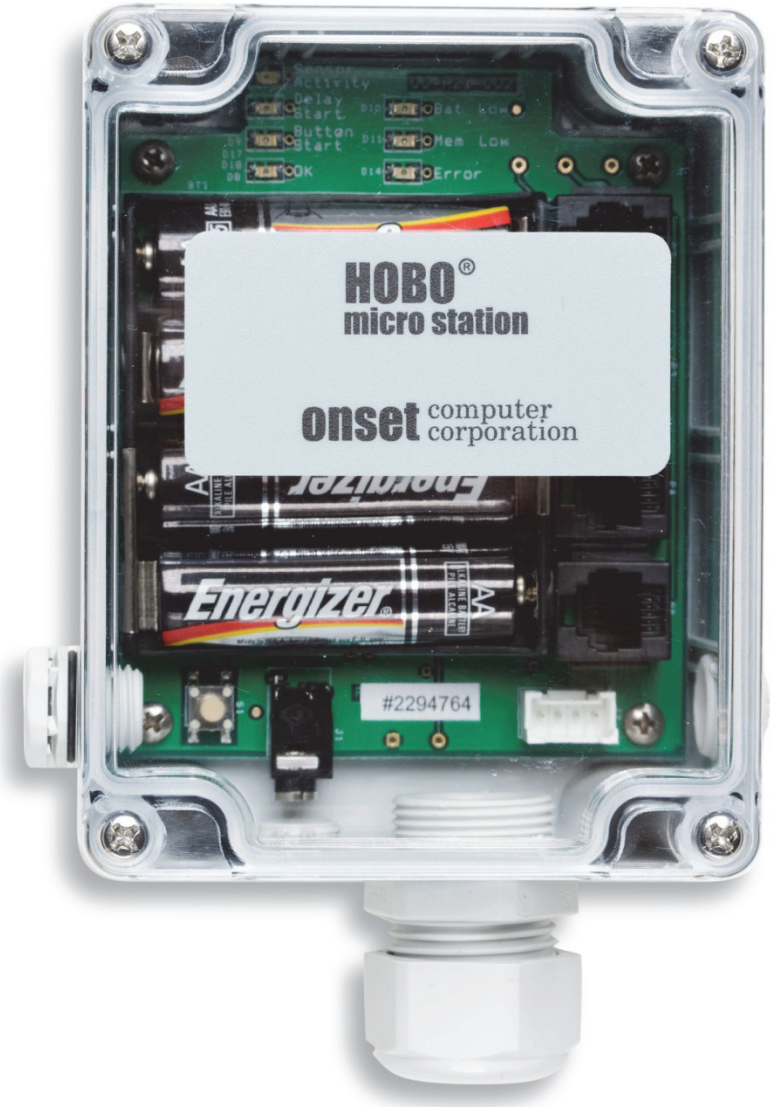
HOBO Micro Station
User's Guide



Part #: MAN-H21-002
Doc #: 7645-K

Contact Information

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

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.

WARNING: Severe shock hazard. Before installing 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 tripod (if using). The Micro 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 Micro Station.

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.

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Chapter 1
Introduction

The HOBO® Micro Station is a four-sensor data logger designed for applications requiring multi-channel monitoring of microclimates in one or more locations. Part of the HOBO Weather Station family, the Micro Station 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 four sensors 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.
- **Weatherproof**. A silicone gasket around the edge of the case keeps out moisture, while a Gore™ Vent allows the case to breath.

Specifications

HOBO Micro 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	Up to four smart sensors (including multiple-parameter sensors)
Communication	3.5 mm serial port
Dimensions	8.9 cm H x 11.4 cm D x 5.4 cm W (3.5 x 4.5 x 2.125 inches)
Weight	0.36 kg (0.8 lb)
Memory	512K nonvolatile flash data storage
Memory Modes	Stop when full, wrap around when full
Operational Indicators	Seven 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 4 sensors with 1 minute or longer logging interval)
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

HOBO Micro Station	
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, with Gore™ Vent and silicone gasket for deployment in harsh weather conditions
Mounting	Mount vertically on flat surface 18 cm (3.5 inches) or wider; optional mast mounting kit for use on 4.1 cm (1 5/8 inches) diameter masts
Enclosure Access	Cover secured by four screws
Sensor Network Cable Length	100 m (328 ft) maximum
Part Number	H21-002
CE	The CE Marking identifies this product as complying with all relevant directives in the European Union (EU).

How to use this manual

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

- Assemble the logger and perform an initial test
- Operate the logger
- Set up the Micro Station in the field
- Troubleshoot problems
- Maintain the Micro 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 Micro 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 are available for use with the Micro Station:

- Temperature
- Temperature/relative humidity
- Rain
- Soil moisture
- Wind speed
- Wind direction
- Barometric pressure (part # S-BPB-CM50 only)
- 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
Assembly and testing

The HOBO Micro Station is shipped partially assembled. This section explains how to assemble the logger, connect the smart sensors, and perform a quick test.

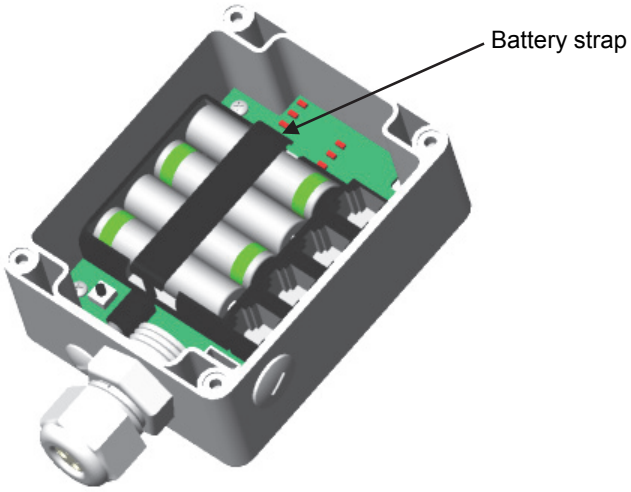
Items required

To configure the Micro Station you will need the following:

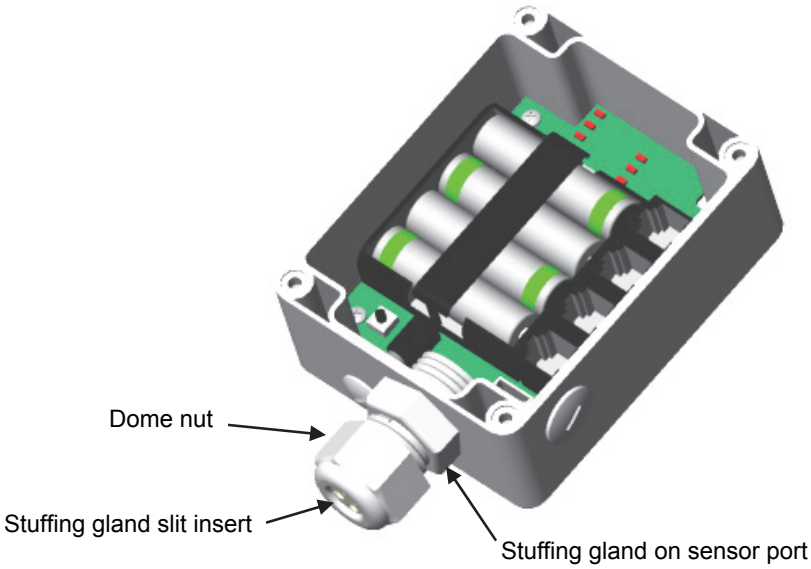
- One to four smart sensors
- Phillips-head screwdriver
- Slotted screwdriver or small coin
- Pen, pencil, or other blunt instrument
- Adjustable 8 inch or 10 inch crescent wrench
- Utility or pocket knife
- PC interface cable (Onset part number CABLE-PC-3.5)
- Computer with logger software installed
- Silicone grease tube

Logger and smart sensor setup instructions

1. Insert four AA alkaline or lithium batteries. For more details on which type of batteries to use, see the *Selecting and installing batteries* section in Chapter 3 on page 15.
2. Place the battery strap on the batteries.

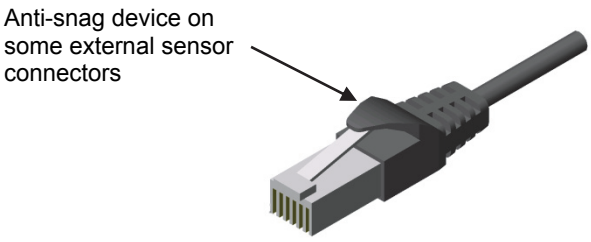


3. With a crescent wrench, remove the dome nut from the stuffing gland in the sensor port.

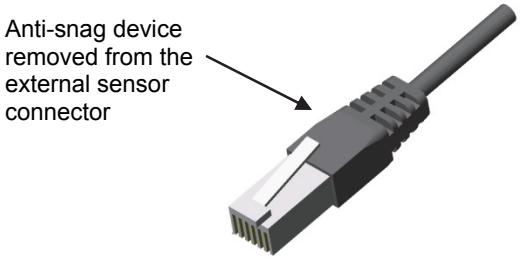


4. Push the slit insert out from the inside of case. You may need to push the slit insert out using a pen (capped end), pencil (eraser end), or other blunt instrument.

5. Some sensors have an anti-snag device on the connector as shown below. If any of your sensors has this device, check that the connector fits through the stuffing gland.

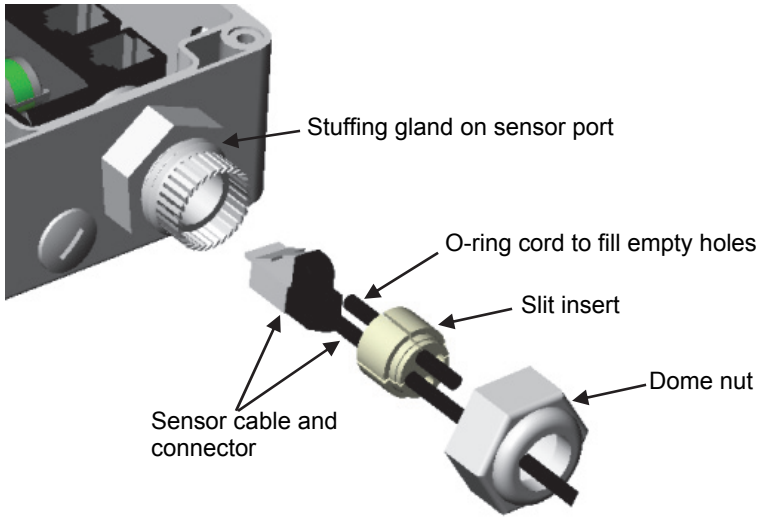


If the connector does not fit through the stuffing gland, you will need to trim the anti-snag device with a knife so that the connector looks like the one below.



6. Insert the sensor connectors through the dome nut. The threaded side of the dome nut should be facing towards the connector. Then, slide the cables through the stuffing gland and through the hole in the case. Push the cables into the slit insert.

   Note: The electronics on some older temperature sensors are housed in a tube that is close to the sensor connector. If you have any of these sensors, be sure to insert them first because they will need more room inside the logger. Adjust the sensor as needed so that the tube with the electronics fits inside the logger without too much unnecessary bending of the cable.

