (custom launch parameters can only be specified with the computer).

The logger has both an internal and external communication port for connection with a computer or Palm handheld. The internal port is located inside the logger enclosure (labeled "comm. port"). The external port is located outside the logger enclosure (see Figure 2) and requires the weatherproof external communications cable (Part # CABLE-HWS2). Use this port to quickly connect to the logger without having to open the logger door.

To connect the logger to the computer or Palm handheld:

1. Open the logger and plug the PC interface or Palm-to-Logger cable into the Comm Port serial jack. Or, keep the logger closed and plug the cable into the optional external weatherproof communications cable (Part # CABLE-HWS2) on the side of the logger.
2. Plug the other end of the PC interface cable into an open COM port on the computer. Or, connect the other end of the Palm-to-Logger cable to a Palm handheld.

Once connected to the computer, use logger software on the computer to configure the launch, read out the logger, or simply check the status. With the Palm handheld, use HandCar to launch, read out, or get current sensor readings. See the following sections for general information on launching and reading out. Refer to the software user's guide for detailed information.

In addition to serial communication, the following optional communication methods are available for use with the logger:

- Remote Modem, for communicating with the Weather Station via an analog phone line.
- Radio Modem, for communicating with the Weather Station wirelessly within a specified range

Both solutions require Remote Site Manager software and connecting the logger to the modem with the external weatherproof communications cable. For instructions on setting this up, refer to the *Remote Modem User Guide*, *Radio Modem Operation Manual*, and *Remote Site Manager User's Guide*.

Launching

There are several parameters you can enter when launching the Weather Station with the logger software. To launch the logger, connect to it as described in *Communicating with the logger* on page 8 and then enter the following launch parameters. **Note:** If you are launching the logger with HandCar on a Palm handheld, the logger will be launched with the parameters you last entered in the logger software on the computer.

Launch parameter	Description
Description	Enter a description of the launch.
Battery type	Make sure the appropriate battery type is selected, otherwise the battery gauge will not be accurate when checking the logger status.
Logging interval	Set how often the logger will record data (for example every 30 minutes, hour, etc). The minimum logging interval is 1 second and the maximum is 18 hours. Keep in mind that the faster the logging interval, the more quickly the batteries will be depleted. See the <i>Estimating Battery Life</i> section on page 11 for more details.
Sampling interval	For use with sensors that support software-selectable measurement averaging. The sampling interval sets how often sensors will take measurements between logging intervals. Check the sensor's data sheet or manual to determine if your sensor supports measurement averaging. When a sampling interval is used during launch, all the sampled measurements for the sensor are averaged together and the average is then recorded as one data point at each logging interval. The individual data points that comprise the average are not saved; only the final, averaged data point is saved. Set the sampling interval to one of the predefined settings from 1 second to 4 minutes. The sampling interval must be less than or equal to the logging interval. Sampling rates shorter than 1 minute will reduce the logger's battery life. Important: If you do not have any sensors that support measurement averaging, set the sampling interval to "Off" as there will be no benefit and it will reduce

Launch parameter	Description
	battery consumption.
When to start logging	<p>Choose one of the following start modes for the logger:</p> <ul style="list-style-type: none"> • Start logging now. The logger will start recording measurements as soon as you are finished configuring the launch. • Delayed start. The launch is postponed until the exact date and time you specify. You can add sensors to the logger any time before the specified start time. • Button start. The launch will not start until you press a button on the logger. This allows you to configure the launch settings in advance, but start the actual launch when you want without choosing a specific date and time. You can add sensors any time before pressing the button on the logger. • Save settings for a later launch. Select this option when you want to save the current launch settings for a future launch, but not start the launch now (for example, prior to heading into the field). This is useful if you plan on launching the logger with a Palm handheld, which doesn't allow you to change launch settings.
Wrap around when full	When this box is checked, new data will overwrite the oldest data in the logger sequentially one sample at a time when the memory is full. The logger will continue logging indefinitely until either the logger is read out and stopped or the battery fails. If this box is not checked, the logger will stop logging when the memory is full and preserve acquired data. For more information on memory, see the <i>Logger memory</i> section on page 16.
Edit sensor locations	Give each sensor a name of up to 30 characters to help identify individual sensors.
Deployment notes	Add up to 2000 characters of notes about the launch.

Reading out data

You can read out data (offload) the logger with logger software. Connect to the logger as described in *Communicating with the logger* on page 8 and then read it out. If the logger is logging, you can choose to either stop the logger before reading out or let it continue logging while reading out.

Readout speed depends on the method used to connect to the logger and the device being used. Typically, a readout via PC interface cable with the computer will take about six minutes for full memory (512K of data). A full logger readout via the Remote or Radio Modem may take up to 20 minutes, and 30 minutes with a Palm handheld. For more details on logger capacity, see *Logger memory* later in this chapter.

Selecting and installing batteries

The Weather Station requires four 1.5 V AA batteries. The logger is shipped with four alkaline batteries, but it is also compatible with lithium batteries. For most applications, alkaline batteries are the preferred solution because:

- They are relatively inexpensive
- The battery gauge in the logger software will provide an accurate battery status
- They have slightly more usable capacity than 1.5 Volt lithium batteries in temperate environments

In cold applications (below 0°C [32°F]) and hot applications (above 40°C [104°F]), lithium batteries will generally outperform alkaline batteries. Alkaline batteries will still work in temperatures ranging from 40° to 50°C (104° to 122°F) and from -20° to 0°C (-4° to 32°F), however, they may not be the best choice. At temperatures lower than -20°C (-4° F) and higher than 50°C (122°F), alkaline batteries are unsuitable; use lithium instead. If the temperature is variable across the extremes, use lithium batteries. Use the following figure to help you choose the battery type based on the expected temperature range in your deployment.

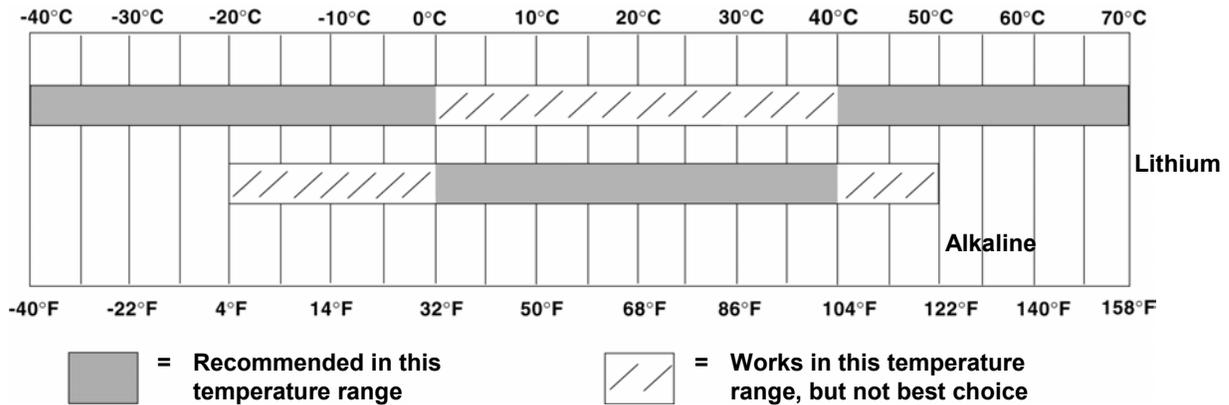


Figure 3: Recommended battery type based on temperature

Note:

- The logger is not designed to run with rechargeable or Carbon Zinc “Heavy Duty” batteries.
- The use of types other than 1.5 Volt alkaline or lithium batteries may result in poor battery performance and erroneous battery state indication.



WARNING: Fire, Explosion, and Severe Burn Hazard. Do not mix battery types, either by chemistry or age; batteries may rupture or explode. When replacing the batteries, read and follow their disposal instructions; dispose of lithium batteries according to local regulations. Do not dispose of batteries in fire. Never attempt to recharge a lithium or alkaline battery. Do not heat the batteries above 185°F (85°C). Do not mutilate or rupture the battery housing. Lithium batteries may explode if the logger is exposed to extreme heat or conditions that could damage or destroy the battery case. Do not expose the contents of the battery to water.

Estimating battery life

Battery life will vary with:

- Logging and sampling intervals (most important factor)
- The number of sensors connected
- Battery type
- Operating environment

Use the following table to help you estimate how long the batteries will last (the run time) based on the logging interval selected and the number of sensors connected. **Note:** The run times in this table assume that the recommended battery type for the temperature range is being used.

Logging Interval	Sampling Interval	1 to 5 sensors	5 to 10 sensors	10 to 15 sensors
1 second	Off	30 to 50 days	20 to 40 days	15 to 30 days
1 minute	Off	12 months	9 to 12 months	7 to 10 months
10 minutes	1 minute	12 months	12 months	9 to 12 months
15+ minutes	1 minute	12 months	12 months	9 to 12 months

Additional guidelines:

- Turn off the sampling interval unless you have sensors that support measurement averaging. At the time of publication, only the 12-bit Temperature, Soil Moisture, Barometric Pressure, Photosynthetically Active Radiation, and Solar Radiation smart sensors and the 4-20 mA and 0-5 Volt input adapters supported measurement averaging. Check the sensor manual to see if your sensor supports measurement averaging.
- Make sure the “Use Before” date on the battery housing is at least two years from the current date.
- Alkaline batteries will lose up to 10% of capacity a year sitting on a hot shelf and can lose up to 50% or more if “cooked” repeatedly (for example, stored on a car dashboard). Keeping batteries in the refrigerator can reduce self-discharge to 1 to 2% per year, however, be sure to avoid condensation forming on the batteries.
- Use new batteries if you expect the deployment to require a substantial portion of battery life based on the table above.
- Batteries are relatively inexpensive; don’t take a chance with suspect batteries.

Checking battery status

There are two ways to check the battery status of the logger:

- Check the Bat Low light on the logger. This light blinks when the battery has 25% or less capacity remaining.
- Check the status with the logger software. For alkaline batteries, the status is displayed in the percentage of capacity remaining. Lithium battery voltage is either listed as “good,” which represents anywhere from 25 to 100% of capacity remaining, or “empty,” which represents 0 to 25% of capacity remaining. Lithium batteries have a relatively flat discharge curve, which means the voltage does not vary much with use until they fail. Because of the uncertainty in capacity, it is recommended that you start new launches with fresh lithium batteries that you know are at 100% rather than relying on old ones.

Changing batteries

It is always recommended that you read out the logger before replacing batteries. If you replace the batteries while the logger is logging, it will stop recording data. The data will not be overwritten, however, until the next launch.

Follow these steps to change the batteries.

1. If the logger is currently logging, you will need to stop logging and readout the data. If you do not want to stop the logger, see the next section for instructions on how to use a 9-volt battery to temporarily continue power while changing the batteries.
2. Unscrew the two thumbscrews on the battery door cover and remove the battery door.
3. Remove the old AA batteries.
4. Insert the new AA batteries.
5. Replace the battery door cover and thumbscrews.
6. Launch the logger using the computer or Palm handheld.
7. Double-check the battery gauge in the logger software to make sure the batteries you installed are full capacity.
8. Replace the battery door cover and thumbscrews.

Using a 9-Volt battery

The Weather Station has an additional 9-volt battery connector adjacent to the four AA battery compartment. Insert a 9-volt battery to temporarily maintain the power to the logger, which allows you to replace aging AA batteries with fresh ones without interrupting logging. To do this:

1. Unscrew the two thumbscrews on the battery door cover and remove the battery door.
2. Plug a 9 Volt battery into the battery connector to the right of the four AA batteries (observe polarity). Press firmly to make sure the connection is solid.
3. Remove the old AA batteries.
4. Insert the new AA batteries.
5. Remove the 9 Volt battery.
6. Replace the battery door cover and thumbscrews.
7. Verify that the logger is operating normally by checking that the “Logging OK” status light is still blinking every two seconds.

While it is possible to run the logger with only a 9 Volt battery, it is not recommended for extended deployment for the following reasons:

- A 9 Volt battery will only last about one to two months (typical use).
- The logger and its software do not provide an accurate battery level indication for a 9 Volt battery.
- The logger battery door cannot be used with a 9 Volt battery in place, it is possible that the batteries will shake loose.
- The 9 Volt battery cannot be used as a “backup” battery. The opposite actually occurs; the 9 Volt battery will be used first, and then the AA batteries will be used.

Note: When changing batteries on the fly, the 9 Volt battery must have at least 7.5 volts remaining. If the 9 Volt battery has less than 7.5 volts, the battery gauge will not reset when new AA batteries are installed. Use a fresh 9 Volt battery if you find that the battery gauge does not reset.

Using a 9-Volt battery eliminator

In some applications where AC power is available, it may be convenient to use a 9 Volt battery eliminator to power the logger. 9 Volt DC supplies are commonly available from electronics supply stores (Radio Shack catalog number 273-1552B). Minimum DC current should be 9 mA. If four AA batteries are also used with the 9V battery eliminator, they will serve as back-up batteries. **Note:** The batteries will NOT be charged and rechargeable batteries should not be used with the logger.

Adding and removing sensors

Smart sensors plug into the logger and collect data about various weather parameters. Before you bring the logger and sensors to the field, it is important that you gather and test all the sensors. Specifically, you should:

- Plug in all the sensors you plan to use,
- Make sure they are communicating, and
- Make sure the readings are valid.

To add a sensor, simply plug it into a sensor port on the logger. Follow these guidelines when adding sensors:

- **Never add or remove sensors while the logger is recording data.** Sensors should only be added while the logger is stopped, when configuring the launch parameters with logger software, or after configuration but before the start of logging in Delayed Start or Button Start modes (for more information on these modes, see the *Launching* section on page 9).
- **Any sensors added while the logger is recording data will be ignored.** Logging will continue normally for other sensors. If a sensor is removed while logging, the Sensor Error status light will blink when the next logging interval is reached. The data for that sensor will then display as missing or erroneous in readouts.
- **You cannot replace one sensor with a new sensor of the same type while logging.** If you would like to replace a sensor with another sensor of the same type (for example, swap a temperature sensor with a new temperature sensor), it is necessary to read out the current data from the logger and re-launch with the new sensor.
- **A maximum of 15 data channels can be used with one logger.** Most sensors use one data channel, which means the sensor is measuring one property only (for example a temperature sensor uses one data channel that records information for temperature). However, there are some sensors that measure more than one property, such as the combination temperature/RH sensor, which uses two data channels.
- **To expand the number of sensors plugged in and data channels used, use 1-to-2 sensor adapters** (Part # S-ADAPT), which allow you to plug two sensors into one port. Note that the 1-to-2 adapter is similar to a standard telephone splitter, but it has 6 conductors. Most telephone splitters have only 4 conductors. A 4-conductor splitter may work, but it is not recommended because the shield in the cable will not be properly grounded.
- **The logger can work with a maximum of 100 meters (328 feet) of smart sensor network cable,** which is the digital communications portion of the sensor cables. If you are using multiple sensors, be sure to check the length of each smart sensor network cable reported in the Sensor Manuals. Add them together and make sure they *do not exceed 100 meters (328 feet)*.

Time accuracy

Upon launch, the logger's clock is set in Coordinated Universal Time (UTC), which is determined from the clock on your computer or Palm handheld. Once the logger is logging, it will keep fairly accurate time. However, there are three main sources of errors with time reporting.

- Host clock error.** A common source of error is an incorrect time in the computer or Palm handheld used to launch the logger. Make sure the clock on your computer or Palm handheld is set to the correct date and time before launching the logger. One resource for calculating accurate time settings for UTC (colloquially known as Greenwich Mean Time or GMT) is the www.time.gov web site. Also be sure to set the correct time zone in HandCar if launching the logger with the Palm handheld.
- Start-up error.** The logger can lose as much as 2 seconds when it is launched. This is a one-time error that occurs as part of the start-up sequence and cannot be avoided.
- Clock drift.** The long-term time accuracy is a function of temperature. The worst-case error is ± 8 parts per million (PPM) a week at 25°C , which is about 5 seconds per week. The error increases as the temperature deviates from 25°C (see the figure below). If the temperature were a constant -20°C , the logger time error could be as much as 35 ppm (21 seconds per week).