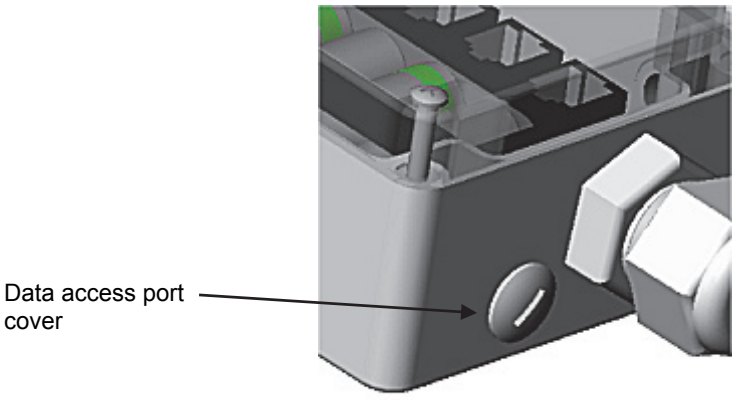


7. Plug the sensors into the logger. Adjust the cable length as necessary so there isn't excess cable inside the case.
8. If you are using fewer than four sensors, add the o-ring cord(s) to plug the empty hole(s) in the slit insert.
9. Apply some silicone grease to the slits on the insert.
10. Push the slit insert back into the stuffing gland. Pushing the slit insert in at a slight angle and with a slight twist may help it slide in more smoothly.
11. Screw the dome nut onto the stuffing gland, tighten by hand, and then an additional ½ to ¾ turn with an adjustable wrench. The dome nut must be snug, but shouldn't be overtightened.
12. From the back side of the stuffing gland, fill the void inside with silicone grease from the package.
13. Remove the desiccant pack from its foil pouch and place inside the logger enclosure to minimize internal condensation.
14. Apply silicone grease to the outside rim of the case where the cover meets up with the housing. The grease should be applied sparingly in this location.
15. Screw the clear cover back onto the case. Use a Phillips-head screwdriver to tighten the four cover screws.

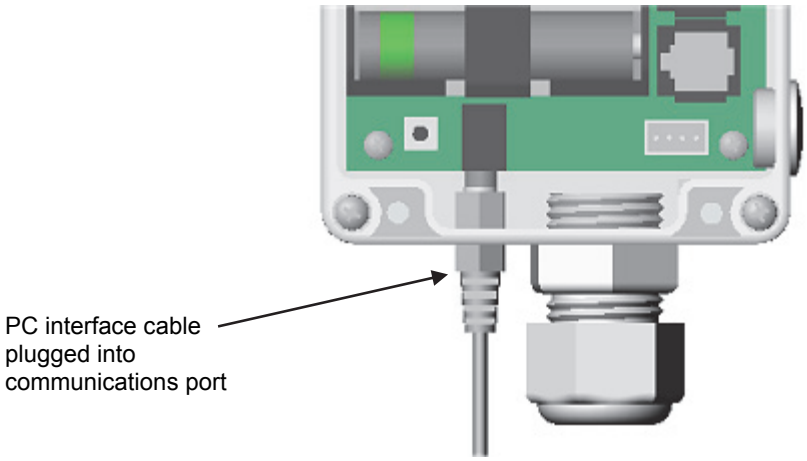
Testing the logger

It is recommended that you test the logger before setting it up in the field. To test the logger:

1. Use a slotted screwdriver or small coin to unscrew the data access port cover.



2. Insert the PC interface cable through the data access port and plug it into the communications port on the logger.



3. Using the logger software, select the Launch icon.
4. Make sure all the sensors you plugged in are visible in the Launch screen.
5. Choose a logging interval of a few seconds so that your test will yield enough data to look at. Select the Start Logging Now option, and click the Start button to launch the logger.
6. After a couple of minutes, read out the logger. You can choose to either stop the logger and read it out or let it continue logging while reading out.
7. Check the data and make sure it appears normal for all sensors.

For more details on launching and logger operation, see Chapter 3. For information on mounting the logger and setting it up in the field, see Chapter 4.

Chapter 3
Logger operation

This chapter explains key elements of Micro 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 Micro Station.

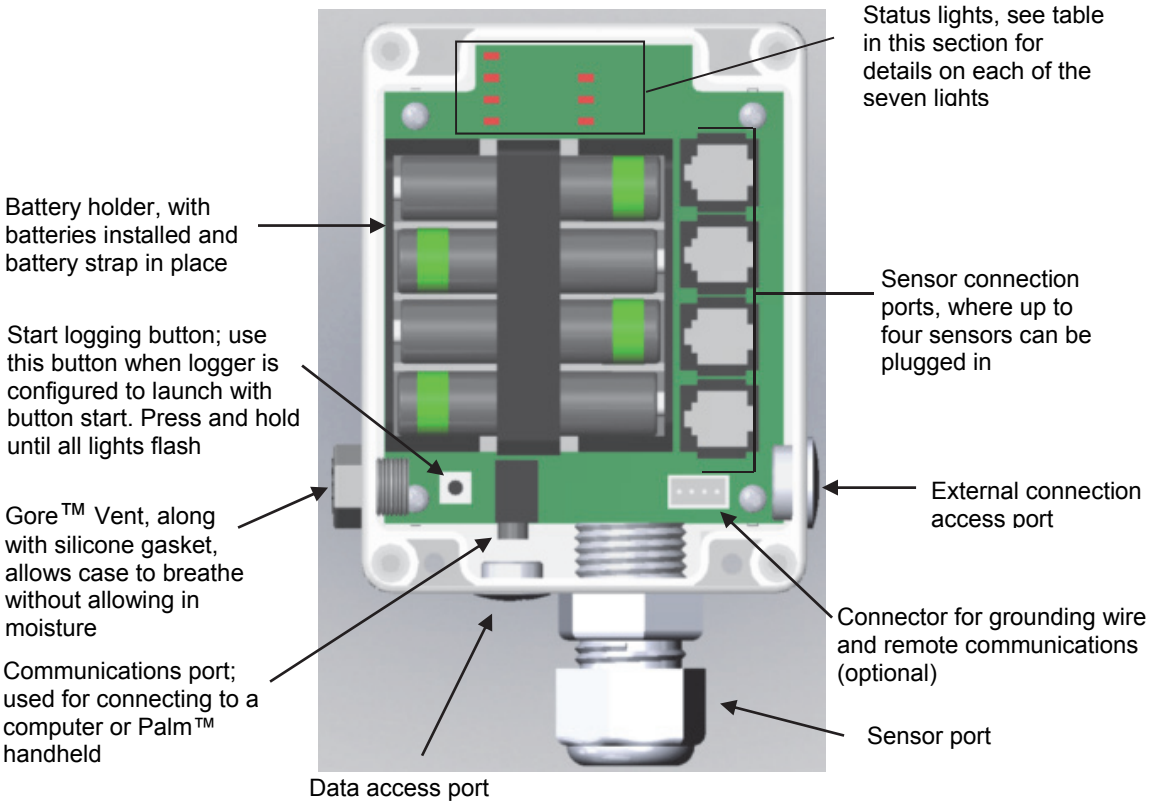


Figure 1: Micro Station components

Status lights

There are seven lights on the Micro 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 *cannot* 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 following section for details on the Wrap Around When Full setting).
Error	There is or has been a sensor communication failure.	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. If this is the only blinking light, then at least one sensor is currently not communicating. Immediate investigation is recommended. In general, it is recommended that you read out any data when this light is blinking, investigate the problem, and re-launch the logger.

Communicating with the logger

You can launch, read out, or check the status of the Micro Station with either a computer or Palm handheld (custom launch parameters can only be specified with the computer). In addition, you can also use a Remote Modem to connect to a Micro Station deployed near an analog phone line or use a Radio Modem for wireless communication with the logger within a specified range.

To connect the logger to the computer or Palm handheld:

1. Use a slotted screwdriver or small coin to unscrew the data access port cover.

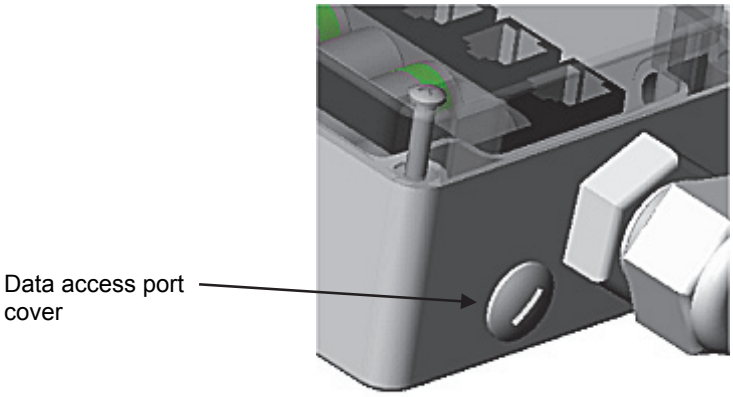


Figure 2: Data access port on logger

2. Insert the PC interface cable or Palm-to-Logger cable through the data access port and plug it into the communications port on the logger.

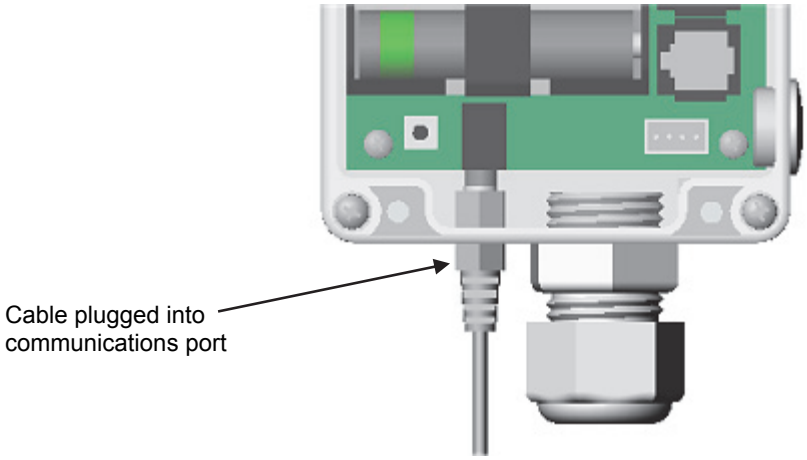


Figure 3: Connecting cable to logger

Once connected to the computer, use the logger software 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.

To connect the logger to the Radio Modem or Remote Modem:

1. Use a slotted screwdriver or small coin to unscrew the external connection access port cover.

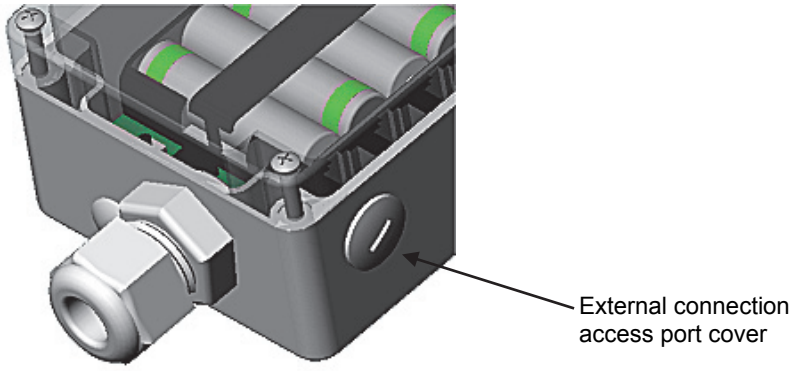


Figure 4: External connection access port on logger

2. Insert the External Communications Port Adapter Cable through the port and plug it into the modem connector. For complete details on attaching this cable, see the *Connecting the External Communications Port Adapter Cable* section on page 25.

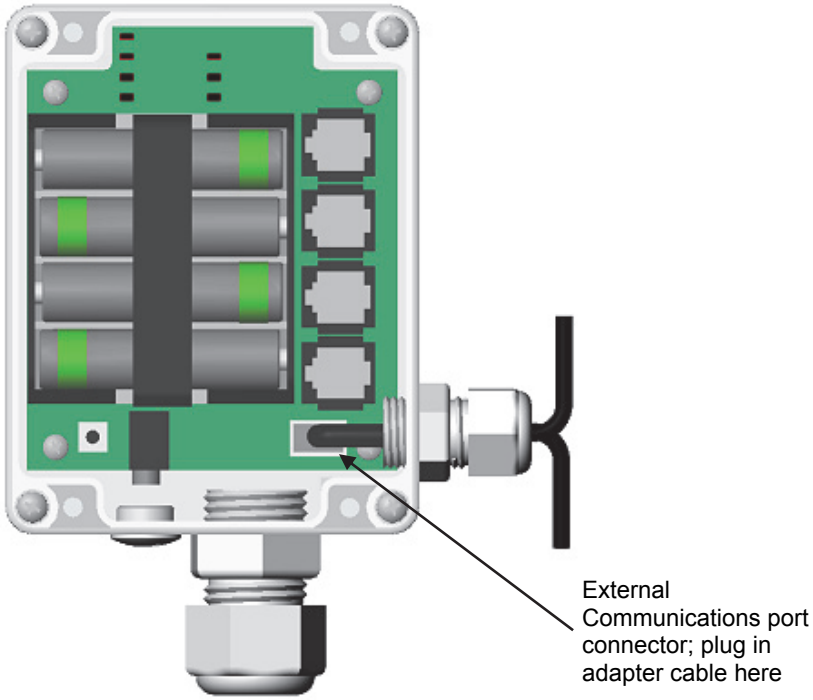


Figure 5: Plugging in external communications port adapter cable

3. Connect the cable to the Remote Modem or serial extension cable.

Once connected, use the Remote Site Manager software to launch, read out, or check the status. See the following sections for general information on launching and reading out. Refer to the *Remote Site Manager User's Guide* for detailed information about the software, the *Radio Modem Operation Manual* for details on configuring the Radio Modem, and the *Remote Modem User's Guide* for information about configuring the Remote Modem.

Launching

There are several parameters you can enter when launching the Micro Station with the logger software. The following table describes the launch parameters you can set. **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.

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 *Estimating Battery Life* section on page 16 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 battery consumption.
When to start logging	Choose one of the following start modes for the logger: • **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**. This allows you to configure the launch settings, but start the actual launch when you want by pressing a button on the logger. 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).
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.
Edit sensor locations	Give each sensor a name of up to 30 characters.
Deployment notes	Add up to 2000 characters of notes about the launch.

Reading out data

You can read out data (offload) the Micro Station with logger software. Connect to the logger as described in *Communicating with the logger* on page 12 and then read it out. If the Micro Station 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 a full Micro Station (512K of data). A full logger readout via the Radio Modem or Remote 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 Micro Station requires four 1.5 volt 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.

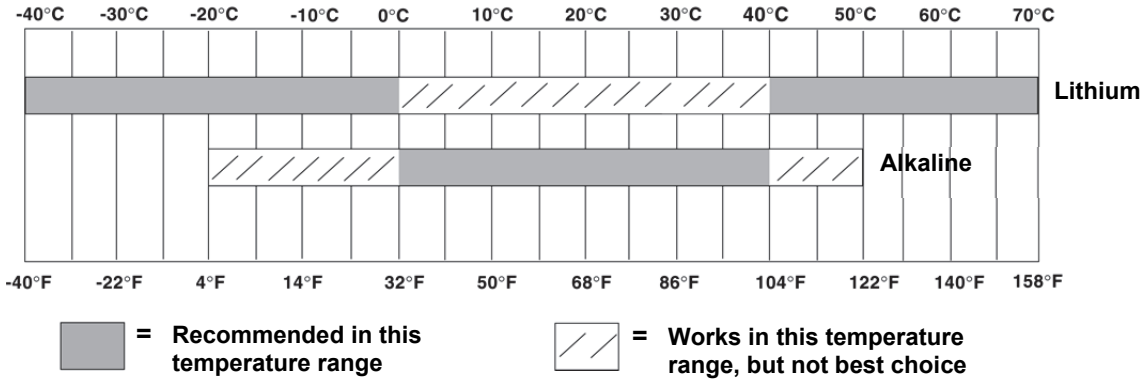


Figure 6: Recommended battery type based on temperature

Notes:

- The logger is not designed to run with rechargeable or Carbon Zinc "Heavy Duty" batteries.
- Using battery types other than 1.5 Volt alkaline or lithium 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 in use (most important factor)
- Number of sensors
- 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. **Note:** The run times in this table assume that the recommended battery type for the temperature range is being used and up to four sensors are connected.

Logging interval	Sampling Interval	Typical battery run time
1 second	Off	30 to 50 days
1 minute	Off	About 12 months
10+ minutes	1 minute	12 months or more

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, 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 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.

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

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 14).
- **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.
- **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 Micro Station's clock is set in Coordinated Universal Time (UTC), which is determined from the clock on your computer or Palm handheld. Once the Micro Station 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 35ppm (21 seconds per week).

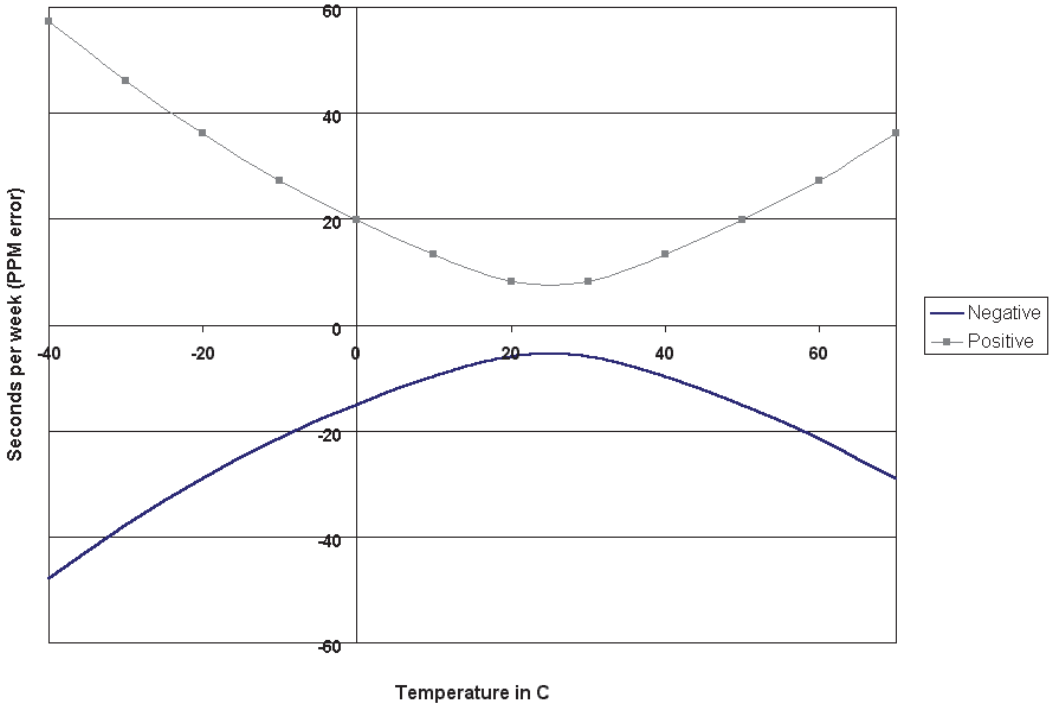


Figure 7: Worst case time error

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 deployment 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 Micro Station with the following sensors is using 56 total bits.

1 Temperature	X	8	=	8
1 Wind Speed	X	16	=	16
2 Temperature/RH	X	16	=	32
Total number of bits				56

At a logging interval of 5 minutes, the memory run time for a Micro Station using 56 bits would be approximately 250 days (based on Figure 8). See the sensor's manual for the number of bits each type of sensor uses.

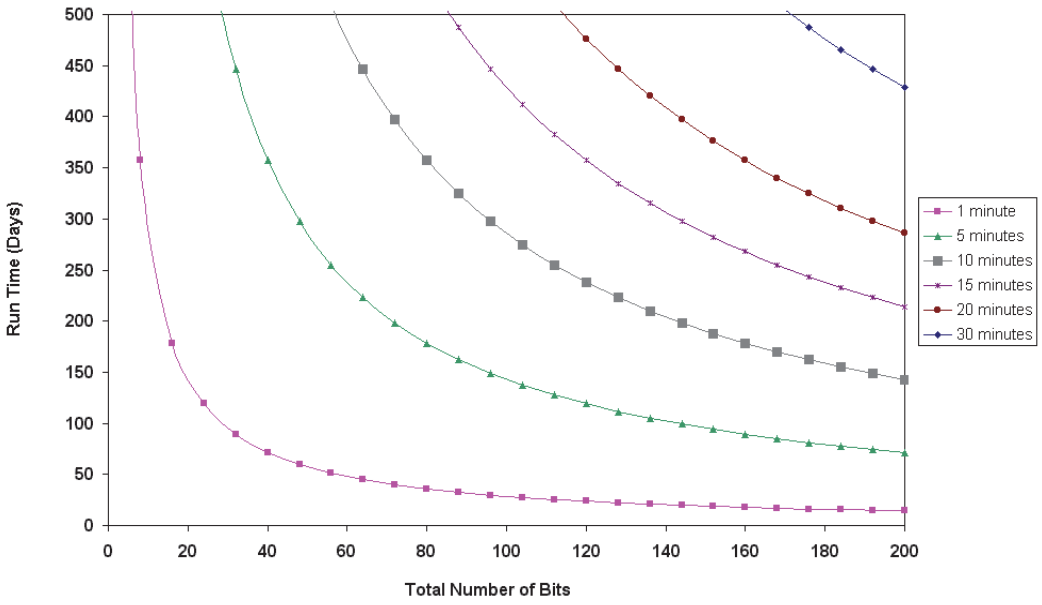


Figure 8: Memory run time

Chapter 4
Field setup and mounting

The HOBO Micro Station shares many of the same optional accessories as the HOBO Weather Station. This chapter explains how to set up the Micro Station in the field, both with and without the optional accessories. This includes:

- Guidelines for typical field setup
- Mounting instructions for a flat surface
- Using Micro Station accessories
- Tripod setup

Guidelines for typical field setup

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

- ⚠ **WARNING: Severe shock hazard**. Do not set up the HOBO Micro Station near power lines. Contact between the HOBO Micro Station and power lines may result in a fatal shock, electrocution, or death.

- **IMPORTANT**: The logger must be mounted vertically so that cables hang down (preventing moisture from entering the connection) and to allow for proper ventilation of the case through the Gore Vent.
- 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 Micro Station.
- An External Grounding Wire Adapter Cable (Part # CABLE-HWS-G) is required if you will be using a wind speed or wind direction sensor with the logger. Both an External Grounding Wire Adapter Cable and a Grounding Kit (Part # M-GKA) are recommended if the logger will be placed in an exposed location on a tripod or tower.
- 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.

- If mounting the logger to a post or wall, note that it is 60 x 103 mm (2.37 x 4.06 inches) between the center of the holes on the back of the logger. See Figure 10 on page 21.
- Onset offers a 1.5 meter mast (Part # M-MPB), which is especially useful when you are trying to minimize the size and visibility of the Micro Station.