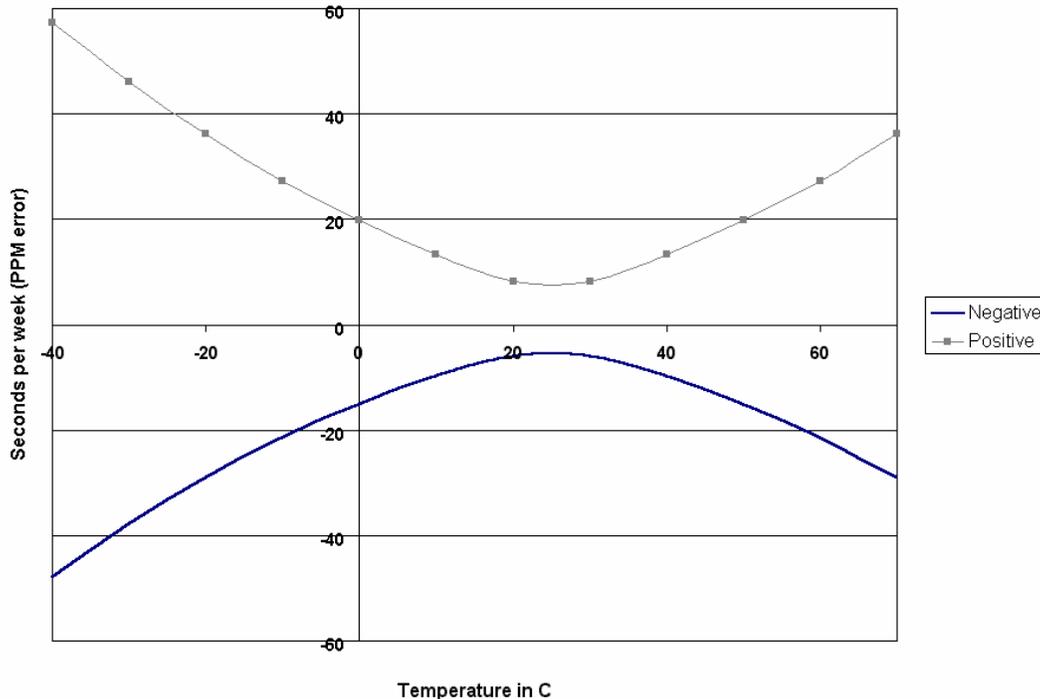


Figure 4: Worst case time error

Reading out the logger and relaunching it will reset the logger's clock. This is useful when your logger has been running for a while and its clock needs to be reset. Just be sure the computer or Palm handheld clock is set accurately before relaunching.

Logger memory

The logger uses non-volatile memory, which means it retains data indefinitely once power runs out. Specifically, the logger uses a high-capacity Flash memory to store data, which can retain the data even when the batteries are removed. This type of memory is very durable.

If the logger dies in the field from dead batteries, replace them and read out the logger immediately. Do not relaunch the logger until the data has been recovered. If your logger is damaged, contact Onset Computer because there is a chance the data can be recovered. Refer to Chapter 6 for information about returning loggers for data recovery.

The logger contains 512K bytes of memory. Up to 10K of this memory is used to store the launch configuration and user notes, leaving at least 502K bytes for data storage. The logger software automatically estimates how long the logger will record data until the memory is full (the run time) based on the logging interval and the number and type of sensors connected. In general, adding sensors decreases running time while increasing the logging interval increases running time. In most applications, battery life limits the duration of the data logging before memory capacity.

The following figure shows the expected run time for several logging intervals based on the total number of bits in place, which is determined by adding together the bits per sample for each sensor measurement parameter in your system. For example, a logger with the following sensors is using 70 total bits.

4 Temperature	X	8	=	32
1 Wind Speed	X	16	=	16
1 PAR	X	10	=	10
1 Rain Gauge	X	12	=	12
Total number of bits				70

At a logging interval of 5 minutes, the memory run time for a Weather Station using 70 bits would be approximately 200 days (based on Figure 5). See the sensor's manual for the number of bits each type of sensor uses.

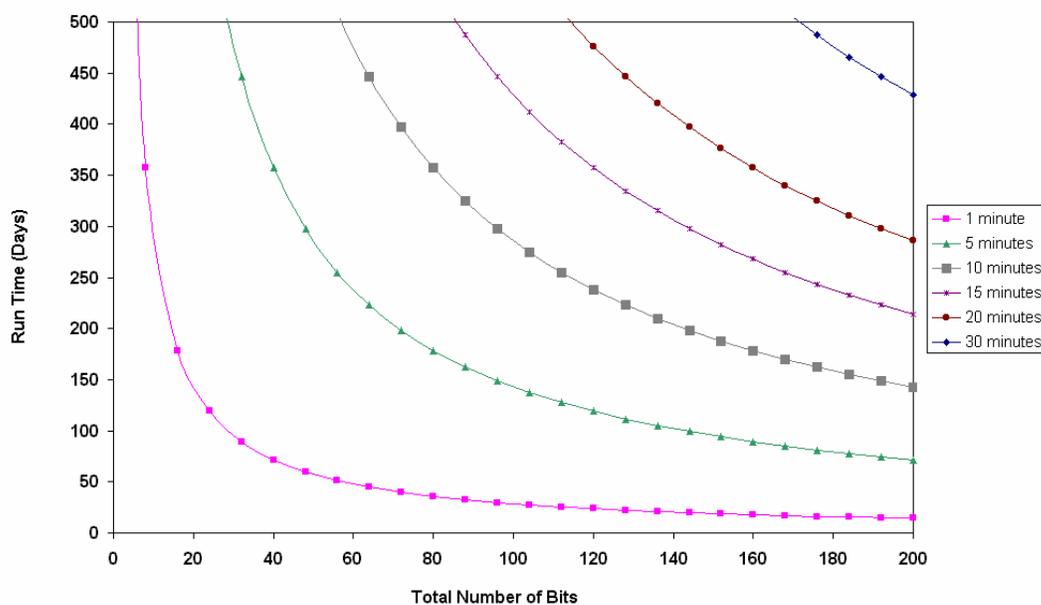


Figure 5: Memory run time

Chapter 4

Field setup

After you've configured the logger and gathered the necessary materials for the field, you are ready to assemble the Weather Station. This chapter includes:

- ✓ Guidelines for typical field setup
- ✓ Guidelines for other mounting configurations
- ✓ Field preparation checklist
- ✓ Steps for setting up the Weather Station

Guidelines for typical field setup

Use the following guidelines to help you choose an appropriate site for setting up the Weather Station and protecting against field hazards.

- When possible, select a location away from trees and buildings, particularly if you will be using the rain gauge or wind speed sensors. Place the rain bucket at a distance away from obstructions that is equal to at least three times the height of the nearest tree, building, or other obstruction, and the wind speed sensor at a distance away from obstructions that is equal to at least five times the height of the obstruction.
-  **WARNING: Severe shock hazard.** Do not set up the HOBO Weather Station near power lines. Contact between the HOBO Weather Station and power lines may result in a fatal shock, electrocution, or death.
- Avoid placing the logger in extremely hot locations (such as on a dashboard or the roof of a greenhouse) and chronically wet locations (such as in a well or any place that is wet most or all of the time). Also avoid rising water and flood zones.
- Conduit is recommended when placing a sensor in or near the ground to protect against animals, lawn mowers, tractors, exposure to chemicals, etc.
- Beware of rodents, birds, cattle, and other animals that can bite, peck, or trample the Weather Station.
- Avoid placing the sensors near falling rocks, dead trees, or other objects that could fall on the HOBO Weather Station.
- A Grounding Kit (Part # M-GKA) is required if using the wind speed or wind speed and direction sensor with the logger. A Grounding Kit is recommended if the logger will be placed in an exposed location on a tripod or tower to reduce the chance of damage from atmospheric electrical activity.

- If possible, avoid sites immediately adjacent to radio/television/microwave towers and equipment. In rare situations, strong electromagnetic interference may result in sensor network errors.
- Take note of the mounting considerations in the Sensor Manuals for additional guidelines relative to the particular sensors you are using.
- For areas with winds greater than 50 mph, or if the rain gauge is attached to the top of the mast, use the Guy Wire Kit (Part # M-GWA) and 1/2 inch Stake Kit (Part # M-SKA) to reduce wind-induced vibration.
- **2 meter Tripod Tower Assembly (Part # M-TPB):** You must set up the tower on level ground; there should be no ground slope. The legs on the 2 meter tower are non-adjustable. If the site you are using is not level, then you will need to either level it or use shims to level the tripod. Be prepared to dig if necessary. Suggested Mounting: Use 1/4 inch Stake Kit (Part #M-SKB).
- **3 meter Tripod Tower Assembly (Part # M-TPA):** The maximum ground slope is 13 degrees. The legs on the 3 meter tower allow for limited adjustment on uneven ground. Be prepared to dig if necessary if the slope is significant. Suggested Mounting: Use 1/2 inch Stake Kit (Part # M-SKA).
- It is recommended that two people set up most tripod systems. Some assemblies are heavy and are easier to handle with two people.
- Be sure to stabilize, level, and secure the tripod on firm ground. It may be necessary to adapt the installation to the existing site conditions as necessary (for example, if mounting the tripod on ice or rock, you may need to use a masonry clamp to secure it).
- If operating in a wet environment, place several desiccant packs in the logger and plug the vent hole in the bottom of the logger enclosure to minimize moisture.

Guidelines for other mounting configurations

It is possible to mount the logger and sensors on either a 1.5 meter or 3 meter mast (Part # M-MPB and M-MPA respectively). The shorter mast is especially useful for smaller system configurations where you are trying to minimize the size and visibility of the system.

There are many ways to install the mast depending on the site. Common mounting methods include pounding the post into the ground, setting it into concrete, and bolting it to existing structures.

- If you will be mounting PAR, wind speed, or rain gauge sensors, be sure that you install the mast vertically (using Mast Level, Part # M-MLA).
- Use the Guy Wire Kit (Onset Part # M-GWA) to stabilize a tall mast. Use 1/2 inch stakes (Part # M-SKA) to secure the guy wires.
- Mount the logger vertically and high enough that ground splash will not enter the vent on the underside of the enclosure.
- If using U-bolts, make sure they are for 1-5/8 inch pipe because that is the hole spacing on the logger mounting bracket.
- If mounting the logger to a post or wall, note that it is 2.06 inches between the center of the holes in the mounting brackets. It is recommended that you use 5/16 inch diameter bolts to mount the logger.

Field preparation checklist

Use the following checklist to make sure you have all the necessary materials for setting up a Weather Station system.

✓	Task																																																				
	Check that you received all the parts for the Weather Station system as ordered.																																																				
	Configure the logger. Install batteries and set up the logger for launch. For details, see Chapters 2 and 3.																																																				
	If you opened any parts: Double-check the packing lists to make sure no pieces are missing.																																																				
	Attach the mounting feet. See instructions on page 40.																																																				
	If you are using the Solar Radiation Shield: Set up the Temperature and Temperature/RH sensors. There are several small pieces required to connect these sensors to the shield that could easily get lost in the field. It is strongly recommended you install these sensors in the solar radiation shield before going to the field. See page 35 in Step 5 for instructions.																																																				
	If you are using the barometric pressure sensor, attach it to the logger now. See page 38 for details.																																																				
	Repack the logger and sensors for transit. It is strongly recommended that you use the original packaging when possible because it is custom-designed to protect the weather station and its components.																																																				
	<p>Gather the tools required for setup. Use the following checklists to make sure you have the necessary tools to set up the logger in the field. “Optional” items depend on your site needs.</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">Logger</th> <th colspan="2" style="text-align: left;">Rain Gauge Sensor</th> </tr> <tr> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>1/2 inch wrench</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Mast level (Part # M-MLA) (optional; for mounting on separate mast)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Flathead screwdriver</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Sledgehammer or post driver (optional; for mounting on separate mast)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Desiccant (optional)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Eye protection—safety glasses (if using sledgehammer/post driver)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td>Slotted screwdriver</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td></td> <td></td> <td>Conduit (optional)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th colspan="2" style="text-align: left;">Light Sensor</th> <th colspan="2" style="text-align: left;">Wind Speed/Direction Sensor</th> </tr> <tr> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Ladder (if deploying sensor above eye level)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>7/16 inch wrench</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Light sensor level (Part #M-LLA)</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Crescent wrench (or second 7/16 inch wrench)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Phillips head screwdriver #1</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>1.06 inch/2.00 inch hose clamps (if mast mounting without cross arm)</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> <tr> <td>Compass</td> <td style="text-align: center;"><input type="checkbox"/></td> <td>Phillips-head screwdriver</td> <td style="text-align: center;"><input type="checkbox"/></td> </tr> </tbody> </table>	Logger		Rain Gauge Sensor		Item	✓	Item	✓	1/2 inch wrench	<input type="checkbox"/>	Mast level (Part # M-MLA) (optional; for mounting on separate mast)	<input type="checkbox"/>	Flathead screwdriver	<input type="checkbox"/>	Sledgehammer or post driver (optional; for mounting on separate mast)	<input type="checkbox"/>	Desiccant (optional)	<input type="checkbox"/>	Eye protection—safety glasses (if using sledgehammer/post driver)	<input type="checkbox"/>			Slotted screwdriver	<input type="checkbox"/>			Conduit (optional)	<input type="checkbox"/>	Light Sensor		Wind Speed/Direction Sensor		Item	✓	Item	✓	Ladder (if deploying sensor above eye level)	<input type="checkbox"/>	7/16 inch wrench	<input type="checkbox"/>	Light sensor level (Part #M-LLA)	<input type="checkbox"/>	Crescent wrench (or second 7/16 inch wrench)	<input type="checkbox"/>	Phillips head screwdriver #1	<input type="checkbox"/>	1.06 inch/2.00 inch hose clamps (if mast mounting without cross arm)	<input type="checkbox"/>	Compass	<input type="checkbox"/>	Phillips-head screwdriver	<input type="checkbox"/>
Logger		Rain Gauge Sensor																																																			
Item	✓	Item	✓																																																		
1/2 inch wrench	<input type="checkbox"/>	Mast level (Part # M-MLA) (optional; for mounting on separate mast)	<input type="checkbox"/>																																																		
Flathead screwdriver	<input type="checkbox"/>	Sledgehammer or post driver (optional; for mounting on separate mast)	<input type="checkbox"/>																																																		
Desiccant (optional)	<input type="checkbox"/>	Eye protection—safety glasses (if using sledgehammer/post driver)	<input type="checkbox"/>																																																		
		Slotted screwdriver	<input type="checkbox"/>																																																		
		Conduit (optional)	<input type="checkbox"/>																																																		
Light Sensor		Wind Speed/Direction Sensor																																																			
Item	✓	Item	✓																																																		
Ladder (if deploying sensor above eye level)	<input type="checkbox"/>	7/16 inch wrench	<input type="checkbox"/>																																																		
Light sensor level (Part #M-LLA)	<input type="checkbox"/>	Crescent wrench (or second 7/16 inch wrench)	<input type="checkbox"/>																																																		
Phillips head screwdriver #1	<input type="checkbox"/>	1.06 inch/2.00 inch hose clamps (if mast mounting without cross arm)	<input type="checkbox"/>																																																		
Compass	<input type="checkbox"/>	Phillips-head screwdriver	<input type="checkbox"/>																																																		

✓	Task																																																																																														
	<p>Gather the tools required for setup (continued)</p> <div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>Soil Moisture Sensor</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Trenching shovel, spade, or flat bar</td> <td></td> </tr> <tr> <td>Water (optional)</td> <td></td> </tr> </tbody> </table> </div> <div style="width: 48%;"> <p>Temperature/RH or Temp Sensor</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Phillips head screwdriver #1 (if sensors are not already installed)</td> <td></td> </tr> <tr> <td>Conduit (optional)</td> <td></td> </tr> </tbody> </table> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>Barometric Pressure Sensor</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Hook and loop tape</td> <td></td> </tr> </tbody> </table> </div> <div style="width: 48%;"> <p>Pulse Input Adapter</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Two wire nuts</td> <td></td> </tr> </tbody> </table> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>0-5 Volt Input Adapter</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Hook and loop tape</td> <td></td> </tr> </tbody> </table> </div> <div style="width: 48%;"> <p>4-20 mA Input Adapter</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Hook and loop tape</td> <td></td> </tr> </tbody> </table> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>3 m or 2 m Tripod with Mast (M-TPA or M-TPB)</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>1/2 inch wrench</td> <td></td> </tr> <tr> <td>Mast level (Part # M-MLA)</td> <td></td> </tr> <tr> <td>Medium size wire cutters</td> <td></td> </tr> <tr> <td>Crescent wrench</td> <td></td> </tr> <tr> <td>Redimix cement (optional)</td> <td></td> </tr> <tr> <td>Shovel (optional)</td> <td></td> </tr> <tr> <td>All purpose grease</td> <td></td> </tr> <tr> <td>Tape measure</td> <td></td> </tr> <tr> <td>Tie wraps</td> <td></td> </tr> </tbody> </table> </div> <div style="width: 48%;"> <p>Cross Arm (M-CAA) or (M-CAB)</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>1/2 inch wrench</td> <td></td> </tr> <tr> <td>Crescent wrench</td> <td></td> </tr> </tbody> </table> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>3 m Mast (M-MPA)</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>1/2 inch wrench</td> <td></td> </tr> <tr> <td>Sledgehammer or post driver</td> <td></td> </tr> <tr> <td>Eye protection—safety glasses (if using sledgehammer/post driver)</td> <td></td> </tr> <tr> <td>Mast level (Part # M-MLA)</td> <td></td> </tr> <tr> <td>Redimix cement (optional)</td> <td></td> </tr> <tr> <td>Shovel (optional)</td> <td></td> </tr> <tr> <td>All purpose grease</td> <td></td> </tr> <tr> <td>Tape measure</td> <td></td> </tr> </tbody> </table> </div> <div style="width: 48%;"> <p>Stake Kit (M-SKA) or (M-SKB)</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Sledgehammer</td> <td></td> </tr> <tr> <td>Eye protection—safety glasses</td> <td></td> </tr> </tbody> </table> </div> </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 48%;"> <p>1.5 m Mast (M-MPB)</p> <table border="1"> <thead> <tr> <th>Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>Sledgehammer or post driver</td> <td></td> </tr> <tr> <td>Eye protection—safety glasses</td> <td></td> </tr> <tr> <td>Mast level (Part # M-MLA)</td> <td></td> </tr> <tr> <td>Redimix cement (optional)</td> <td></td> </tr> <tr> <td>Shovel (optional)</td> <td></td> </tr> <tr> <td>All purpose grease</td> <td></td> </tr> <tr> <td>Tape measure</td> <td></td> </tr> </tbody> </table> </div> </div>	Item	✓	Trenching shovel, spade, or flat bar		Water (optional)		Item	✓	Phillips head screwdriver #1 (if sensors are not already installed)		Conduit (optional)		Item	✓	Hook and loop tape		Item	✓	Two wire nuts		Item	✓	Hook and loop tape		Item	✓	Hook and loop tape		Item	✓	1/2 inch wrench		Mast level (Part # M-MLA)		Medium size wire cutters		Crescent wrench		Redimix cement (optional)		Shovel (optional)		All purpose grease		Tape measure		Tie wraps		Item	✓	1/2 inch wrench		Crescent wrench		Item	✓	1/2 inch wrench		Sledgehammer or post driver		Eye protection—safety glasses (if using sledgehammer/post driver)		Mast level (Part # M-MLA)		Redimix cement (optional)		Shovel (optional)		All purpose grease		Tape measure		Item	✓	Sledgehammer		Eye protection—safety glasses		Item	✓	Sledgehammer or post driver		Eye protection—safety glasses		Mast level (Part # M-MLA)		Redimix cement (optional)		Shovel (optional)		All purpose grease		Tape measure	
Item	✓																																																																																														
Trenching shovel, spade, or flat bar																																																																																															
Water (optional)																																																																																															
Item	✓																																																																																														
Phillips head screwdriver #1 (if sensors are not already installed)																																																																																															
Conduit (optional)																																																																																															
Item	✓																																																																																														
Hook and loop tape																																																																																															
Item	✓																																																																																														
Two wire nuts																																																																																															
Item	✓																																																																																														
Hook and loop tape																																																																																															
Item	✓																																																																																														
Hook and loop tape																																																																																															
Item	✓																																																																																														
1/2 inch wrench																																																																																															
Mast level (Part # M-MLA)																																																																																															
Medium size wire cutters																																																																																															
Crescent wrench																																																																																															
Redimix cement (optional)																																																																																															
Shovel (optional)																																																																																															
All purpose grease																																																																																															
Tape measure																																																																																															
Tie wraps																																																																																															
Item	✓																																																																																														
1/2 inch wrench																																																																																															
Crescent wrench																																																																																															
Item	✓																																																																																														
1/2 inch wrench																																																																																															
Sledgehammer or post driver																																																																																															
Eye protection—safety glasses (if using sledgehammer/post driver)																																																																																															
Mast level (Part # M-MLA)																																																																																															
Redimix cement (optional)																																																																																															
Shovel (optional)																																																																																															
All purpose grease																																																																																															
Tape measure																																																																																															
Item	✓																																																																																														
Sledgehammer																																																																																															
Eye protection—safety glasses																																																																																															
Item	✓																																																																																														
Sledgehammer or post driver																																																																																															
Eye protection—safety glasses																																																																																															
Mast level (Part # M-MLA)																																																																																															
Redimix cement (optional)																																																																																															
Shovel (optional)																																																																																															
All purpose grease																																																																																															
Tape measure																																																																																															

✓	Task																																								
	<table border="1" style="width: 100%;"> <thead> <tr> <th colspan="2" style="text-align: left;">Grounding Kit (M-GKA)</th> <th colspan="2" style="text-align: left;">Guy Wire Kit (M-GWA)</th> </tr> <tr> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> </tr> </thead> <tbody> <tr> <td>1/2 inch wrench</td> <td></td> <td>Phillips head screw driver #2</td> <td></td> </tr> <tr> <td>Sledgehammer</td> <td></td> <td>1/2 inch wrench</td> <td></td> </tr> <tr> <td>Eye protection—safety glasses</td> <td></td> <td>Medium size wire cutters</td> <td></td> </tr> <tr> <td>Medium size wire cutters</td> <td></td> <td>Crescent wrench</td> <td></td> </tr> <tr> <th colspan="2" style="text-align: left;">Solar Radiation Shield (M-RSA)</th> <th colspan="2" style="text-align: left;">Light Sensor Bracket (M-LBA)</th> </tr> <tr> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> <th style="text-align: left;">Item</th> <th style="text-align: center;">✓</th> </tr> <tr> <td>1/2 inch wrench</td> <td></td> <td>1/2 inch wrench</td> <td></td> </tr> <tr> <td>Phillips head screwdriver #1 (if sensors aren't already installed)</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>	Grounding Kit (M-GKA)		Guy Wire Kit (M-GWA)		Item	✓	Item	✓	1/2 inch wrench		Phillips head screw driver #2		Sledgehammer		1/2 inch wrench		Eye protection—safety glasses		Medium size wire cutters		Medium size wire cutters		Crescent wrench		Solar Radiation Shield (M-RSA)		Light Sensor Bracket (M-LBA)		Item	✓	Item	✓	1/2 inch wrench		1/2 inch wrench		Phillips head screwdriver #1 (if sensors aren't already installed)			
Grounding Kit (M-GKA)		Guy Wire Kit (M-GWA)																																							
Item	✓	Item	✓																																						
1/2 inch wrench		Phillips head screw driver #2																																							
Sledgehammer		1/2 inch wrench																																							
Eye protection—safety glasses		Medium size wire cutters																																							
Medium size wire cutters		Crescent wrench																																							
Solar Radiation Shield (M-RSA)		Light Sensor Bracket (M-LBA)																																							
Item	✓	Item	✓																																						
1/2 inch wrench		1/2 inch wrench																																							
Phillips head screwdriver #1 (if sensors aren't already installed)																																									

Steps for setting up the Weather Station

The steps to assemble the Weather Station on a tripod are:

The following steps explain how to set up the logger on a tripod. Step 1 includes instructions for both the 2 and 3 meter tripod assembly. Steps 2 through 10 are the same whether you use the 2 or 3 meter tripod.

- Step 1: Assemble, level, and stabilize the 2 or 3 m tripod/lower mast, page 22
- Step 2: Install the Grounding Kit, page 29
- Step 3: Temporarily install the upper mast, page 30
- Step 4: Mount the cross arm and wind sensor, page 31
- Step 5: Install other smart sensors, page 33
- Step 6: Mount the upper mast to the lower mast, page 39
- Step 7: Mount the logger enclosure to the upper mast, page 40
- Step 8: Install the Guy Wire Kit, page 42
- Step 9: Final positioning and leveling of sensors, page 44
- Step 10: Plug in sensors, tie cables, and begin logging, page 45

If you choose an alternate configuration, you can still follow these instructions but skip the steps specifically for the tripod assembly. Also refer to the recommendations in Guidelines for other mounting configurations on page 18.

Step 1: Assemble, level, and stabilize the 2 or 3 m tripod/lower mast

There are two types of tripods available: the 2 meter (Part # M-TPB) and 3 meter (Part # M-TPA). The 2 meter instructions begin on this page. The 3 meter instructions begin on page 25.

2 meter tripod/lower mast assembly instructions:

This is an example of a typical 2 meter tripod assembly.

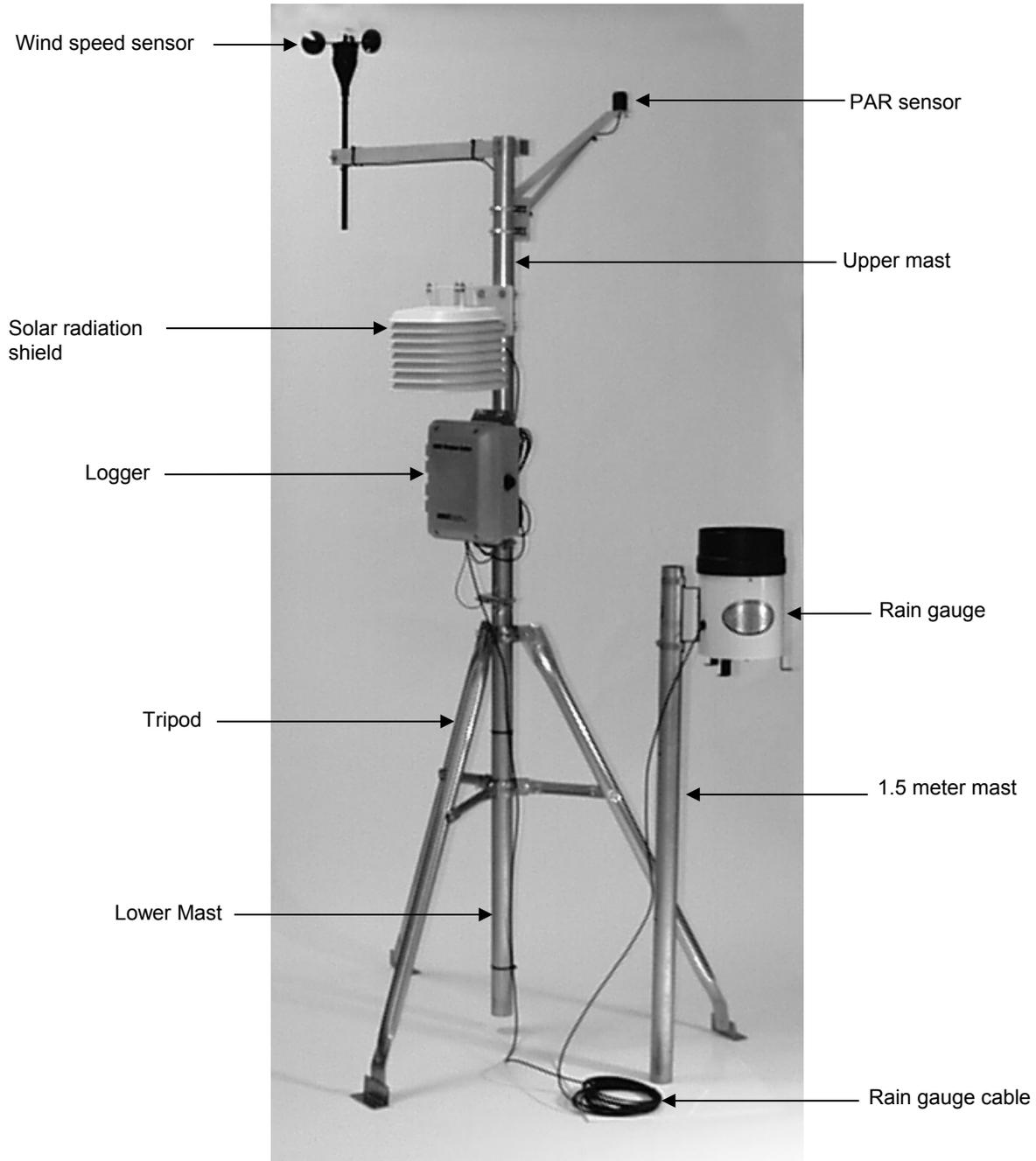


Figure 6: Typical 2 meter Weather Station configuration with rain gauge mounted on separate 1.5 meter mast (the rain gauge should be further from the tripod in the field than shown in this example)

1. Open the 2 meter tripod and place it in an upright position.
2. Using a 1/2 inch wrench, build six nut and bolt assemblies (5/16-18) like the one shown below.

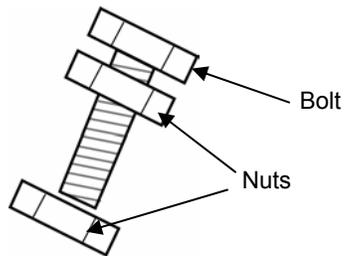


Figure 7: Nut and bolt assembly

3. Take one of the nut and bolt assemblies and insert it through a tri-clamp hole with the bolt head facing outward.
4. Loosely install a nut on the bolt to the inside of the tri-clamp.

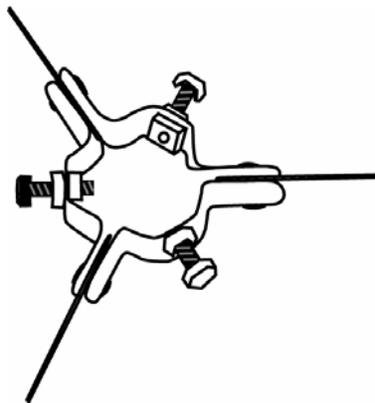


Figure 8: Tri-clamp and bolts

5. Install the remaining five nut and bolt assemblies in the same manner for both upper and lower tri-clamps. Make sure the bolt assemblies on the upper and lower mast tri-clamps leave enough room for the lower mast section to slip through.
6. Slide the lower mast from the top into the tri-clamps with the creased end of the mast facing up (see Figure 9). The creases on the lower mast should face north and south.

7. Tighten the tri-clamp bolts by hand so that the mast is temporarily locked into position. **Note:** The lower mast can rest on the ground at this time. You will adjust the height of the lower mast later.

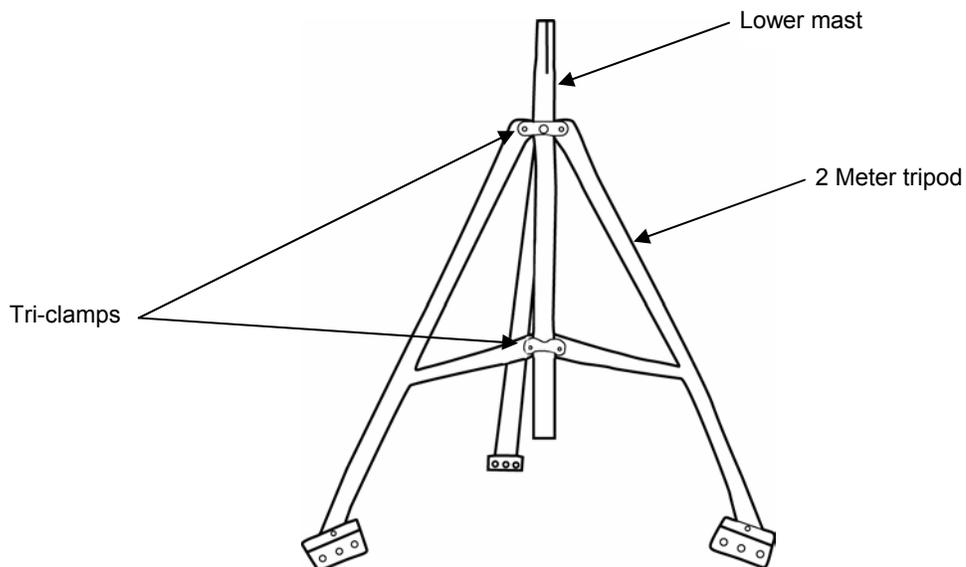


Figure 9: Two meter tripod and lower mast

8. Because the tripod for the 2 meter configuration has non-adjustable legs, you must verify that the mounting surface area is level. If it is not, use shims or remove soil as needed. You can attach the Post Level (Part # M-LVA) to the mast to verify that it is vertical as you level the surface. You can also use the tri-clamp bolts to fine tune the vertical adjustment later after you adjust the height of the mast.
9. Secure the tripod. Use either the $\frac{1}{4}$ -inch diameter stake kit (Part # M-SKB) or bolt the tripod to cement pads with $\frac{1}{4}$ -inch anchors. Install a stake or bolt through one of the holes on each of three tripod feet.
10. If site conditions (high winds, etc.) warrant further stabilization of the tripod, use the Guy Wire Kit (Part # M-GWA). Instructions for installing the Guy Wire Kit are later in this chapter.