Mounting instructions for a flat surface

You can mount the Micro Station to a flat surface without any optional accessories.

IMPORTANT: The logger must be mounted vertically so that cables hang down (preventing moisture from entering the connection) and to allow for proper ventilation of the case through the Gore Vent.

To mount the logger to a flat surface, such as a 2x4 pressure-treated stud or plank, you will need:

- Phillips-head screwdriver
- Four Phillips-head screws (shipped with logger)

Follow these instructions:

1. Remove the clear cover from the case.
2. There are four holes next to each of the four screw holes used to attach the clear cover as shown below. Screw in the four Phillips-head screws through the inside of the case into the flat surface. Use the dimensions in Figure 10 for determining where to drill holes on the mounting surface.

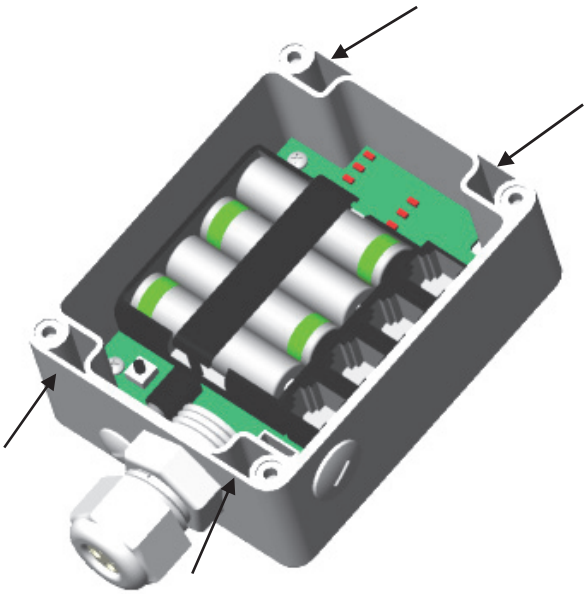


Figure 9: Holes for mounting logger

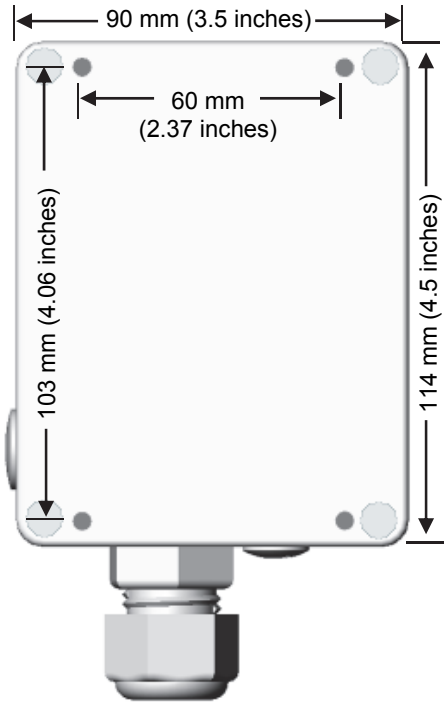


Figure 10: Dimensions for mounting pattern

3. Replace the clear cover.

Using Micro Station accessories

This section explains how to use the following accessories with the Micro Station:

- Mast Mounting Kit
- External Grounding Wire Adapter Cable
- External Communications Port Adapter Cable

Mounting the logger with the Mast Mounting Kit

An optional Mast Mounting Kit (Part # M-MKA) is available for mounting the logger to a 4.1 cm (1 5/8 inch) diameter mast, such as the optional 1.5 m mast (Part # M-MPB), or 2 m tripod (Part #-M-TPB) and 3 m tripod (Part # M-TPA).

IMPORTANT: The logger must be mounted vertically so that cables hang down (preventing moisture from entering the connection) and to allow for proper ventilation of the case through the Gore Vent.

The tools required to mount the logger to a mast are:

- 1/2 inch wrench
- Phillips-head screwdriver
- Mast Mounting Kit (Part # M-MKA), which includes one mounting plate, two 1-5/8 inch U-bolt assemblies, and four 6x38 flat head screws.

Follow these instructions:

1. Unscrew the clear cover on the logger.
2. Place the four screws provided in this kit through each of the four holes next to the screw holes used to attach the clear cover. Screw in the four screws through the inside of the case to the mounting plate.
3. Using the two 1-5/8 inch U-bolt assemblies and the mounting plate, mount the logger upright to the mast. Place the U-bolts around the mast and install the saddle clamps. Place the logger mounting plate against the saddle clamps and screw on the U-bolt hex nuts.
4. Screw the cover back on the logger when done. Make sure there is adequate silicone grease on the cover gasket before replacing the cover.

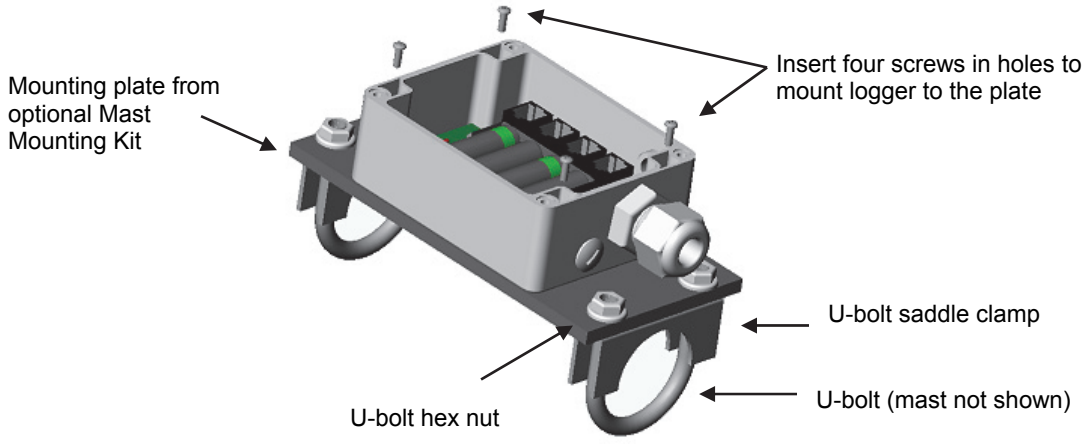


Figure 11: Mounting the logger with the Mount Kit

Connecting the External Grounding Wire Adapter Cable

An External Grounding Wire Adapter Cable (Part # CABLE-HWS-G) is required if you will be using a wind speed or wind direction sensor with the logger or if the logger will be placed in an exposed location on a tripod or tower.

The tools required to connect the External Grounding Wire Adapter Cable are:

- Small coin or slotted screwdriver
- Phillips-head screwdriver
- Crescent wrench
- Silicone grease packet

Follow these instructions:

1. Use a slotted screwdriver or small coin to unscrew the external connection access port cover.

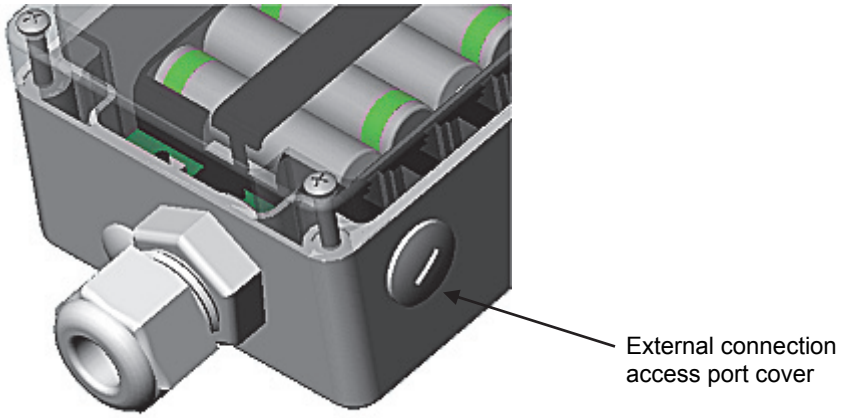


Figure 12: External connection access port on logger

2. Apply silicone grease to the o-ring on the fitting.
3. Insert the cable through the external connection access port. Screw in the fitting to seal the hole. Hand-tighten the fitting and then tighten an additional ½ to ¾ turn with a crescent wrench.
4. Plug the cable into the connector. Note that the cable can fit into the connector in one direction only. Hand-tighten the dome nut and then tighten an additional ½ turn with a crescent wrench.

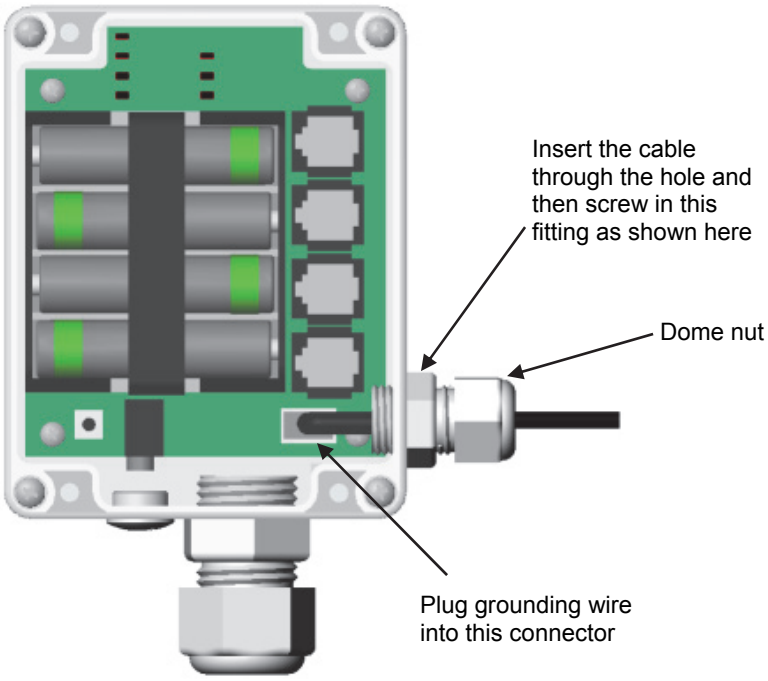


Figure 13: Grounding wire plugged into logger

5. Fill the void in the backside of the gland nut with silicone grease.
6. Connect the grounding wire to a clamp on the mast or tripod.
7. Screw the cover back on the logger. Make sure there is adequate silicone grease on the cover gasket before replacing the cover.

Connecting the External Communications Port Adapter Cable

An optional External Communications Port Adapter cable (Part # CABLE-HWS-F) is available for connecting the logger to the Remote Modem or to a serial extension cable. This cable includes a grounding wire, which is required if you will be using a wind speed or wind direction sensor with the logger or if the logger will be placed in an exposed location on a tripod or tower.

The tools required to connect the External Communications Port Adapter Cable are:

- Small coin or slotted screwdriver
- Phillips-head screwdriver
- Crescent wrench
- Silicone grease packet

Follow these instructions:

1. Use a slotted screwdriver or small coin to unscrew the external connection access port cover.

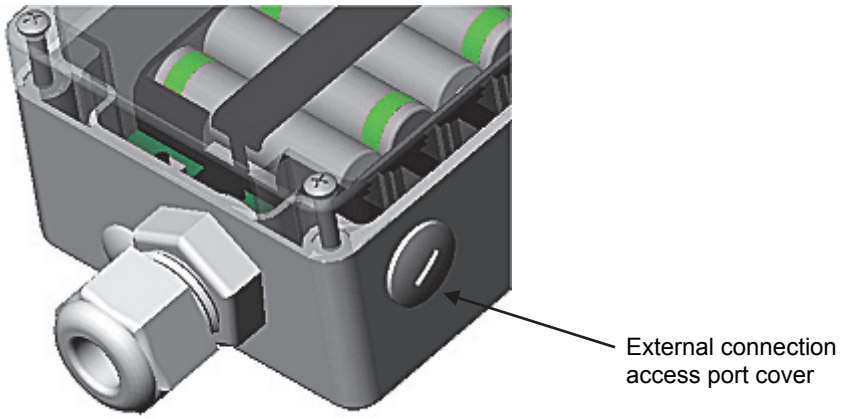


Figure 14: External connection access port on logger

2. Apply silicone grease to the o-ring on the fitting to be inserted.
3. Insert the cable through the external connection access port. Screw in the fitting to seal the hole. Hand-tighten the fitting and then tighten an additional ½ to ¾ turn with a crescent wrench.

4. Plug the cable into the connector. Note that the cable can fit into the connector in one direction only. Hand-tighten the dome nut and then tighten an additional ½ turn with a crescent wrench.

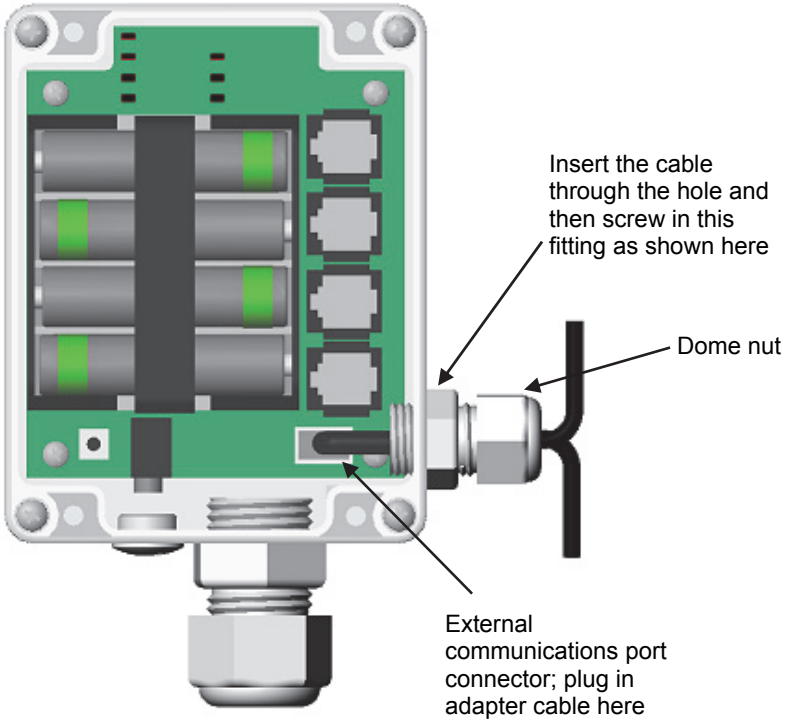


Figure 15: External communications port adapter cable plugged into logger

5. Fill the back side of the gland nut with silicone grease.
6. Connect the communications end of the cable to the Remote Modem or serial cable.
7. Connect the grounding wire to a clamp on the mast or tripod.
8. Screw the cover back on the logger.

2 or 3 meter tripod system setup (optional)

This section explains how to set up the Micro Station using the tripod, masts, and other optional accessories from the HOBO Weather Station family. This includes:

- Guidelines for a tripod system setup
- Field preparation checklist
- Steps for setting up the 2 or 3 meter tripod system

Guidelines for a tripod system setup

In addition to the *Guidelines for a typical field* setup on page 20, adhere to the following guidelines for using the Micro Station with a tripod:

- If you will be using a rain gauge or wind sensor, select a location away from trees and buildings. 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 or wind direction 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 Micro Station near power lines. Contact between the Micro Station and power lines may result in a shock, electrocution, or death.

- For areas with winds greater than 50 mph, to stabilize a tall mast, 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 secure the system.
- Either an External Grounding Wire Adapter Cable (Part # CABLE-HWS-G) or an External Communications Port Adapter Cable (Part # CABLE-HWS-F) is required if you will be using a wind speed or wind direction sensor with the logger or if the logger will be placed in an exposed location. In addition, the Grounding Kit (Part # M-GKA) is recommended if the logger will be outdoors in an exposed location. Electrically ground the logger to its mounting mast, which in turn must be connected to a ground rod to reduce the chance of damage from atmospheric electrical activity.
- 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).

Field preparation checklist

Use the following checklist to make sure you have all the necessary materials for setting up a Micro Station with accessories from the HOBO Weather Station family of products.

✓	Task
	Check that you received all the parts for your Micro Station system as ordered.
	Configure the logger. Set up the logger for launch; install batteries and battery strap. For details, see Chapters 2 and 3.
	If you are using the External Grounding Wire Adapter Cable or External Communication Port Adapter Cable, install them now. See the instructions on page 23 and 25 respectively.
	If you opened any parts: Double-check the packing lists to make sure you haven't lost any pieces.
	If you are using the Mast Mounting Kit, mount the logger now. See the instructions on page 22.
	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 42 in Step 5 for instructions.
	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 Micro Station and its components.
	Gather the tools required for setup. Use the following checklists to make sure you have the necessary tools to set up the Micro Station in the field. The items marked "optional" depend on your site needs.

Logger

Item	✓
Phillips-head screwdriver	
Adjustable 8 inch or 10 inch crescent wrench (if using mast mounting kit)	
Pen, pencil, or other blunt instrument	
Small coin or slotted screwdriver	
Utility or pocket knife	

Rain Gauge Sensor

Item	✓
Mast level (Part # M-MLA) (optional; for mounting on separate mast)	
Sledgehammer or post driver (optional; for mounting on separate mast)	
Eye protection—safety glasses (if using sledgehammer/post driver)	
Slotted screwdriver	
Conduit (optional)	

Light Sensor

Item	✓
Ladder (if deploying sensor above eye level)	
Light sensor level (Part #M-LLA)	
Phillips head screwdriver #1	
Compass	

Wind Speed or Wind Direction Sensor

Item	✓
7/16 inch wrench	
Crescent wrench (or second 7/16 inch wrench)	
1.06 inch/2.00 inch hose clamps (if mast mounting without cross arm)	

✓	Task

Gather the tools required for setup (continued)

Soil Moisture Sensor

Item	✓
Trenching shovel, spade, or flat bar	
Water (optional)	

Temperature/RH or Temp Sensor

Item	✓
Phillips head screwdriver #1 (if sensors are not already installed)	
Conduit (optional)	

4-20 mA Input Adapter

Item	✓
Hook and loop tape	

Pulse Input Adapter

Item	✓
Two wire nuts	

0-5 Volt Input Adapter

Item	✓
Hook and loop tape	

3 m or 2 m Tripod with Mast (M-TPA or M-TPB)

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	

Cross Arm (M-CAA) or (M-CAB)

Item	✓
1/2 inch wrench	
Crescent wrench	

Stake Kit (M-SKA) or (M-SKB)

Item	✓
Sledgehammer	
Eye protection—safety glasses	

3 m Mast (M-MPA)

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	

1.5 m Mast (M-MPB)

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

Grounding Kit (M-GKA)

Item	✓
1/2 inch wrench	
Sledgehammer	
Eye protection—safety glasses	
Medium size wire cutters	

Guy Wire Kit (M-GWA)

Item	✓
Phillips head screw driver #2	
1/2 inch wrench	
Medium size wire cutters	
Crescent wrench	

Solar Radiation Shield (M-RSA)

Item	✓
1/2 inch wrench	
Phillips head screwdriver #1 (if sensors aren't already installed)	

Light Sensor Bracket (M-LBB)

Item	✓
1/2 inch wrench	

Steps for setting up the 2 or 3 meter tripod system

The following steps explain how to set up the logger in a tripod system. Step 1 includes instructions for both the 2 and 3 meter 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 31

Step 2: Install the Grounding Kit, page 36

Step 3: Temporarily install the upper mast, page 37

Step 4: Mount the cross arm and wind sensor, page 38

Step 5: Install other smart sensors, page 40

Step 6: Mount the upper mast to the lower mast, page 45

Step 7: Mount the logger enclosure to the upper mast, page 46

Step 8: Install the Guy Wire Kit, page 47

Step 9: Final positioning and leveling of sensors, page 49

Step 10: Plug in sensors, tie cables, and begin logging, page 50

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 33.

2 meter tripod/lower mast assembly instructions:

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.

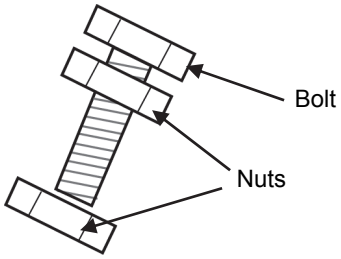


Figure 16: Nut and bolt assembly

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.

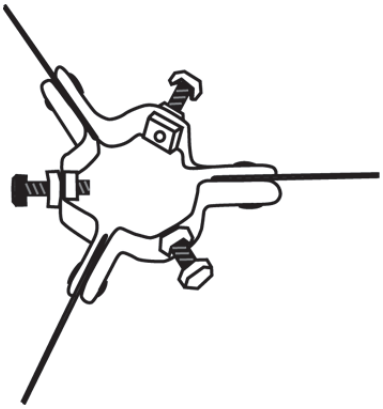


Figure 17: Tri-clamp and bolts

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 18). 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.

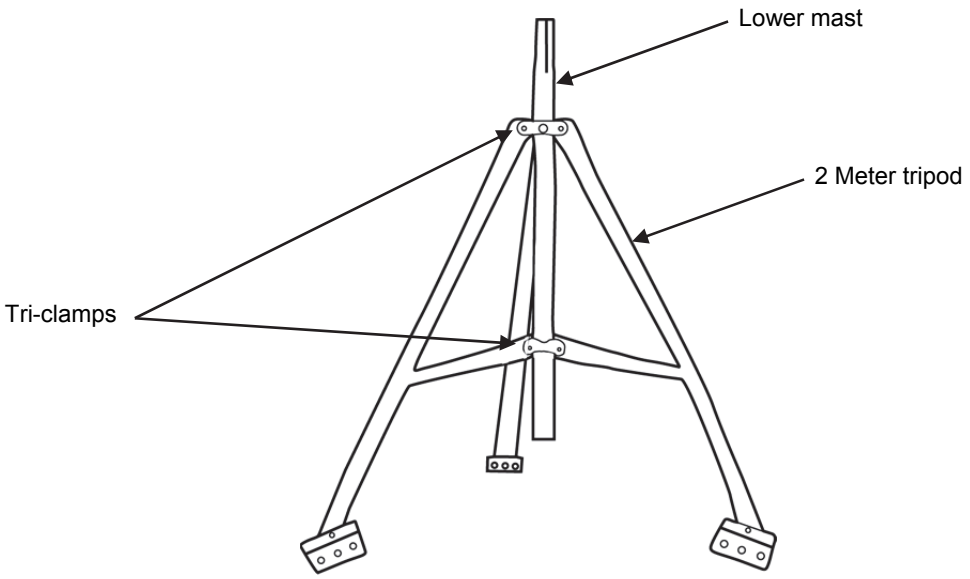


Figure 18: Two meter tripod and lower mast

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 Mast Level (Part # M-MLA) 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 ¼-inch diameter stake kit (Part # M-SKB) or bolt the tripod to cement pads with ¼-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:

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 19). 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.