3 meter tripod/lower mast assembly instructions:

This is an example of a typical 3 meter tripod assembly.

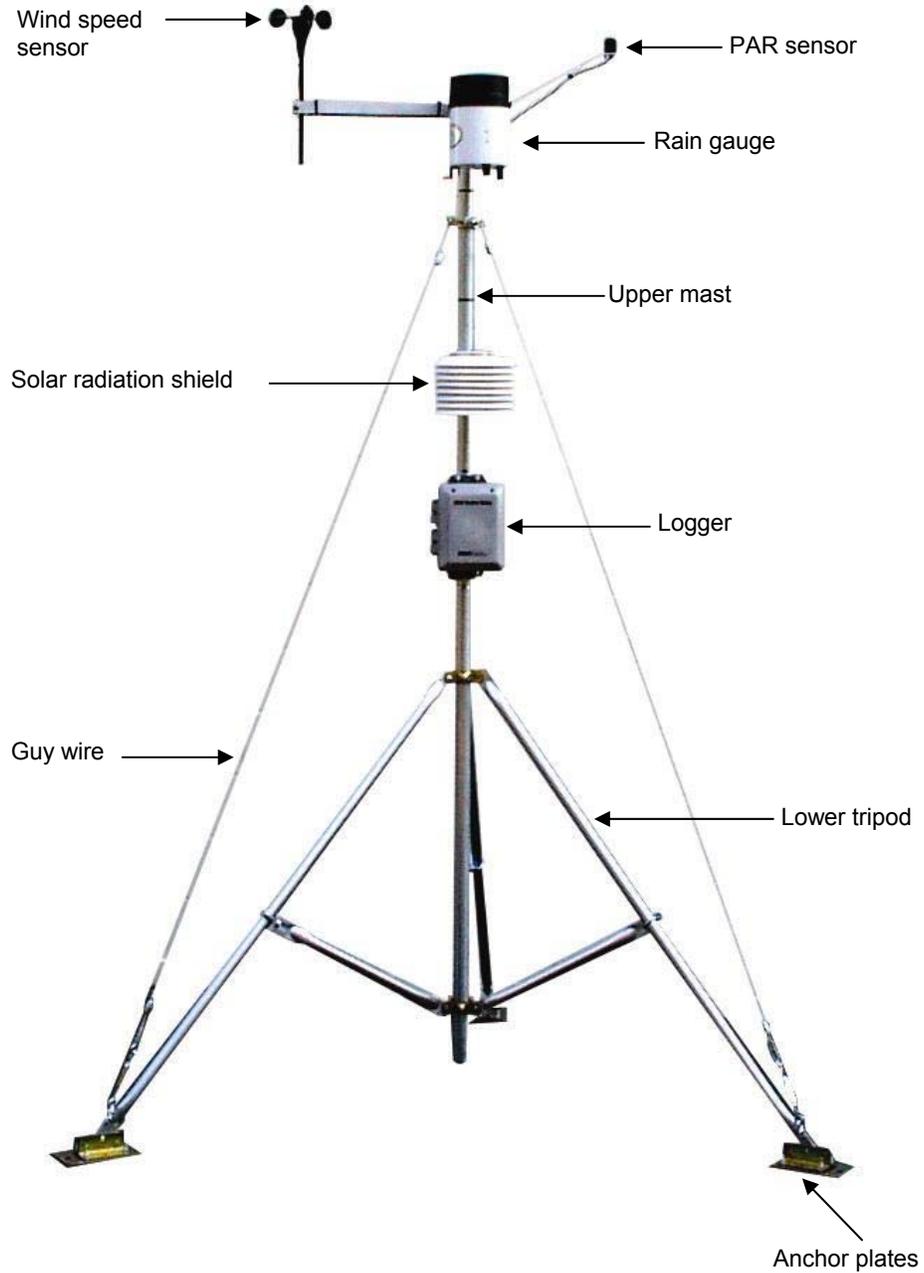


Figure 10: Typical 3 meter Weather Station configuration with mast-mounted rain gauge

1. Using 5/16 inch nuts, attach the three anchor plates to the three tripod foot brackets, with the large holes to the outside (see Figure 11). Tighten the nuts securely.
2. Attach the three leg U-bolts with saddle clamps, one each onto the outer legs about 20 cm (8 inches) up from the anchor plates.

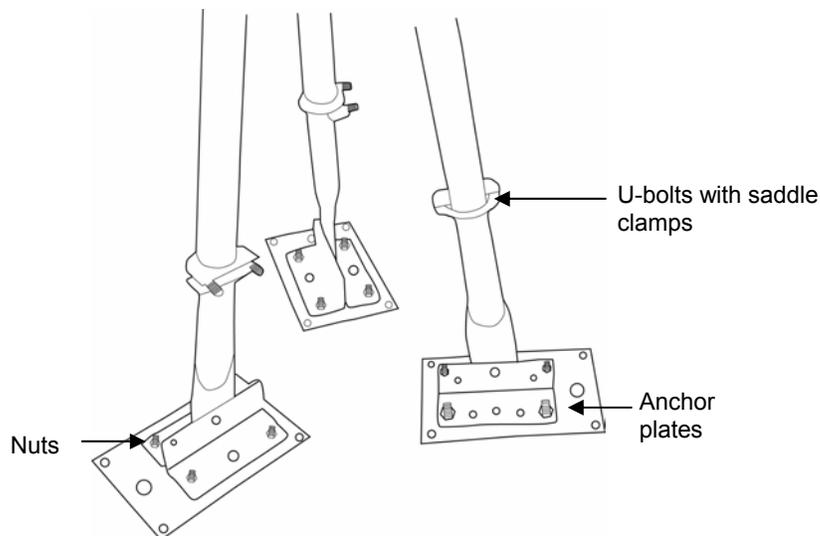


Figure 11: Three meter lower tripod

3. Open the tripod and place it in an upright position.
4. Unfold the leg brace assembly and place the assembly flat on the ground.

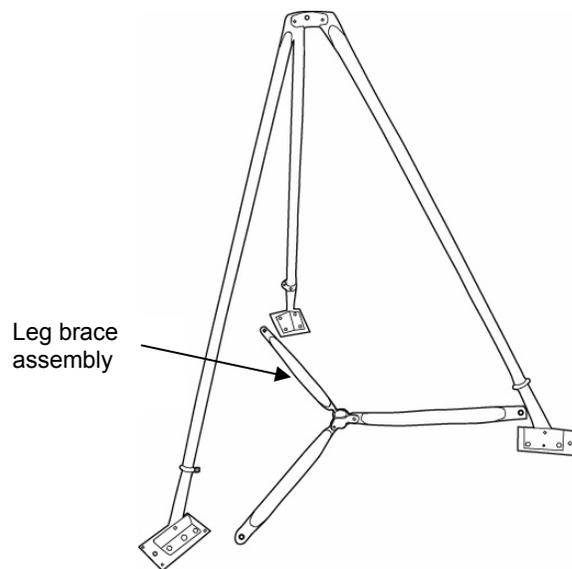


Figure 12: Leg brace and 3 meter tripod

- Attach each of the three inner legs to each of the leg U-bolt assemblies (5/16-18 inch) using the inner stud of the U-bolt. To attach each inner leg, remove the nut from the inner stud, slide the leg over the stud, and then tighten the nut finger.

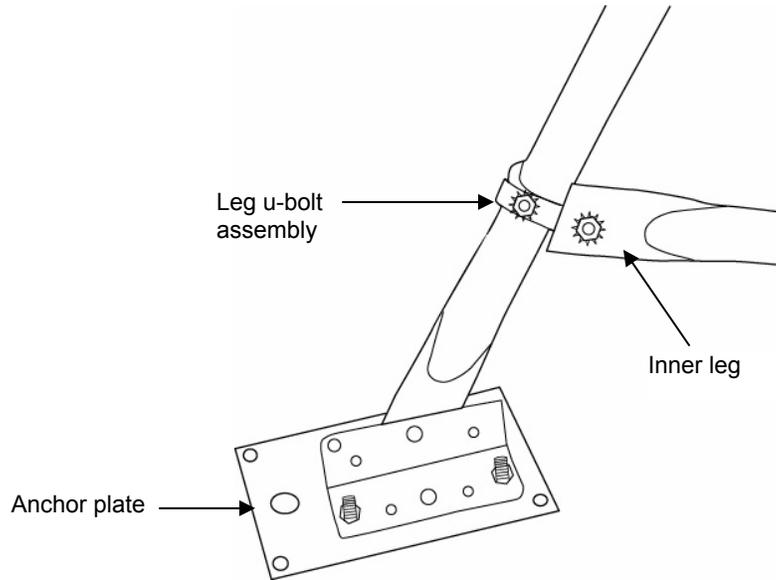


Figure 13: Three meter tripod inner leg

- Loosen the three lock nuts on the bolts on the upper and lower mast tri-clamp assemblies. Back the three bolts out of the upper and lower mast tri-clamp assemblies so that the lower mast section can be slipped down through the upper mast tri-clamps and into the lower mast tri-clamp with the creased end of mast facing up. When the lower mast section is installed, hand-tighten the upper and lower mast tri-clamps.

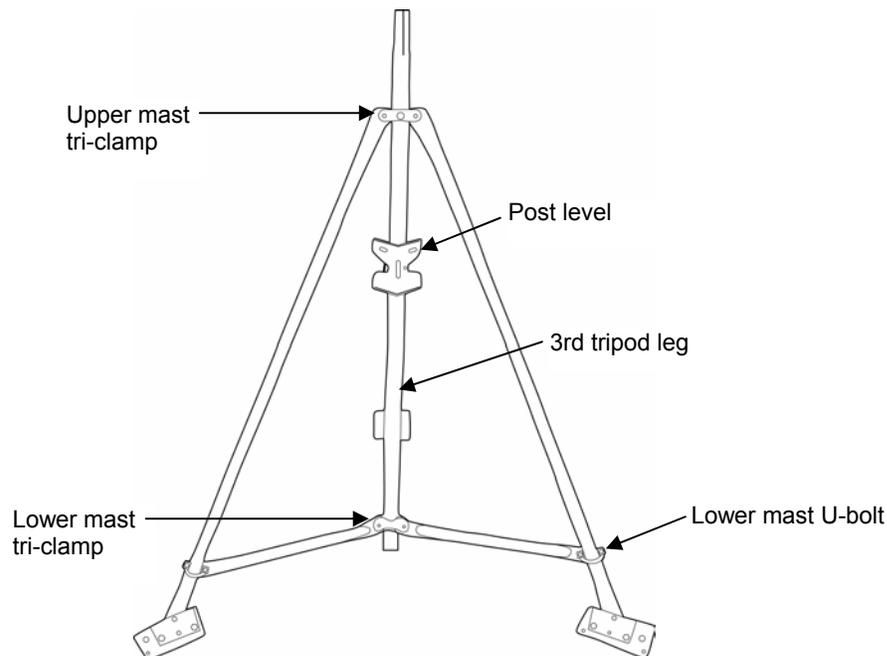


Figure 14: Three meter tripod lower mast

7. Install a Post Level (Part # M-LVA) on the lower mast as shown in the previous figure.
8. When the tripod is oriented on the site, secure one of the three tripod legs to its mounting location and tighten the U-bolts on this leg.
9. Adjust the second leg to level in one direction and secure this leg.
10. Use the third leg to adjust the mast close to level.
11. When the mast is close to being level, secure the third leg.
12. Fine tune the mast level by sliding the U-bolts slightly up or down. Tighten all three leg tri-clamps using a 1/2 inch wrench. Again, verify that the mast is level.
13. After checking level and orientation, tighten all upper and lower mast U-bolts and lock nuts.
14. Orient the lower mast creases so they face north and south.
15. Tighten the tri-clamp bolts so that the mast is locked into position. Note the lower mast should be about 8 inches (20 cm) above the ground at this time (assuming that if you are using the wind sensor, you want it to end up at 3 meters or almost 10 feet).

Step 2: Install the Grounding Kit

This section explains how to install the grounding rod from the Grounding Kit (Part # M-GKA) and attach it to the lower mast of either the 2 meter and 3 meter tripods.

1. Attach the ground wire to the lower mast of the tripod using the U-bolt assembly delivered with the grounding kit.
2. Slide the ground rod clamp over the ground rod prior to driving it into the ground. This allows you to work with the clamp before the top of the rod is damaged from impact.
3. Using a sledgehammer, drive the ground rod into the ground as close as possible to the lower mast of the tripod.
4. Attach the ground wire to the ground rod. Cut off excess cable length and discard or recycle.
5. Tighten the clamp bolt.

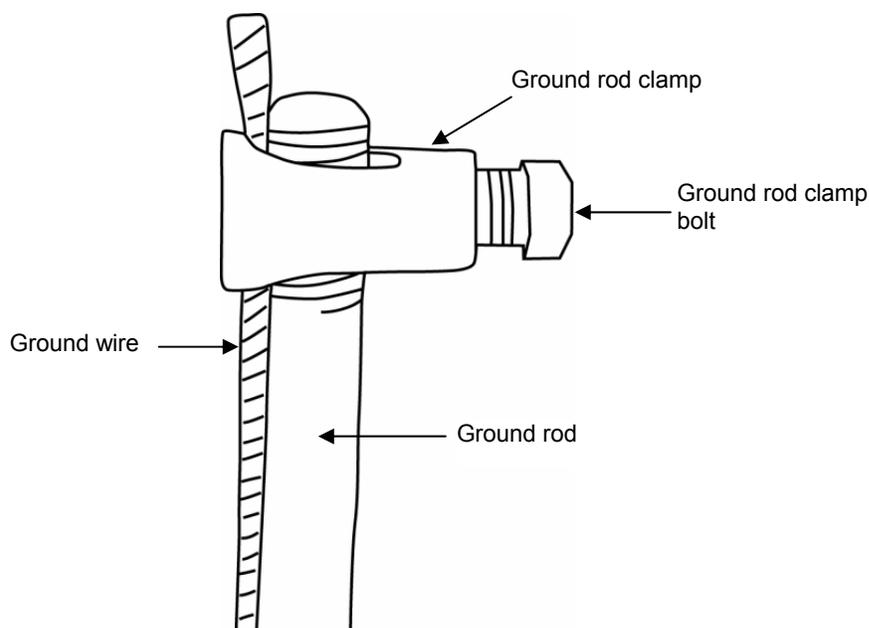


Figure 15: Ground wire attachment

Step 3: Temporarily install the upper mast

This section explains how to temporarily attach the upper mast to the tripod base. This allows you to easily work on the upper mast while it is resting on the base of the tripod.

Note: If you prefer to permanently install the upper mast at this point because you will be able to reach the fully assembled tower, go to *Step 6: Mount the upper mast to the lower mast* on page 39 and then return to Step 4. Otherwise, follow these temporary steps and then permanently attach the upper mast later.

1. If you will be using the Guy Wire Kit (Part # M-GWA), install the guy wire upper mast clamp about two-thirds up the upper mast. Tighten the clamp by hand to temporarily hold it in place. You will need to adjust it later.
2. Stand the upper mast upright and tie a cable tie to one leg brace and one leg of the tripod using the cable ties supplied. Remove the cable ties after the cross arm and sensors are installed.

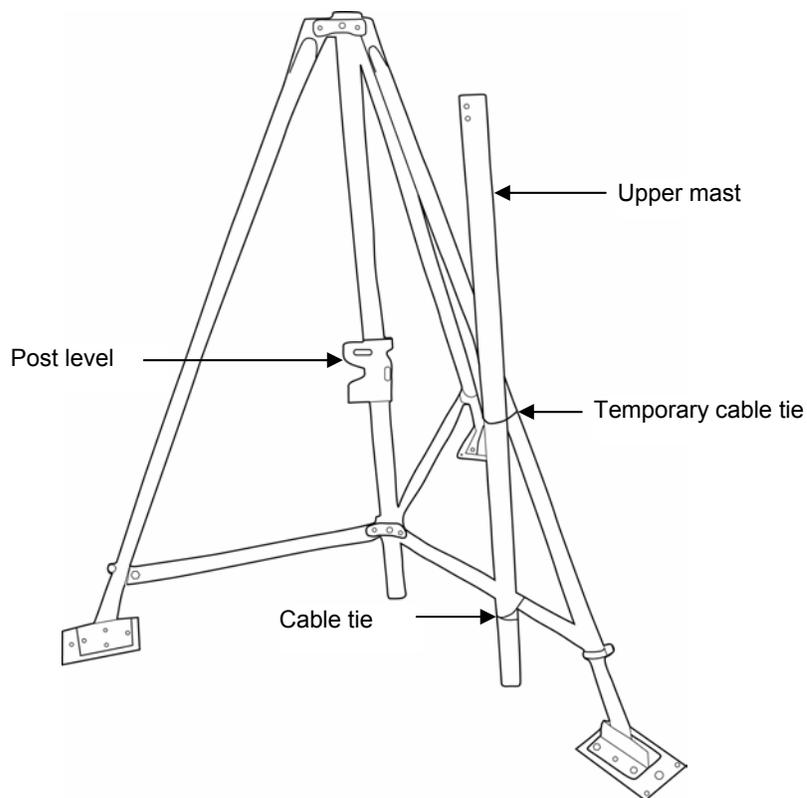


Figure 16: Upper mast (temporary)

Step 4: Mount the cross arm and wind sensor

This section explains how to attach the cross arm and wind sensor to the upper mast. It is recommended that you use the cross arm to mount the wind sensor because it keeps this sensor away from other sensors that could cause wind turbulence or wind shadows. It is also the best way to ensure the sensor is vertical. If you are not installing a cross arm, proceed to *Step 5: Install other smart sensors*.

To mount the cross arm:

1. Attach the cross arm to the upper mast using the two 1/4-20 x 2-3/4 inch hex head bolts. Mount the cross arm on the side opposite the dimple (at the bottom of the upper mast) with the word "TOP" on the upper surface of the cross arm.
2. Pass the two bolts with flat washers on them through the two holes on the cross arm and through the two holes at the top of the upper mast. Install a nylock nut on each bolt. Do not securely tighten the bolts yet.
3. Install the mast plug into the upper mast top with the slot facing down and going over the two bolts. **Note:** After the mast plug is installed, it should be flush with the top of the mast.
4. Tighten the two nuts equally.

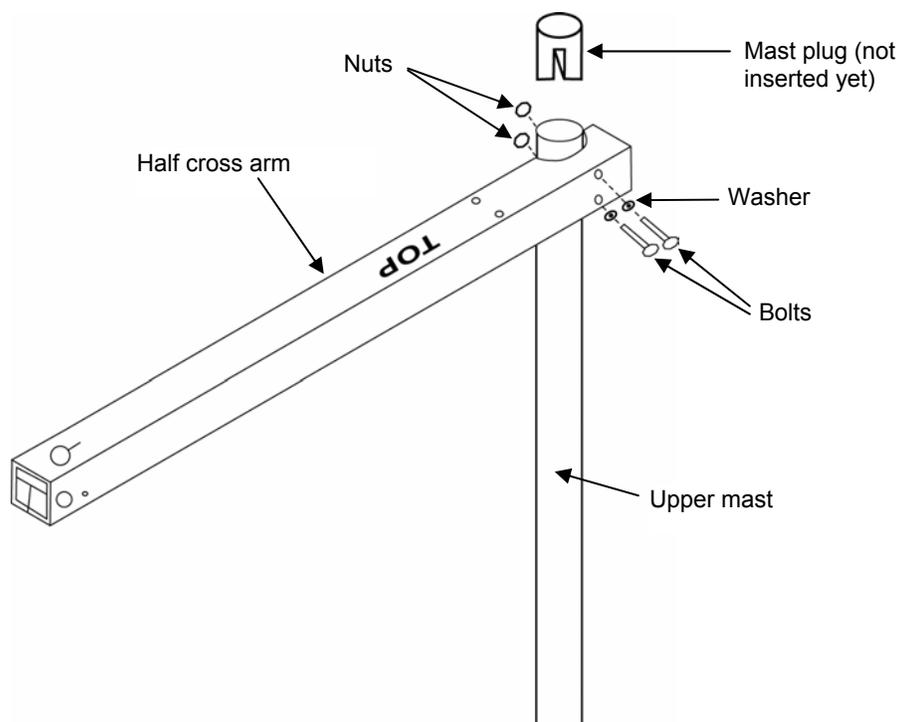


Figure 17: Half cross arm (setup is same for full cross arm)

To mount the wind sensor on the cross arm:

Note: Although the wind sensor is designed to operate in 100+ mph winds, it can be damaged with improper handling. Store the sensor in its shipping box until you are ready to install it on the cross arm.

1. Insert the end of the black mounting rod through the top of the cross arm (see Figure 18).

2. Insert a 1/4-20 x 1 3/4 inch hex head bolt with a flat washer on it through the 1/4 inch hole on the end of the cross arm.
3. Install another flat washer and nylock nut on the bolt, allowing the black mounting rod to protrude 1/2 inch (1.3 cm) from the bottom of the cross arm.
4. Tighten the nut and bolt until the rod is clamped in place and the cross arm just starts to deform.

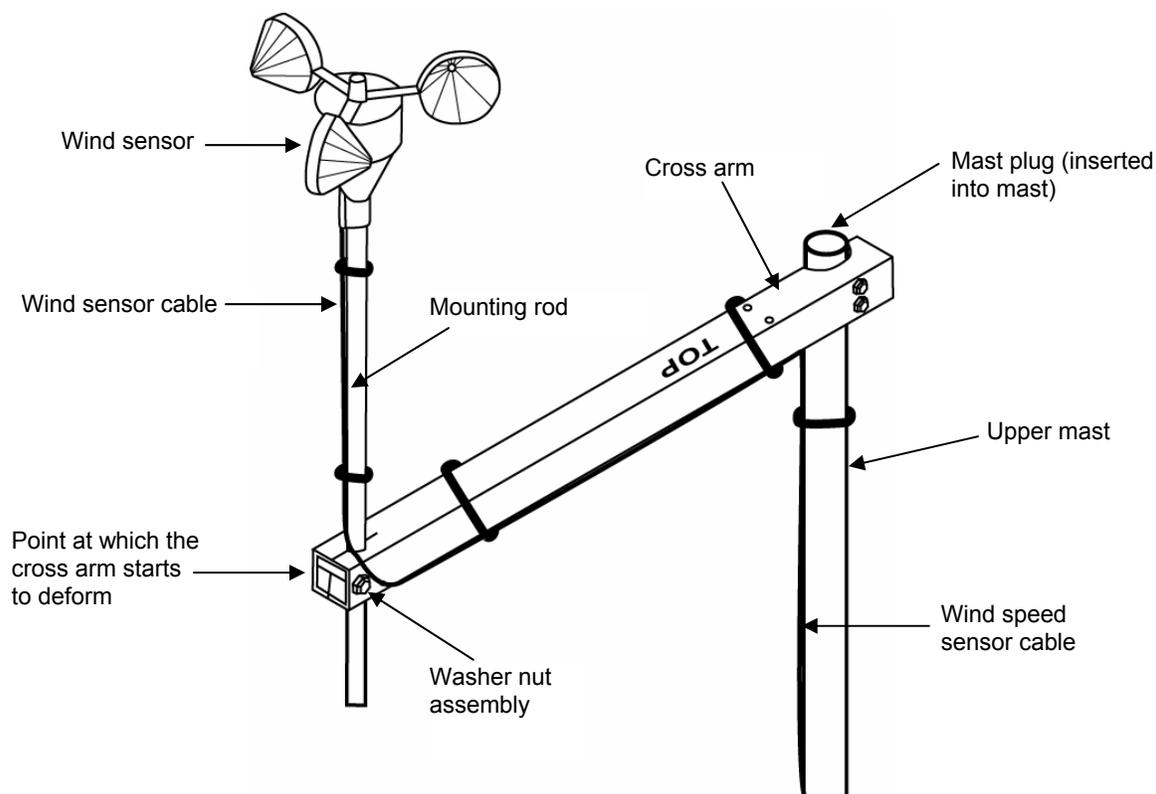


Figure 18: Wind sensor attachment

If you are attaching the sensors to the upper mast while it is temporarily attached to the tripod base: Go to *Step 5: Install other smart sensors.*

If you are installing the sensors on a mast that is already mounted on top of the lower mast: You can adjust the wind sensor to the desired height from the ground. This can be accomplished by raising and lowering the entire mast, the wind sensor on the cross arm, or a combination of both.

1. Loosen the tri-clamp bolts and raise or lower the entire mast so that the wind sensor is close to the desired height. Make sure there is at least 5 cm (2 inches) of mast extending below the lower tri-clamp.
2. Make sure the upper mast dimple is still facing north (if in northern hemisphere) and then re-tighten the tri-clamps. Once the tri-clamp bolts are tight, tighten the lock nuts to lock the bolts in place. This requires two wrenches: one to hold the bolt and one to tighten the lock nut against the tri-clamp.
3. Loosen the bolt on the wind sensor mounting rod and raise or lower it as necessary so the center of the wind sensor anemometer cups is at the desired height. Re-tighten the bolt.

Step 5: Install other smart sensors

This section explains how to install the following sensors:

- Rain Gauge, page 33
- Light, page 35
- Temperature or Temperature/RH, page 35
- Soil Moisture, page 37
- Barometric Pressure, page 38
- 4-20 mA or 0-5 Volt Input Adapter, page 38
- Pulse Input Adapter, page 38

If you are not installing any of these sensors, skip to *Step 6: Mount the upper mast to the lower mast* on page 39.

Guidelines for installing sensors

- If running cables along the ground, we recommend running them through conduit to protect them from animals (some animals like to chew on the cables), lawn mowers, and being tripped on.
- For information on protecting the sensors properly, refer to the Sensor Manuals.
- Leave enough slack in the cables so that they can be routed into the logger.
- If you are deploying multiples of the same sensor type, be sure to note the serial number on the cable associated with each measurement location so you can interpret the data later.

Rain gauge installation instructions

For the most accurate rainfall measurements, it is recommended that you mount the rain gauge upslope, about 3 meters (10 feet) away from the tripod, on a 1.5 meter high mounting pole (Part # M-MPB). Alternatively, you can mount the rain gauge on the tripod mast. This section includes steps for both configurations.

If mounting the rain gauge on a separate pole: Secure the rain gauge to the separate mounting pole, using the two hose clamps provided (see the instructions on the next page). This separate mounting pole can either be pounded in the ground or mounted in concrete, depending on how firm the ground is. In either case, be sure the pole is vertical when you install it. The top of the pole should be slightly less than the height desired for the top of the rain gauge (1 meter or 3 feet is typical).

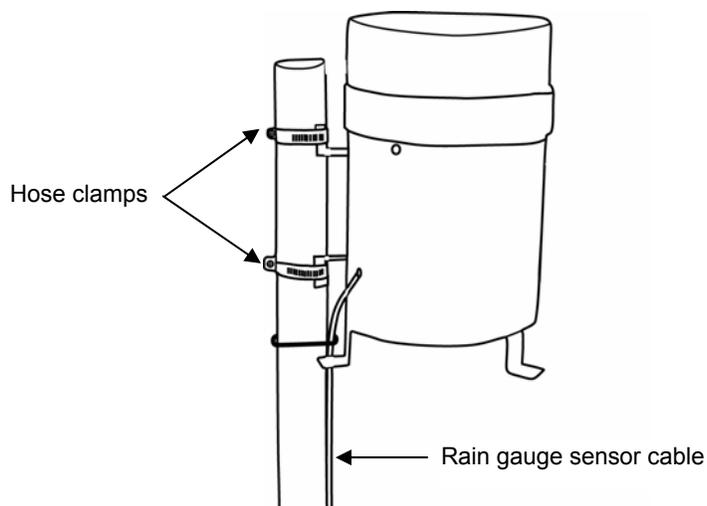


Figure 19: Rain gauge on separate mounting pole

If mounting the rain gauge on the tripod mast: Secure the rain gauge near the top of the mast on the side opposite the cross arm, using the two hose clamps provided.

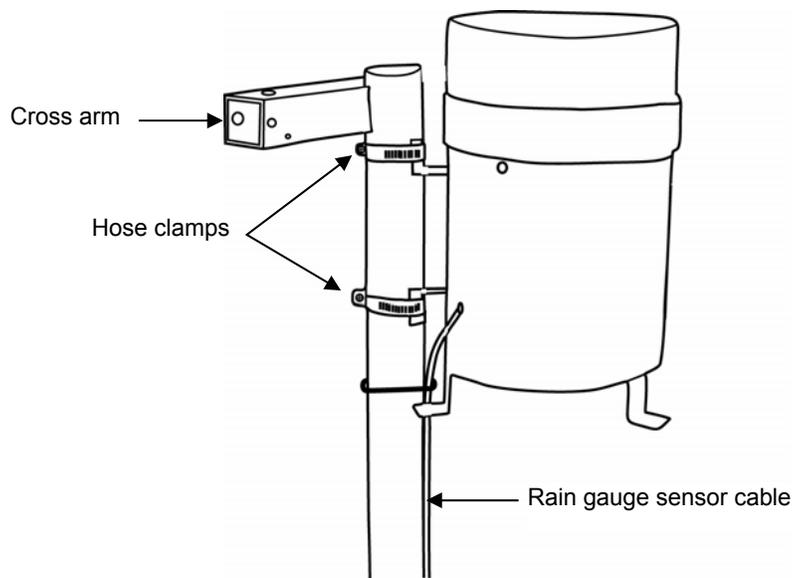


Figure 20: Rain gauge on the tripod mast

1. Open each hose clamp and place it around the mast.
2. Close the hose clamps until the rain gauge side bracket easily slides into the clamp.
3. Hold the rain gauge bracket against the mast with the top of the rain gauge above the top of the mast.
4. Slip the upper clamp over the side bracket and tighten the clamp until the rain gauge is secure.
Note: Be sure the collector is above the top of the mast so you don't get any splashing, wind, shedding, or shadow effects.

5. Install the lower clamp and check that the top of the bucket is level. **Note:** For windy locations, it is recommended that you use the Guy Wire Kit (Part # M-GWA) to reduce vibration and ensure data collection accuracy (installed later).

Light sensor installation instructions

1. Position the light sensor on top of the light sensor bracket (Part # M-LBA) slot with its cable running through the slot in the bracket.
2. Using the two screws and lock washers supplied, attach the sensor to the bracket through the two holes on either side of the slot. **Note:** Do not completely tighten the screws until you level the sensor.
3. Position the bracket so it faces opposite the dimple on the upper mast. This will position the sensor so it will be facing south (in the northern hemisphere), minimizing the chance of shading.
4. Mount the light sensor bracket on the upper mast with the two U-bolt assemblies, mounting it high enough on the mast to avoid the possibility of shading the sensor. **Note:** If you mount the sensor above eye level, you will need a stepladder or other secure platform so that you can clearly view the light sensor level when you level your sensor.

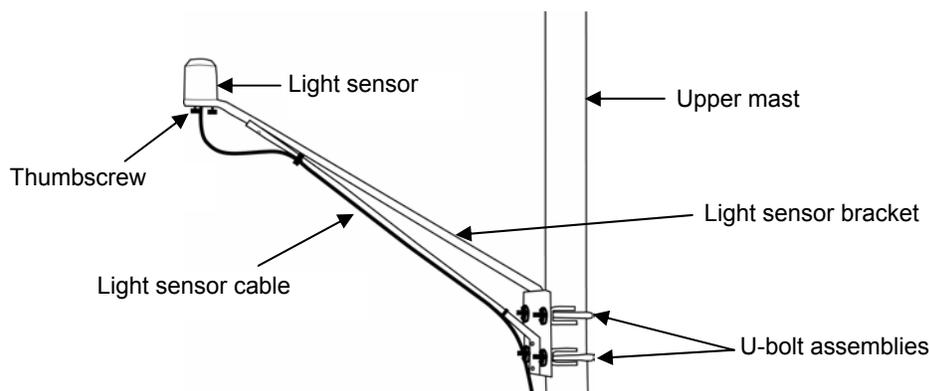


Figure 21: Light sensor on the mast

Temperature or temperature/RH sensor with solar radiation shield installation instructions

In the Field Preparation Checklist in this chapter, it was recommended that you install the sensor in the solar radiation shield (Part # M-RSA) *before* going into the field. If you already installed the sensor, skip to step 2 of these instructions on the next page.