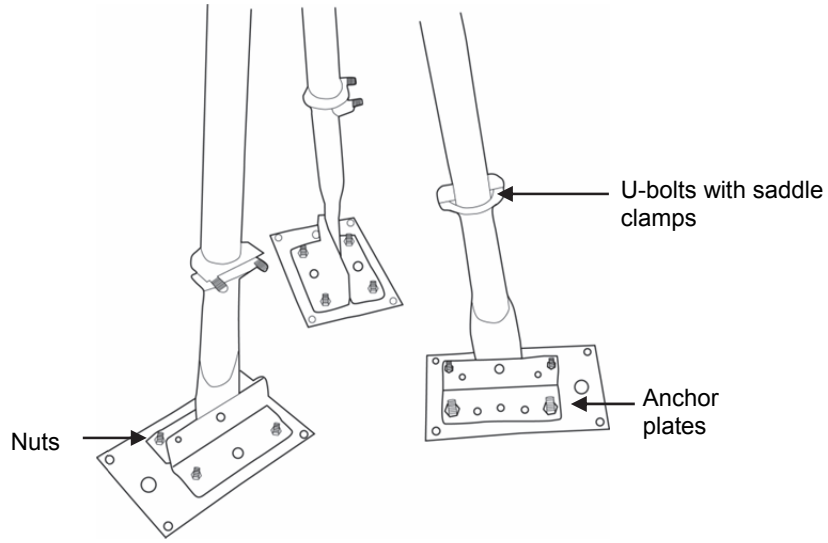


Figure 19: Three meter lower tripod

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.

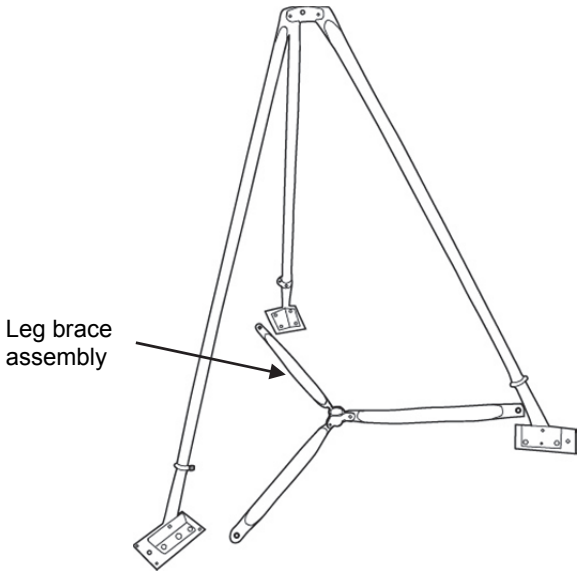


Figure 20: Leg brace and 3 meter tripod

5. 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.

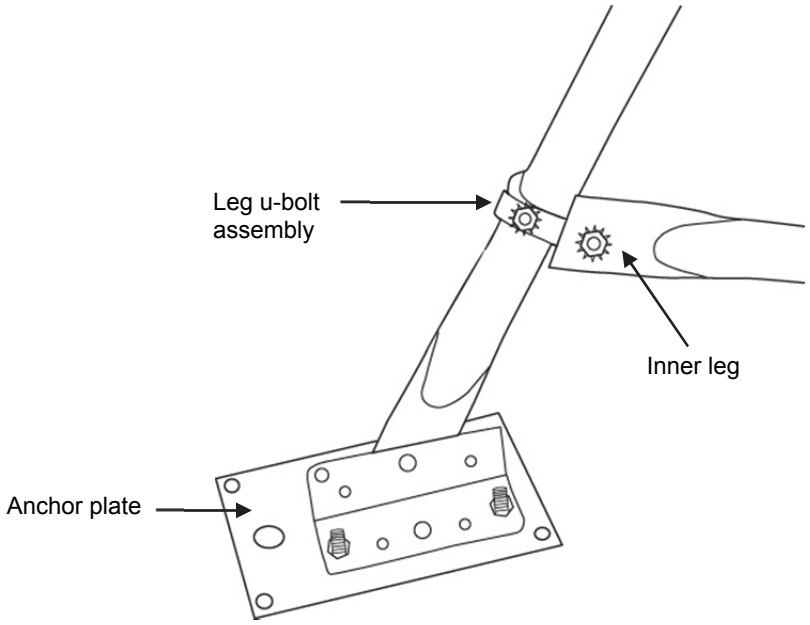


Figure 21: Three meter tripod inner leg

6. 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.

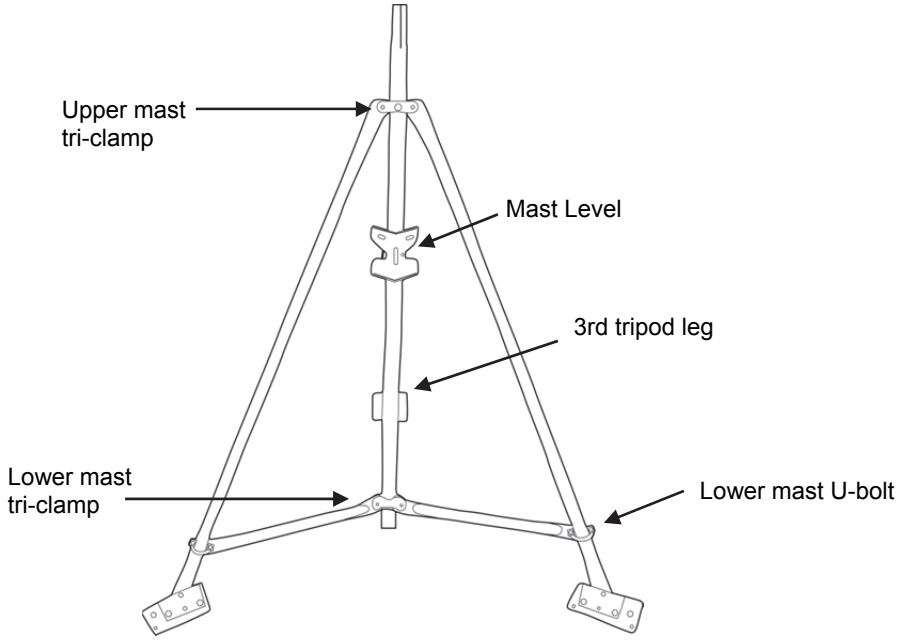


Figure 22: Three meter tripod lower mast

7. Install a Mast Level (Part # M-MLA) 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.

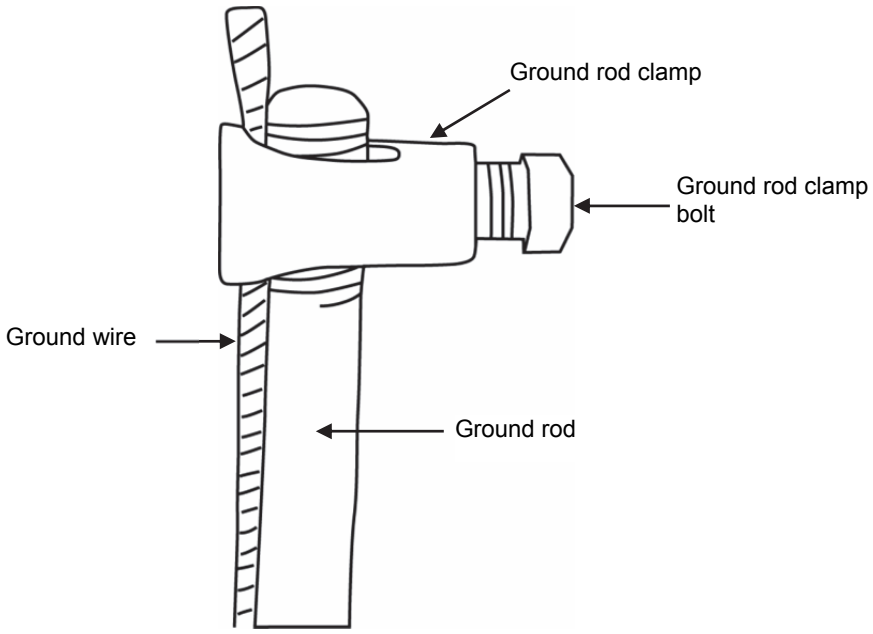


Figure 23: Ground wire attachment

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 45 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.

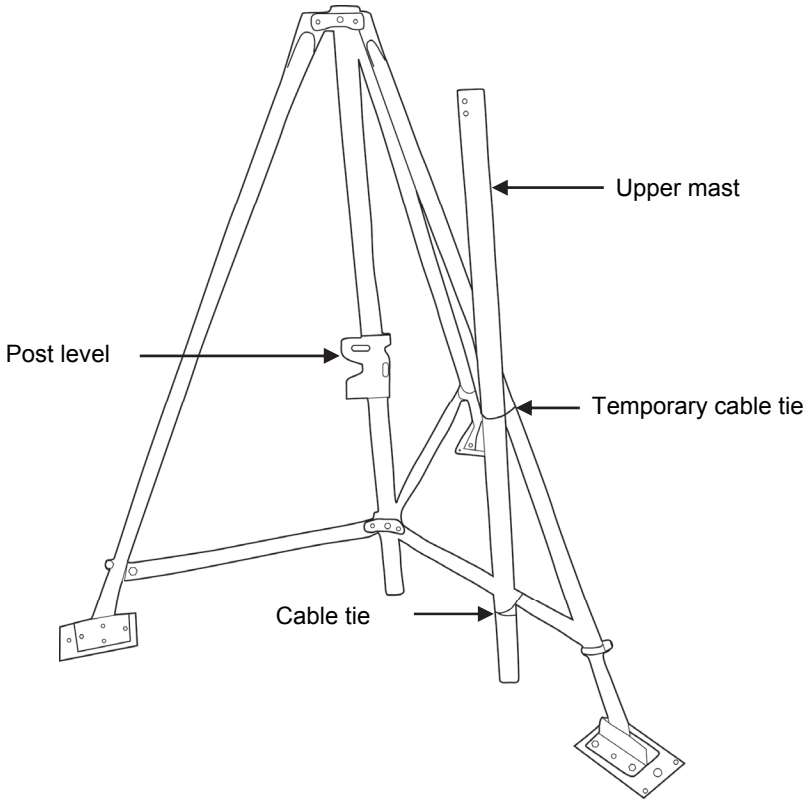


Figure 24: Upper mast (temporary)

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.

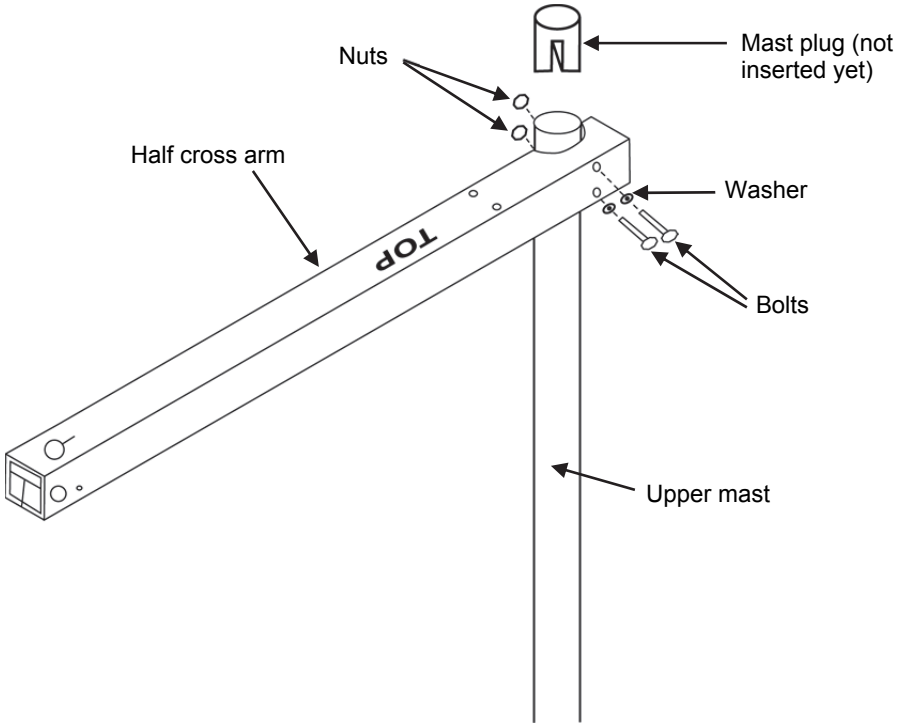


Figure 25: Half cross arm (setup is same for full cross arm)

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 26).
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.

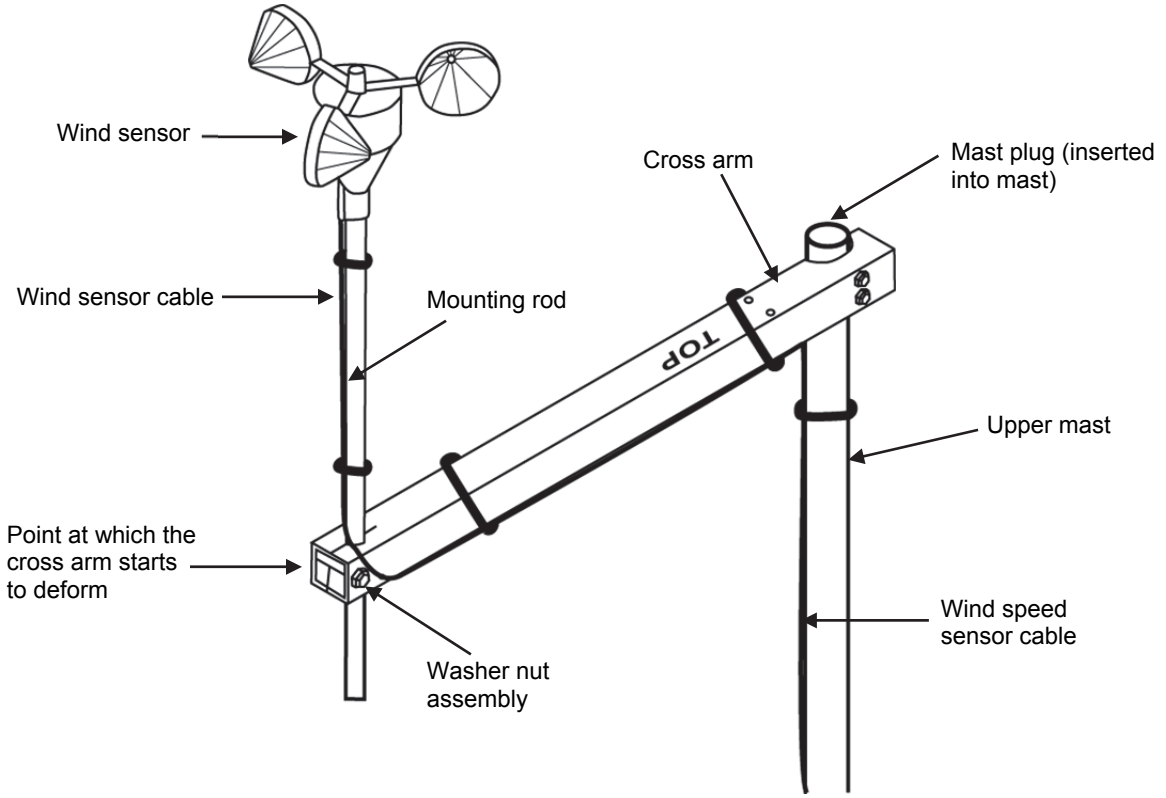


Figure 26: Wind sensor attachment

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 40
- Light, page 41
- Temperature or Temperature/RH, page 42
- Soil Moisture, page 44
- 4-20 mA or 0-5 Volt Input Adapter, page 44
- Pulse Input Adapter, page 44

If you are not installing any of these sensors, skip to *Step 6: Mount the upper mast to the lower mast* on page 45.

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).

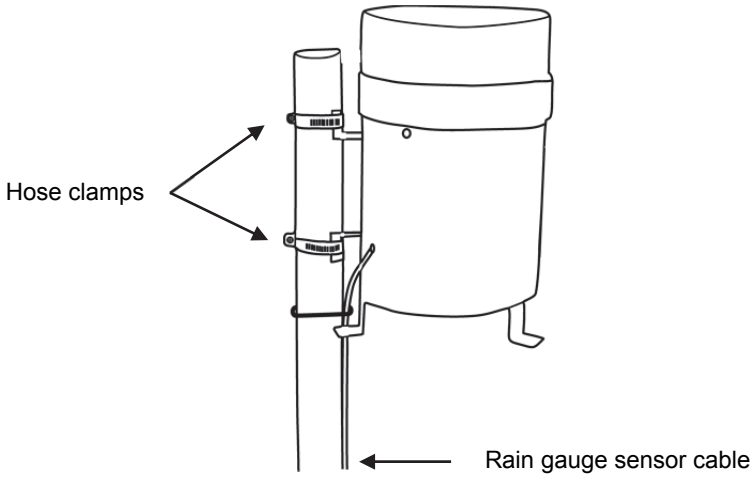


Figure 27: Rain gauge on separate mounting pole

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.

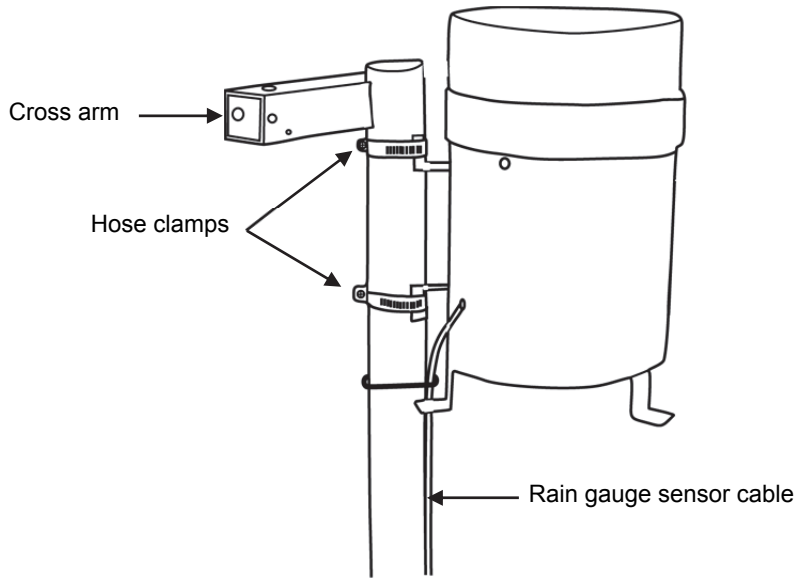


Figure 28: Rain gauge on the tripod mast

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-LBB) 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.

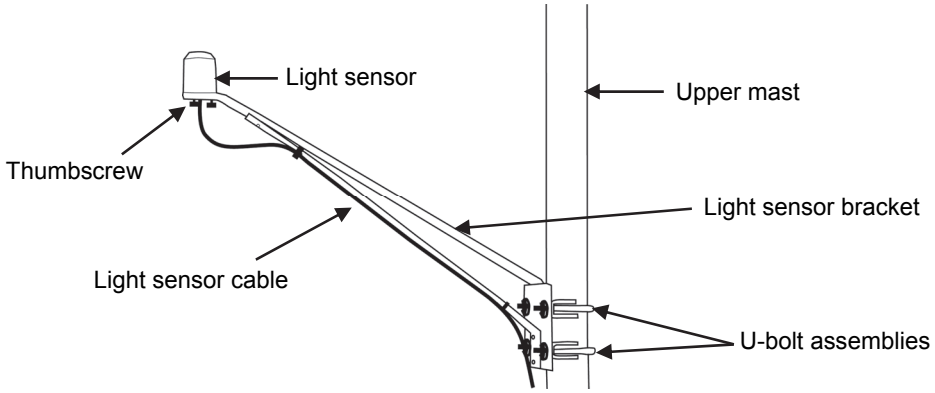


Figure 29: Light sensor on the mast

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 three 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 30). Be careful not to block the RH sensor openings. Feed the cable out through the third and fourth shield plates (see Figure 32). Replace the bottom three shield plates.

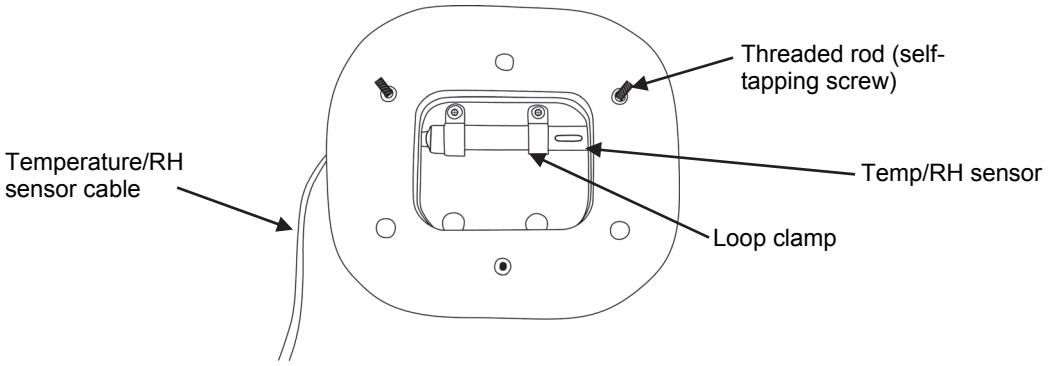


Figure 30: Temperature/RH sensor inside solar radiation shield

To install the temperature sensor into the solar radiation shield: Remove the bottom three shield plates by removing the three wing nuts. Install the temperature sensor using the small black loop clamp, washer, and screw (see Figure 31). Feed the cable out through the third and fourth shield plates (see Figure 32). Replace the bottom three shield plates.

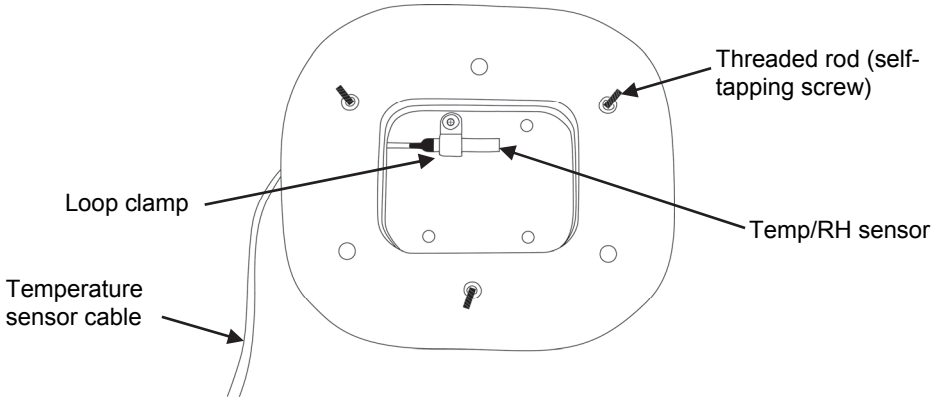


Figure 31: Temperature sensor inside solar radiation shield

2. Mount the white solar radiation shield assembly onto the upper mast using the two U-bolts provided (see the figure below).
3. 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.