1. **To install the temperature/RH sensor into the solar radiation shield:** Remove the bottom two shield plates by removing the three wing nuts. Install the temperature/RH sensor using the two black loop clamps, two washers, and two self-tapping screws (see Figure 22). Be careful not to block the RH sensor openings. Feed the cable out through the third and fourth shield plates (see Figure 24). Replace the bottom two shield plates.

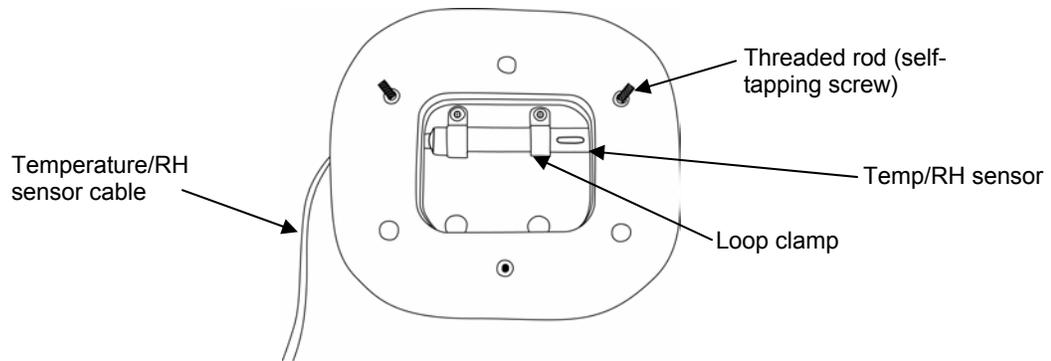


Figure 22: Temperature/RH sensor inside solar radiation shield

To install the temperature sensor into the solar radiation shield: Remove the bottom two shield plates by removing the three wing nuts. Install the temperature sensor using the small black loop clamp, washer, and screw (see Figure 23). Feed the cable out through the third and fourth shield plates (see Figure 24). Replace the bottom two shield plates.

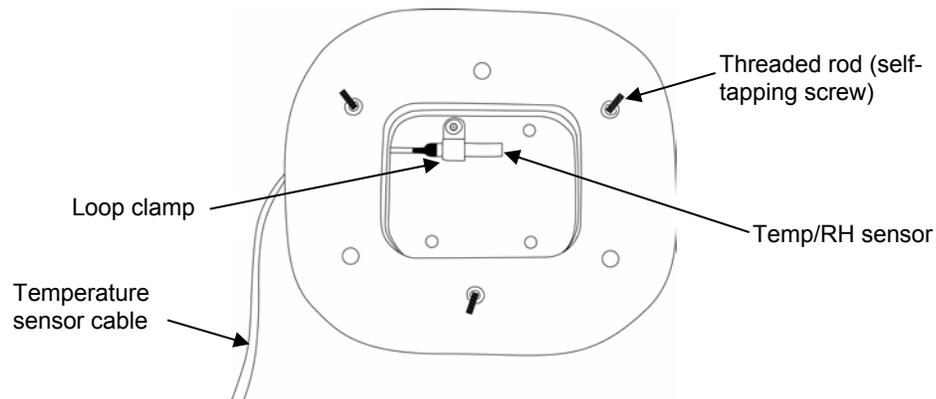


Figure 23: Temperature sensor inside solar radiation shield

2. Mount the white solar radiation shield assembly onto the upper mast using the two U-bolts provided (see Figure 24).

- Position the solar radiation shield to the desired height and tighten the U-bolt assemblies. Optimum orientation of the solar radiation shield is to face it into the direction of the predominant wind.

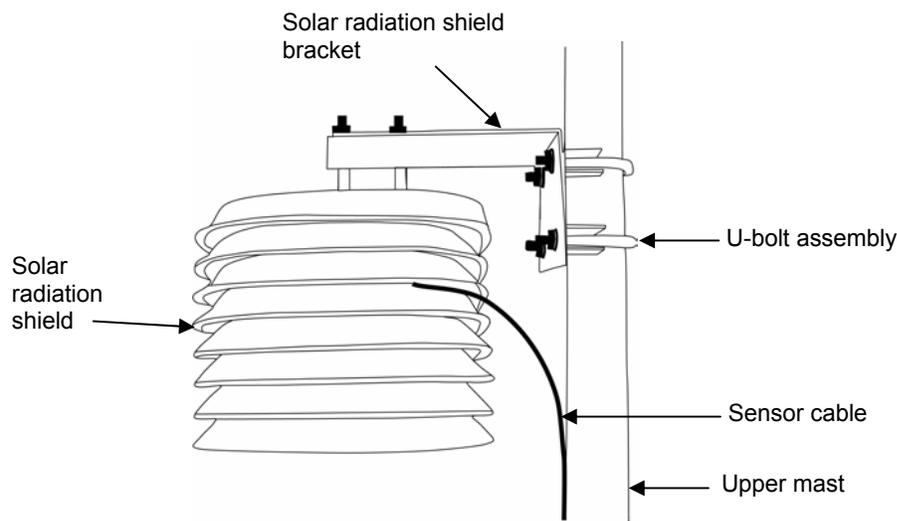


Figure 24: Solar radiation shield attachment

Soil moisture sensor installation instructions

This sensor measures the water content in the space immediately adjacent to the probe surface. Air gaps or excessive soil compaction around the probe can profoundly influence soil water content readings. Do not mount the probes adjacent to large metal objects, such as metal poles or stakes. Maintain at least 8 cm (3 inches) of separation between the probe and other objects. Any objects, other than soil, within 8 cm (3 inches) of the probe can influence the probe's electromagnetic field and adversely affect output readings.

- Use a thin implement like a trenching shovel, gardening spade, or flat bar to make a pilot hole in the soil. Make sure the hole is straight in the direction you will be orienting the probe. The probe can be oriented in any direction. However, orienting the flat side perpendicular to the surface of the soil will minimize effects on downward water movement and avoid the possibility that water will pool on top of the sensor.
- Insert the probe into the hole, making sure the entire length of the probe is covered.
- Insert a shovel into the soil a few inches away from the probe and gently force soil toward the probe to provide good contact between the probe and the soil.
- Water the soil surrounding the sensor to facilitate settling of the soil.
- Do not excessively pack or compress the soil adjacent to the sensor. The soil should contact the sensor surface, but should not be packed.

For deeper installation, excavate down to just above the level you wish to measure, then install the probe as described above.

If you need to calibrate the probe for the soil, you may want to gather soil samples from each sample depth at this time.

When removing the probe from the soil, **do not pull it out of the soil by the cable!** Doing so may break internal connections and make the probe unusable.

Mount the barometric pressure sensor

If you did not mount the barometric pressure sensor before leaving for the field, follow these steps.

1. Open the logger enclosure by loosening the four outside housing screws.
2. Affix the hook and loop tape to the back of the barometric pressure sensor housing.
3. Remove the backing and place the barometric pressure smart sensor on top of the battery cover.

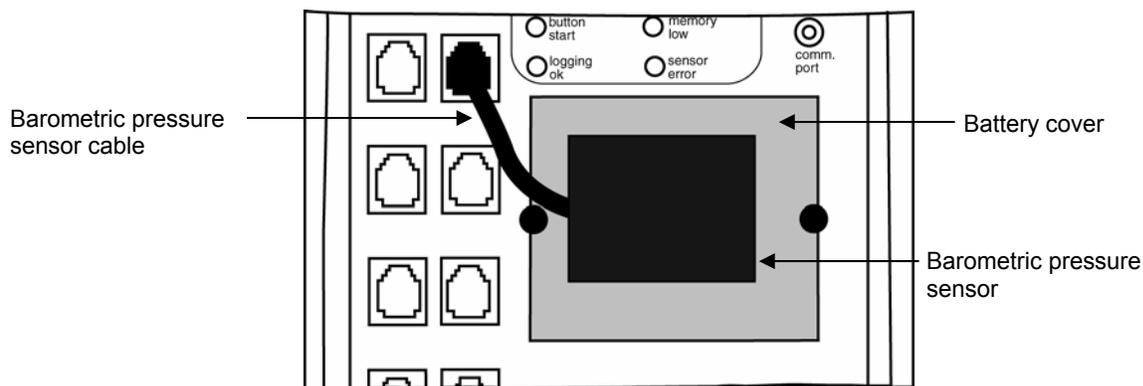


Figure 25: Barometric pressure sensor in logger enclosure

Mount the 4-20 mA or 0-5 volt input adapters

To mount the 4-20 mA or 0-5 Volt input adapters, use the self-adhesive hook-and-loop tape to mount the input adapter on top of the battery cover. If another sensor is already mounted on the battery door, then use the back of the logger enclosure door. Refer to the sensor manual for more information on how to use the input adapter.

Mount the pulse input adapter

To mount the pulse input adapter, secure the adapter housing to the mast or sensor mounting arm. Coil excess cable and secure it with cable ties. When making a connection to a third-party sensor, take time to make sure the connection is reliable and is protected from rain, dirt, and direct exposure to the elements. The input cable can be connected directly to screw terminals on the sensor or to sensor cables with wire nuts. To use the wire nuts, strip about 1 cm (3/8 inch) of insulation from the end of the wires taking care not to nick the metal conductors. Twist the stripped wires together clockwise and then screw on the wire nut clockwise. Check the connection by gently pulling on the wires to verify a solid mechanical connection. Always strain-relief the connection to make sure that it is not broken by being jerked or repeatedly worked back and forth. Refer to the sensor manual for more information on how to use the pulse input adapter.

Step 6: Mount the upper mast to the lower mast

This section explains how to attach the upper mast to the lower mast of the tower. If you already performed this step, go to *Step 7: Mount the logger enclosure to the upper mast*. It is recommended that two people work together to attach the upper mast to the lower mast.

1. Lightly grease the creased (upper) end of the lower mast.
2. While holding the upper mast securely, cut the cable ties that were temporarily holding the upper mast to the lower mast.
3. Slide the upper mast onto the lower mast with the dimple going into the crease and oriented north if you are in the northern hemisphere, and south if you are in the southern hemisphere.
4. When the upper and lower masts are aligned, install the 1-5/8 inch U-bolt assembly onto the upper mast, placing it just above the dimple (about 2.5 cm or 1 inch from the upper mast bottom). Tighten the clamp.

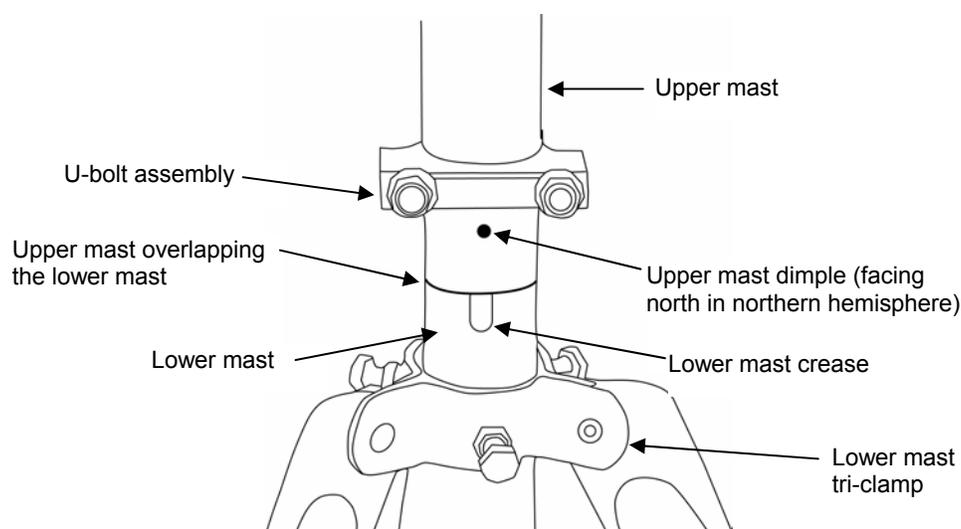


Figure 26: Upper and lower mast assembly

If you haven't attached the cross arm and wind sensor: See the instructions in *Step 4: Mount the cross arm and wind sensor*.

If you are using the 2 meter or 3 meter tripods and the wind sensor: You can adjust the wind sensor to a height suited for your needs. Adjust the height by raising and lowering the entire mast, the wind sensor on the cross arm, or a combination of both.

1. Loosen the tri-clamp bolts and raise or lower the entire mast so that the wind sensor is close to the desired height. Make sure there is at least 5 cm (2 inches) of mast extending below the lower tri-clamp.
2. Make sure the upper mast dimple is still facing north (if in northern hemisphere) and then re-tighten the tri-clamps. Once the tri-clamp bolts are tight, tighten the lock nuts to lock the bolts in place. This requires two wrenches: one to hold the bolt and one to tighten the lock nut against the tri-clamp.
3. Loosen the bolt on the wind sensor mounting rod and raise or lower it as necessary so the center of the wind sensor anemometer cups is at the desired height. Re-tighten the bolt.

Step 7: Mount the logger enclosure to the upper mast

1. Attach the two gray mounting feet to the back of the logger housing using the flat head screws provided if you have not already done so. Make sure the feet are positioned correctly for the screws to fit into the holes properly.

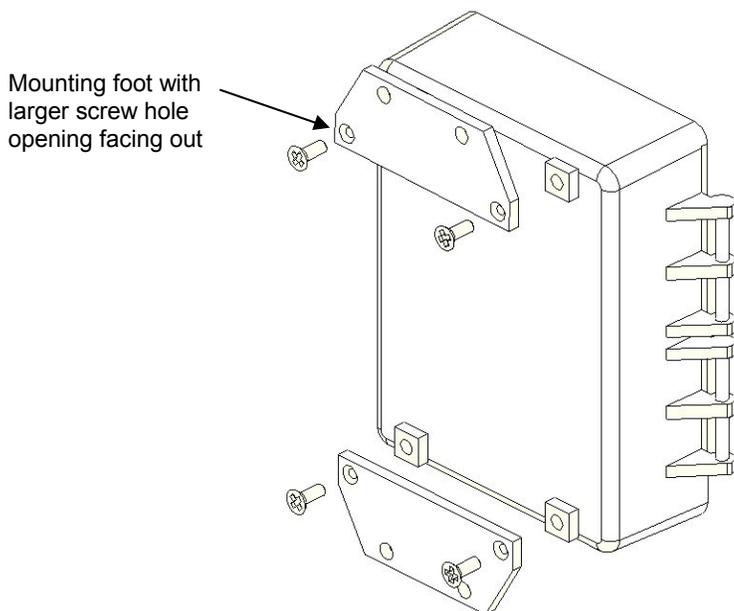


Figure 27: Mounting feet on logger

2. Using the two 1-5/8 inch U-bolt assemblies provided, mount the logger enclosure on the lower end of the upper mast in line with the upper mast dimple (see Figure 28). The lower housing U-bolt can be placed directly above the U-bolt holding the mast pieces together. **Note:** When assembling the U-bolts, place the U-bolts around the upper mast, and install the saddle clamp. Place the logger enclosure against the saddle clamps and screw on the top U-bolt nuts only.

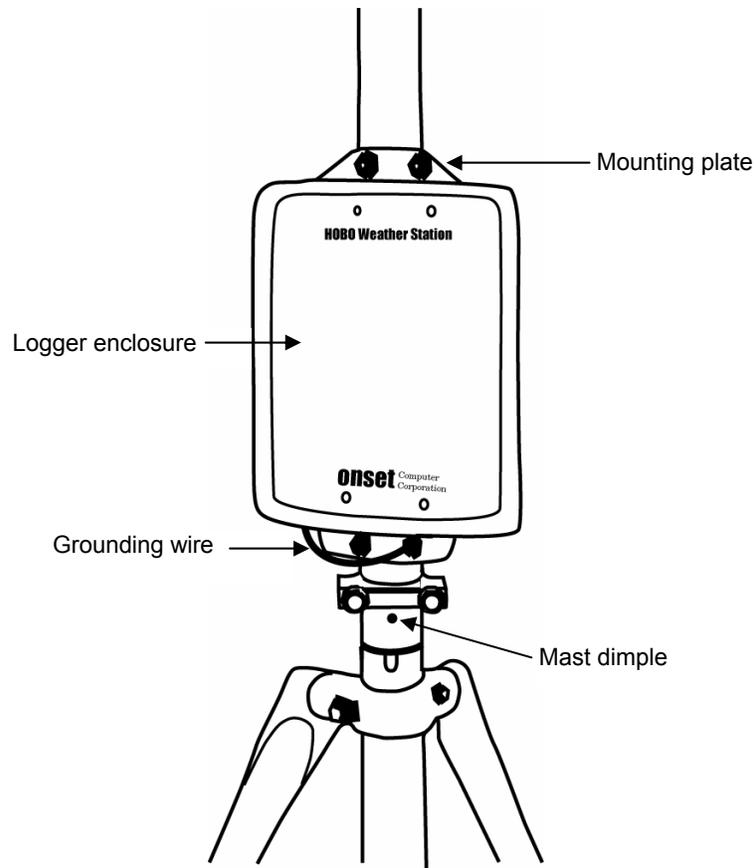


Figure 28: Logger Housing on Mast

3. If you are using the Guy Wire kit, position the logger enclosure so that it will not be in the way of guy wires.
4. Attach the logger's ground wire to the lower housing U-bolt. Screw on the lower U-bolt nuts and then tighten all the U-bolt nuts.

Step 8: Install the Guy Wire Kit

If you are not installing the Guy Wire Kit (Part # M-GWA), skip to *Step 9: Final positioning and leveling of sensors*. If you are using the 2 meter tripod, you will need to attach the guy wires to three 1/2 inch stakes (Part # M-SKA), which should be spaced evenly around the tripod at a distance of 3 to 4 m (10 to 13 ft) from the mast.

1. If you haven't already done so, attach the upper mast tri-clamp to the upper mast. Orient the eyebolts on the upper clamp so they align with each tripod foot or a 1/2 inch stake.
2. Attach one end of the guy cable to one eyebolt on the upper mast tri-clamp. Open the wire clamp by loosening the screw on it. Place the clamp over the wire and tighten. Leave 2.5 cm (1 inch) of wire protruding from the clamp.

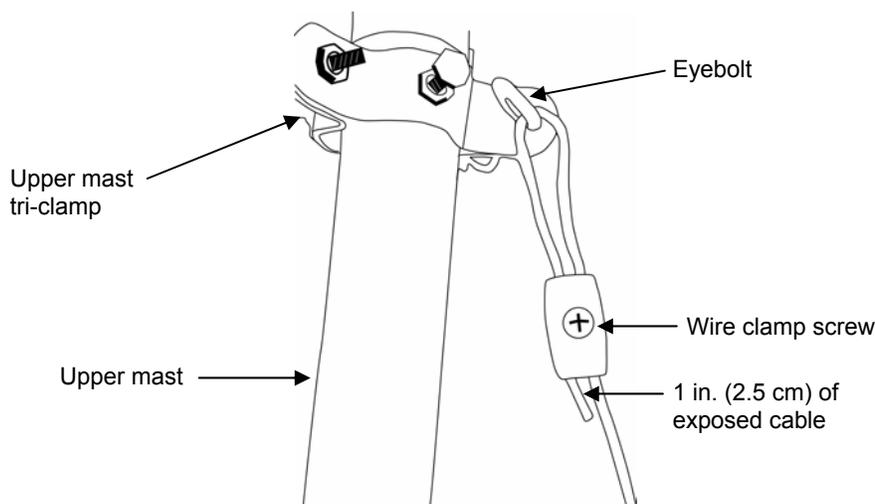


Figure 29: Guy wire attachment

3. Hook one "S" hook and one turnbuckle onto the corresponding stake (see Figure 30) or leg (see Figure 31).

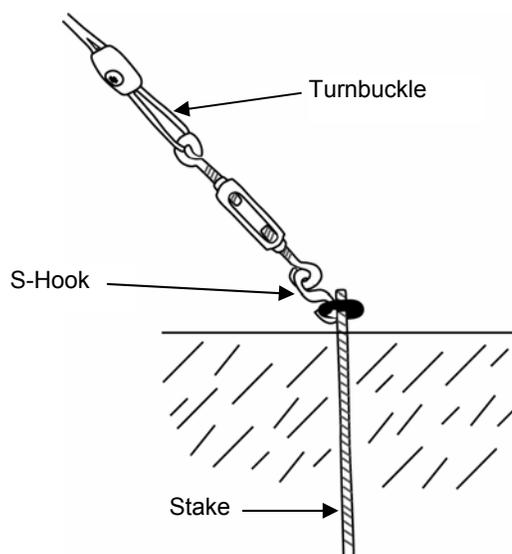


Figure 30: Guying to 1/2 inch Stakes

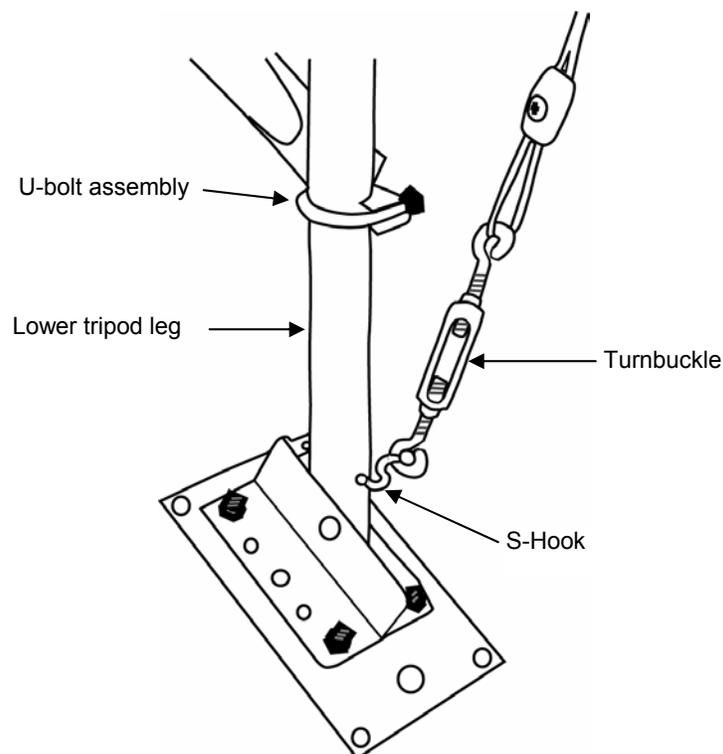


Figure 31: Guying to 3 Meter tripod feet

4. Cut the guy cable so that it can be put through the loose end of the turnbuckle and the wire clamp (see Figure 29 if using the 2 meter tripod; see Figure 30 if using the 3 meter tripod). Make sure the turnbuckle is extended as shown in the figures before feeding the cable through.
5. Install the hooks, turnbuckles, and cables onto the other two stakes or tripod legs.
6. Tighten the three guy wires evenly by turning the turnbuckles.
7. Attach a Post Level (Part # M-LVA) on the upper mast to maintain the mast at vertical.
8. The guy wires should be taut when the installation is complete.

Step 9: Final positioning and leveling of sensors

Once the upper mast is locked in place and guyed, position the sensors at the correct heights and check that the rain gauge is level (if on a tripod).

Follow these steps to level the light sensor.

1. Make sure the screws holding the sensor to the mounting bracket are loose.
2. Place the light sensor level (Part # M-LLA) on the sensor.
3. Adjust the height of the thumbscrews to level the sensor (start with the thumbscrews protruding about 1/16 inches from the bracket).
4. Once the sensor is near level, tighten the mounting screws.
5. Check the light sensor level and repeat these steps as necessary.
6. When the sensor is level, **be sure to remove the light sensor level.**

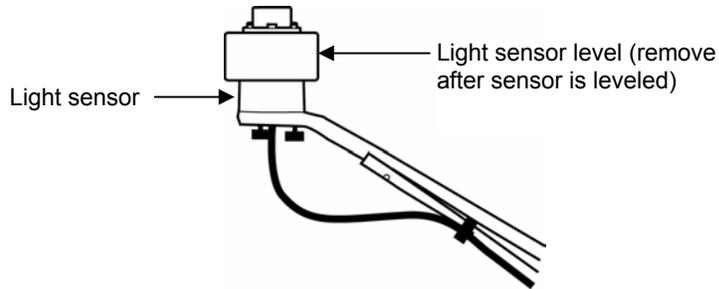


Figure 32: Light sensor and light sensor level

Step 10: Plug in sensors, tie cables, and begin logging

This section explains how to finish the logger setup.

1. If you haven't already done so, open the logger enclosure by loosening the four outside housing screws.
2. Pass all the sensor cable ends through the opening on the bottom of the logger enclosure. Note that some of the cables have a small circuit board near the plug-in connector that gets inserted into the logger housing as well. Be careful not to force or flex the circuit board as you install the cables. If there are a lot of cables, push them to one side of the hole to make room for inserting the next cable.
3. Plug all the sensors with tabs facing up into the logger board located within the logger enclosure. It does not matter which connector you plug each sensor into. *You can use a maximum of 15 channels and 100 meters (328 ft) of smart sensor cable.* **Note:** If you are installing more than ten sensors, you will need to install an adaptor (Part # S-ADAPT) for each additional sensor. The adaptors fit into any of the connectors on the logger board except the upper left connector and the connector second from the bottom on the right.
4. If you have a laptop or Palm handheld on site, check current readings to ensure the sensors are all working. Note that you cannot check current readings if the logger is waiting for a Button Start or a Delayed Start.
5. Check that the batteries are securely seated in their holder and reattach the battery cover.
6. Neatly wrap all the sensor cables together using a cable tie, and secure the cables to the square, white bracket under the battery door (see Figure 33). Again, be careful not to bend the circuit boards in the cables.

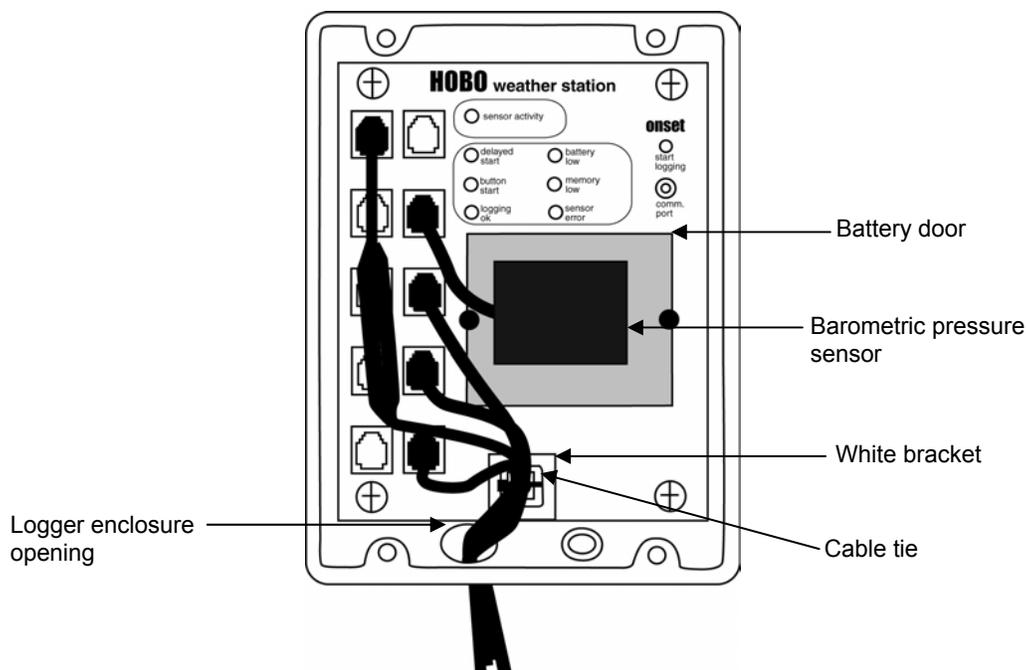


Figure 33: Logger with sensor cables attached

7. Use cable ties to secure the wind sensor cables to the cross arm, bracket, and mast. The sensor cables should run below the cross arm and brackets to minimize the chance of birds pecking and damaging the cables. Cable ties should be spaced no more than .3 m (1 foot) apart.

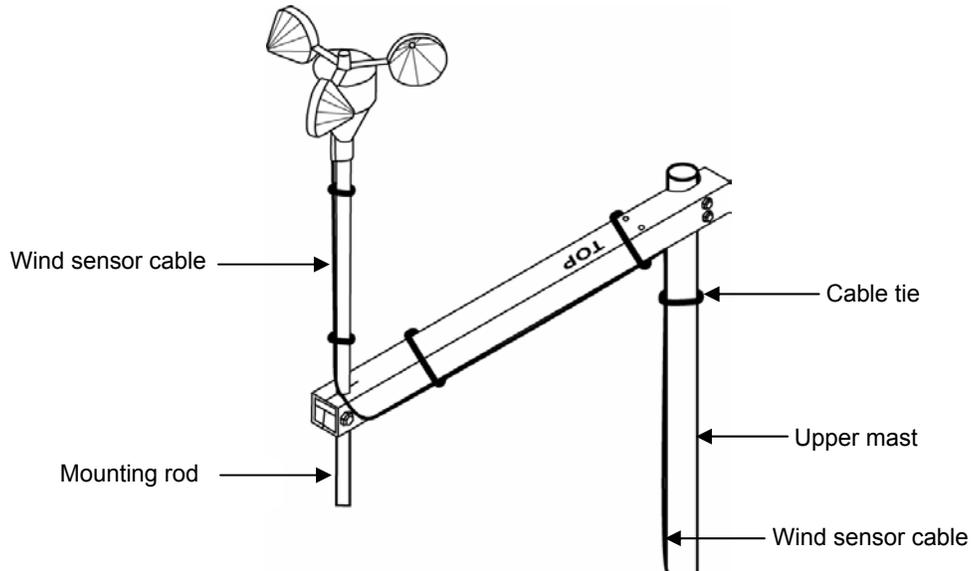


Figure 34: Securing the wind sensor cable

8. Tie the sensor cable below the light sensor bracket.

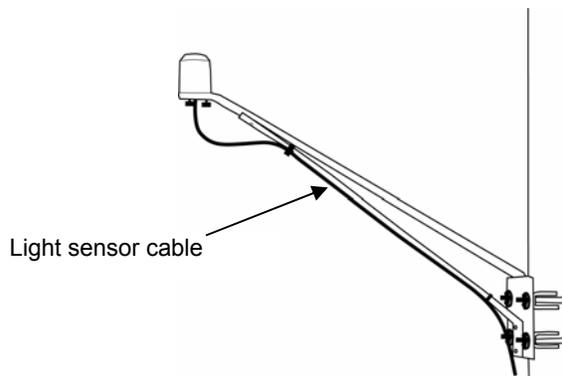


Figure 35: Securing the light sensor cable

9. Use cable ties to secure cables to the mast (see Figures 36 and 37). Also secure any cables running to remote sensors to the mast or to one of the tripod legs.

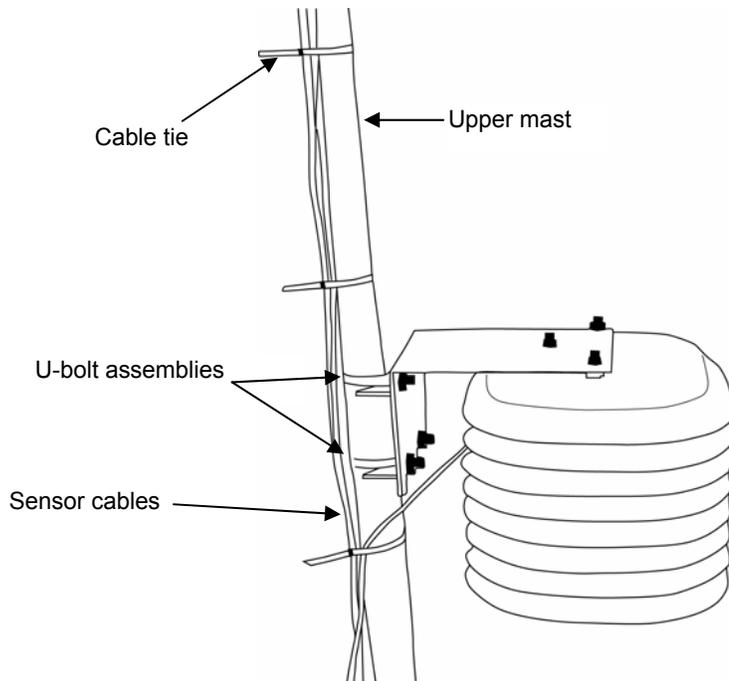


Figure 36: Securing the sensor cables on upper mast

10. Gather the excess cable and attach the cable ties to the upper mast behind the logger enclosure (see Figure 37). Leave about a 2 inch (5 cm) drip loop of cable below the logger.

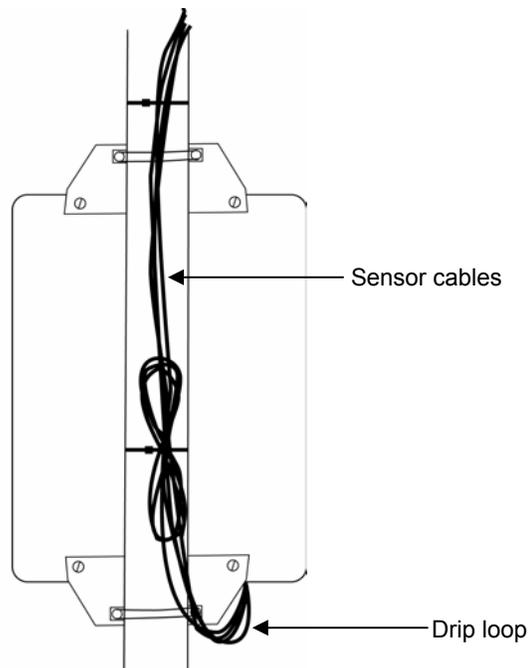


Figure 37: Sensor Cables on Mast

11. Once you verify that the cables are secured in the inside of the logger box, take all the cables and push them over to one side of the logger enclosure opening. Using the duct seal, make a ball that is bigger than the logger enclosure opening, stuff the duct seal into the hole from the outside,

filling the void between the cables and the housing. This minimizes the possibility of dust, insects, and driving rain getting into the logger housing. **This step is especially important if the system is located in a wet environment.** Flare out the duct seal on the inside to lock it place.

12. All cables should be neatly secured to the mast when complete.
13. Recheck that all the U-bolts, nuts, and clamps are secure for the entire system.
14. The logger is ready to begin logging.
 - If you configured the logger to launch with a button start, the Button Start light should be blinking. To start logging, press and hold the button inside the logger enclosure for a second until all lights flash (the logger cover must be off to access the button).
 - If you configured the logger to launch in delayed start mode, the Delay Start light should be blinking. The logger will start automatically at the date/time you entered.
 - If you did not set up the logger with a button or delayed start, connect the logger to the computer or Palm handheld and launch it. See Chapter 3 for details on connecting to the logger and launching.
15. Once the logger is launched, make sure the OK status light is blinking. This indicates the logger is recording data properly. You may need to cup your hand over the top of the logger to see the lights in full sunlight.
16. If the logger is being used in a wet environment, place several dry desiccant packs inside the logger enclosure (remove desiccant pack from its foil pouch before installing).
17. Close the logger door and tighten the four cover screws.

Congratulations! The Weather Station setup is complete. For details on reading out the logger, see Chapter 3. Be sure to read *Chapter 6* for details on performing routine checkups on the Weather Station.

Chapter 5

Troubleshooting

This chapter lists common problems you may encounter with the Weather Station and possible resolutions.

Problem	Resolution
Individual sensors are not found or are missing in the logger software launch screen	<ul style="list-style-type: none"> • If a sensor is removed and then immediately re-inserted, it may not be auto-detected and therefore will not appear in the launch screen. Click the “Reset” or “Add Sensor” button in the launch screen. • Check for a loose connection between the sensor and the logger. • Make sure you haven’t exceeded the maximum of 15 sensors connected to the logger. Note that some sensors are dual sensors and count as two, such as the temperature/RH sensor and the wind speed sensor. If you have more than 15 sensors, remove one or more until you have 15 or less. • Make sure you haven’t exceeded 100 meters (328 ft) of network cable.
All sensors are missing in the logger software launch screen	<ul style="list-style-type: none"> • Remove all but one sensor, then check if the sensor appears in the launch screen. Continue to remove and re-insert the sensors one at a time until you find the bad sensor. If you find a bad sensor or if none of the sensors communicate, contact your Onset dealer or Onset Computer Corporation.
The error status light is blinking	<ul style="list-style-type: none"> • If the error light is blinking in conjunction with the OK light, there was a communication failure. The system has recovered, but you may have an intermittent problem. Try checking the sensors one at a time to make sure they are all communicating. If you find a bad sensor or if no sensor communicates, contact your Onset dealer or Onset Computer Corporation. • If the error light is the only light blinking, then at least one sensor is currently not communicating. Immediate investigation is recommended. Look for a loose connection, which could cause bad electrical contact with a sensor. If found, remove the offending sensor and check its wires and connector for damage and/or signs of moisture. • In general, it is recommended that you read out any data when this light is blinking, investigate the problem, and re-launch the logger.
The battery low light is blinking after the batteries were replaced	<ul style="list-style-type: none"> • Check the polarity; make sure the batteries are installed properly. It is possible one cell is reversed. • Make sure you are using the correct battery type. The logger uses four 1.5 volt AA alkaline or lithium batteries. The type must be specified in the launch screen for the correct battery status. • Make sure you aren’t using a combination of alkaline and lithium batteries. Never mix battery types. • Check the battery expiration date; make sure it is at least two years from the current date. Batteries can lose significant capacity if stored at elevated temperatures. • Check the voltage with a voltmeter. Alkaline batteries should be at least 1.5

Problem	Resolution
	volt per cell when new; lithium batteries should be 1.6 volt per cell.
Batteries die prematurely	<ul style="list-style-type: none"> • Check for excessive moisture in the logger enclosure. Severe and/or repeated condensation in the logger enclosure can lead to short circuits and battery failure. It may be necessary to add additional sealing and/or desiccant to the logger enclosure to prevent condensation. • Check to make sure that both the logging and sampling intervals are set for at least 1 minute or greater. Sampling/Logging intervals faster than 1 minute will rapidly deplete the battery. See the section on <i>Estimating battery life</i> on page 11 for more details. • Check for damaged wiring and/or sensors. Damaged cables or connectors can result in complete or partial short circuits that will rapidly drain batteries.
No status lights are flashing	<ul style="list-style-type: none"> • The lights are very faint. In direct sunlight, shield the sun and check again. • Make sure the batteries are not dead. Batteries should have at least 1 volt per cell. • The memory may be full. Read out (offload) data from the logger and re-launch. • The logger may not have been launched. Check the status with the logger software.
OK status light is not flashing	Make sure the logger is launched. If you configured the logger to launch with a delayed start, check the date and time you selected and make sure the Delay Start light is flashing. If you configured the logger to launch with a button start, press and hold the button on the logger for a second until all the lights flash.
Data file contains errors	If you are missing data for a particular sensor, check that the sensor was properly installed. Remove and re-insert the sensor, and check that it can take current readings. If you find that it is not communicating, it may be a bad sensor. Contact your Onset dealer or Onset Computer Corporation.
Data file can't be opened	The data file may have become corrupted. In rare circumstances, the data file may have errors. Offload the logger again and try opening the file again. If that does not work, contact your Onset dealer or Onset Computer Corporation.
Logger is not found	<ul style="list-style-type: none"> • Check and replace the batteries. • Check communications cable connections.

Chapter 6

Maintenance, support, and service

This chapter explains:

- ✓ Recommended maintenance for the Weather Station
- ✓ Who to contact for support
- ✓ Warranty information
- ✓ Return, repair, and service policies

Maintenance

Regular maintenance on the Weather Station is essential because it extends the life of the components and helps to ensure the accuracy of recorded measurements. When the logger is deployed in the field, potential damage can come from numerous sources, such as rodents, birds, vandals, and heavy storms. Periodic check-ups in the field allow you to:

- Check that the station is still set up and functioning as you intended
- Check for damage
- Minimize the impact of any damage found

This is particularly important if the logger is being deployed for a long period of time, such as several months or a year. Regular checkups will help ensure that you are continuing to gather data as expected.

Performing a visual inspection

Periodically perform a visual inspection of the Micro Station tower and logger enclosure. Check that:

- Cables and wires are not damaged, cracked, cut, split, or broken
- All the screws and bolts are tightly secured
- The mast is still level (if in use)
- The ground attachments are fastened to the tripod and logger (if in use)
- There is no excess rust; replace rusty parts as necessary

Cleaning the Weather Station

The logger enclosure does not require regular cleaning. However, it is recommended that in dusty locations you regularly clean these items:

- **Solar radiation shield.** Wash with soap and water. Dirt/cobwebs obstruct air flow. Discoloration can cause increased solar absorption, which can result in increased errors. Do not get the temperature/RH sensor wet; see the temperature/RH sensor manual for instructions on cleaning it.
- **Light sensor.** Make sure the drain hole is not plugged. If you need to clean the sensor head, see the sensor manual for details and cautions on proper cleaning.
- **Rain gauge.** Make sure there are no leaves or debris in the collector. Make sure the funnel is not plugged; use a cotton swab if necessary to clean.
- **Anemometer on wind speed sensor.** Make sure the cups do not have any dirt/dust/cobwebs. Spray bearing with a light oil.
- **Anemometer on wind speed and direction sensor.** Apply a couple drops of 3-in-1 oil or other motor oil to the bearings on the vein and anemometer.
- **Logger enclosure.** Remove dust with compressed air. Do not get water inside the enclosure.
- **Tower.** Hose with fresh water if necessary.

Checking the desiccant pack

If the Weather Station is located in a wet environment, it is recommended that one or more desiccant packs be placed inside the logger. The desiccant pack is “indicating,” which means it changes color from blue to pink when it is no longer absorbing moisture. If the desiccant pack is blue, it is still good. If it is pink, it is bad and needs to be reconditioned. To recondition a desiccant pack, place it in a warm, dry spot until it turns blue. For example, place the desiccant pack in an oven set to 50 to 70°C (122 to 158°F) for 24 hours. Once it turns blue again, you can place it back in the logger.

If the desiccant pack is pink, also check for condensation within the logger. If there is condensation, check that the fittings are still tight and secure and the cover’s rubber gasket is clean, or consider moving the logger to a drier location.

Replacing the batteries

Batteries are cheap insurance. Replace them at least once a year to prevent any loss of data. Be sure to read out the logger before replacing the batteries. If you do not want to interrupt the data logging to change batteries, temporarily insert a 9 Volt battery while you remove the old AA batteries and replace them with new ones. For more details, refer to the *Selecting and installing batteries section* in Chapter 3.

Verifying the sensor accuracy

For most sensors, it is recommended that you test sensor measurement accuracies once a year. Onset Computer can verify the accuracy of all sensors and recalibrate applicable sensors. For more details on verifying sensor accuracy, refer to the Sensor Manuals included with the sensors.

Who to contact for technical support

If you have questions about the Weather Station, contact the company where you bought it: either Onset Computer Corporation or an Onset Authorized Dealer.

Before calling

Before calling for technical support, you can evaluate and often solve the problem if you do the following:

- Check this manual or online technical support at onsetcomp.com or hobohelp.com. It may only take a few moments to get the answers you need.
- Write down the events that led to the problem.

When contacting Onset Computer Corporation or an Onset Authorized Dealer, please indicate that you need technical support for HOBO products. Be prepared to provide:

- **Most important:** A datafile showing any anomalies
- The part and serial numbers for the logger and the sensors
- The software version number
- Details on the hardware and software configuration of your computer, including the manufacturer, model number, peripherals, and operating system version
- A complete description of the problem or question

By providing detailed information, technical support response time will be faster and the assistance will be more accurate.

Onset Computer contact information

Shipping Address:	Onset Computer Corporation 470 MacArthur Blvd. Bourne, MA 02532 Note: Returns must also have the RMA # obtained from Onset listed on the box with the address (Attn. RMA #) as described in the <i>Returns</i> section below.
Mailing Address:	P.O. Box 3450 Pocasset, MA 02559-3450
Toll-free phone:	1-800-LOGGERS (1-800-564-4377)
Phone:	(508) 759-9500
Fax:	(508) 759-9100
E-mail:	loggerhelp@onsetcomp.com
Internet:	www.onsetcomp.com

Warranty

Onset Computer Corporation (“Onset”) warrants to the original end-user Purchaser for a period of one year from the date of original purchase that the HOBO product(s) purchased will be free from defect in material and workmanship. During the warranty period Onset will, at its option, either repair or replace products that prove to be defective in material or workmanship.

This warranty is void if the product has been damaged by the Purchaser as a result of improper maintenance, abuse, misuse, mishandling, misapplication, error or negligence of Purchaser, or if there has been an unauthorized alteration, attachment or modification.

THERE ARE NO WARRANTIES BEYOND THE EXPRESSED WARRANTY AS PROVIDED IN THIS DOCUMENT. IN NO EVENT SHALL ONSET BE LIABLE FOR LOSS OF PROFITS OR INDIRECT, CONSEQUENTIAL,

INCIDENTAL, SPECIAL OR OTHER SIMILAR DAMAGES ARISING OUT OF ANY BREACH OF THIS CONTRACT OR OBLIGATIONS UNDER THIS CONTRACT, INCLUDING BREACH OF WARRANTY, NEGLIGENCE, STRICT LIABILITY, OR ANY OTHER LEGAL THEORY.

LIMITATION OF LIABILITY. The Purchaser's sole remedy and the limit of Onset's liability for any loss whatsoever shall not exceed the Purchaser's price of the product(s). The determination of suitability of products to the specific needs of the Purchaser is solely the Purchaser's responsibility. **THERE ARE NO WARRANTIES BEYOND THE EXPRESSED WARRANTY IN THIS DOCUMENT. EXCEPT AS SPECIFICALLY PROVIDED IN THIS DOCUMENT, THERE ARE NO OTHER WARRANTIES EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE. NO INFORMATION OR ADVICE GIVEN BY ONSET, ITS AGENTS OR EMPLOYEES SHALL CREATE A WARRANTY OR IN ANY WAY INCREASE THE SCOPE OF THE EXPRESSED WARRANTY OFFERED WITH THE SALE OF THIS PRODUCT.**

INDEMNIFICATION. Products supplied by Onset are not designed, intended, or authorized for use as components intended for surgical implant or ingestion into the body or other applications involving life-support, or for any application in which the failure of the Onset-supplied product could create or contribute to a situation where personal injury or death may occur. Products supplied by Onset are not designed, intended, or authorized for use in or with any nuclear installation or activity. Products supplied by Onset are not designed, intended, or authorized for use in any aeronautical or related application. Should any Onset-supplied product or equipment be used in any application involving surgical implant or ingestion, life-support, or where failure of the product could lead to personal injury or death, or should any Onset-supplied product or equipment be used in or with any nuclear installation or activity, or in or with any aeronautical or related application or activity, Purchaser will indemnify Onset and hold Onset harmless from any liability or damage whatsoever arising out of the use of the product and/or equipment in such manner.

LEGAL REMEDIES. This warranty gives you specific legal rights. You may also have other rights which vary by jurisdiction. The remedies provided herein are in lieu of all other remedies, express or implied.

Returns

Note: Please direct all warranty claims to the place of purchase.

Before returning a failed unit directly to Onset, you must obtain a Return Merchandise Authorization (RMA) number from Onset. You must provide proof that you purchased the Onset product(s) directly from Onset (purchase order number or Onset invoice number). Onset will issue an RMA number that is valid for 30 days. You must ship the product(s), properly packaged against further damage, to Onset (at your expense) with the RMA number marked clearly on the outside of the package. Onset is not responsible for any package that is returned without a valid RMA number or for the loss of the package by any shipping company. Loggers must be clean before they are sent back to Onset or they may be returned to you.

Repair policy

Products that are returned after the warranty period or are damaged by the customer as specified in the warranty provisions can be returned to Onset with a valid RMA number for evaluation.

ASAP repair policy

For an additional charge, Onset will expedite the repair of a returned product.

Data-back service

HOBO Weather Station data loggers store data in non-volatile flash data storage. Onset will, if possible, recover your data to disk.

Tune up service

Onset will examine and retest any HOBO Weather Station logger or sensors.