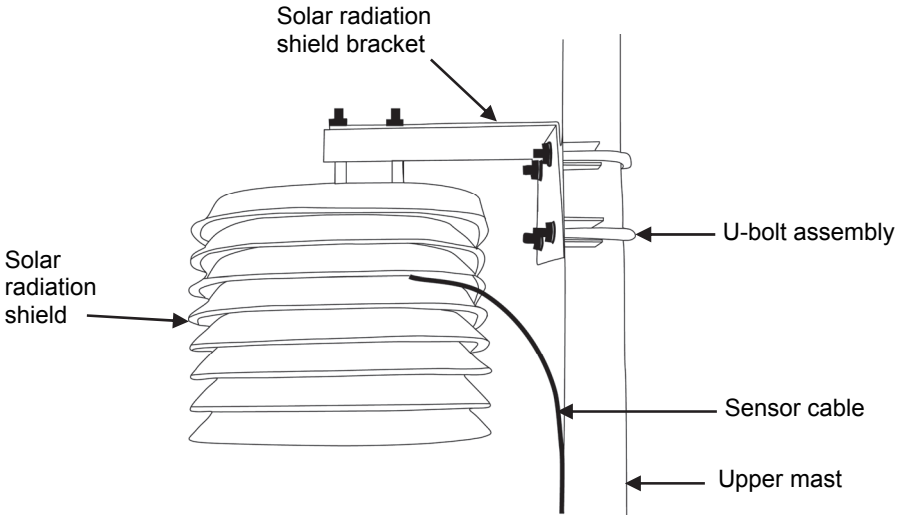


Figure 32: Solar radiation shield attachment

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.

1. 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.
2. Insert the probe into the hole, making sure the entire length of the probe is covered.
3. 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.
4. Water the soil surrounding the sensor to facilitate settling of the soil.
5. 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 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.

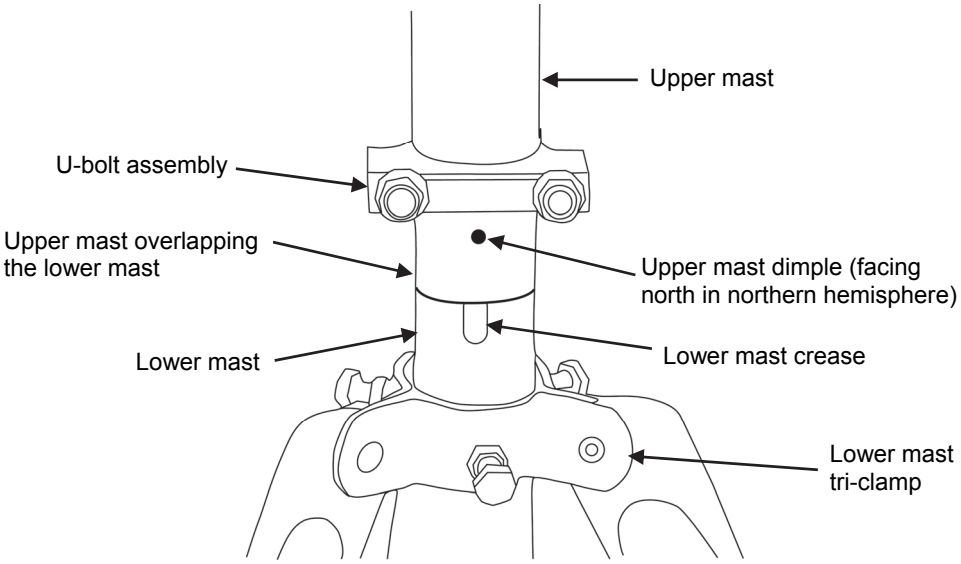


Figure 33: Upper and lower mast assembly

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. Install the Mast Mounting Kit. See instructions on page 22.
2. Using the two 1-5/8 inch U-bolt assemblies provided, mount the logger with mounting plate on the lower end of the upper mast in line with the upper mast dimple. The bottom U-bolt on the mounting plate 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 against the saddle clamps and screw on the top U-bolt nuts only.

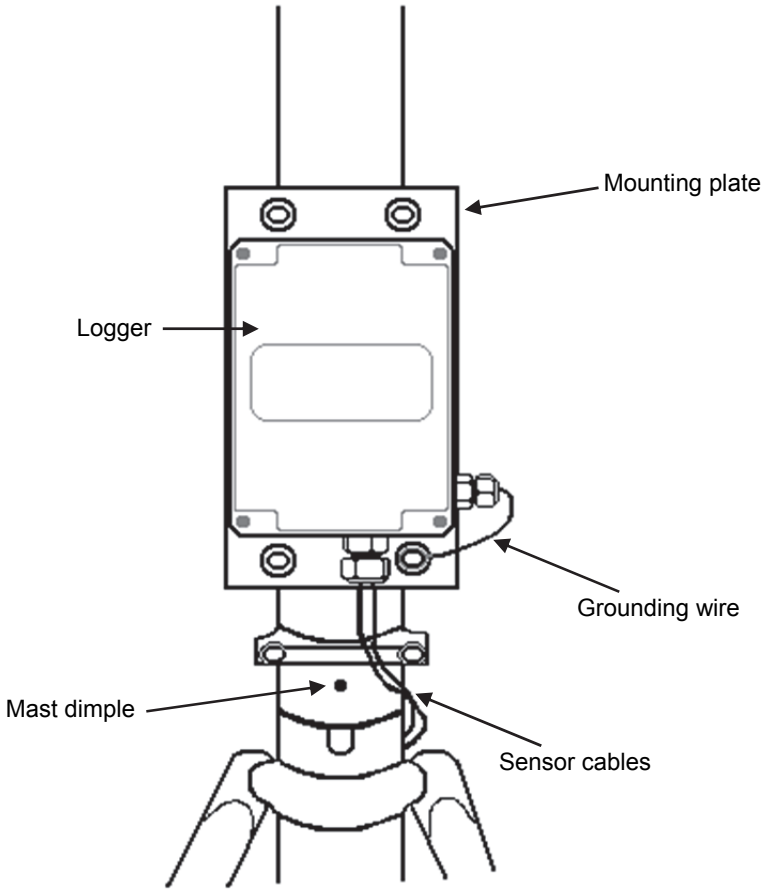


Figure 34: Logger on mast

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. If you are using the External Grounding Wire Adapter Cable or External Communications Port Adapter Cable (see page 23 and page 25 respectively), attach the grounding wire to the mounting plate 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 the installing 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.

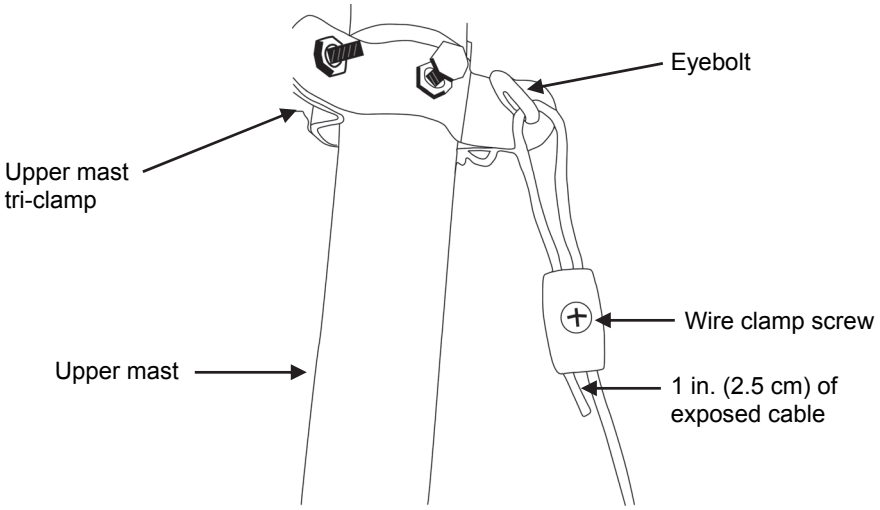


Figure 35: Guy wire attachment

3. Hook one "S" hook and one turnbuckle onto the corresponding stake (see Figure 36) or leg (see Figure 37).

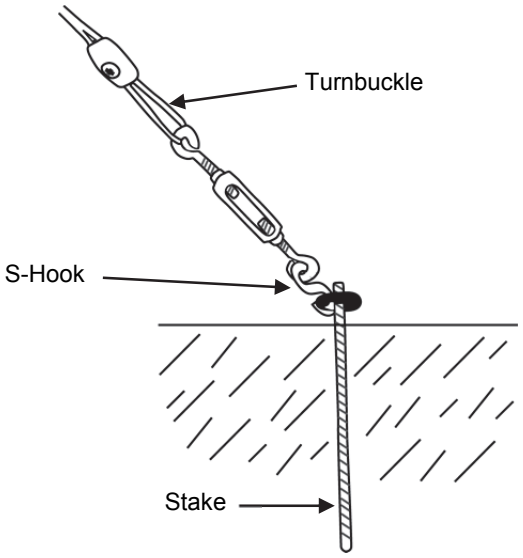


Figure 36: Guying to 1/2 inch Stakes

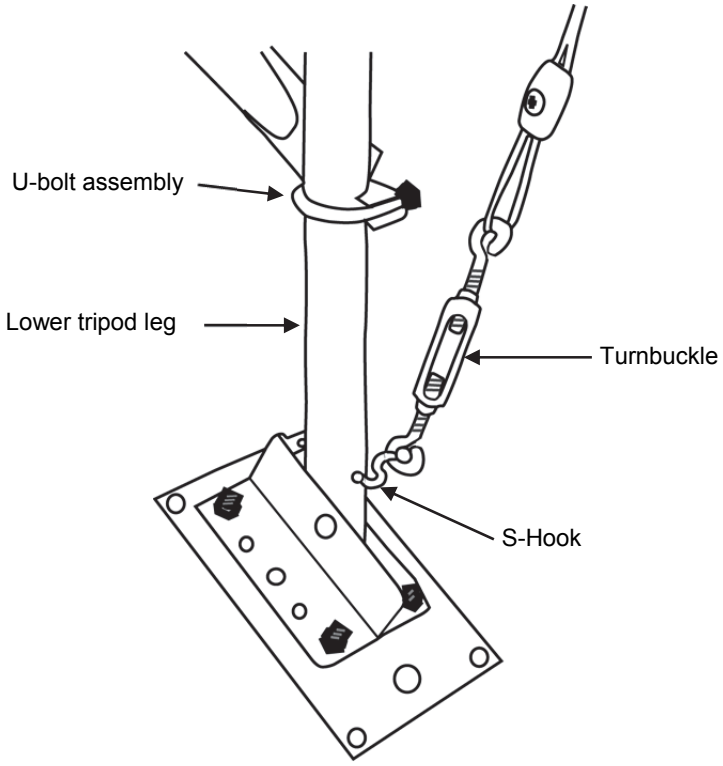


Figure 37: Guying to 3 Meter tripod feet

4. Cut the guy cable so that it can be put through the loose end of the turnbuckle and the wire clamp (see Figure 36 if using the 2 meter tripod; see Figure 37 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 Mast Level (Part # M-MLA) 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**.

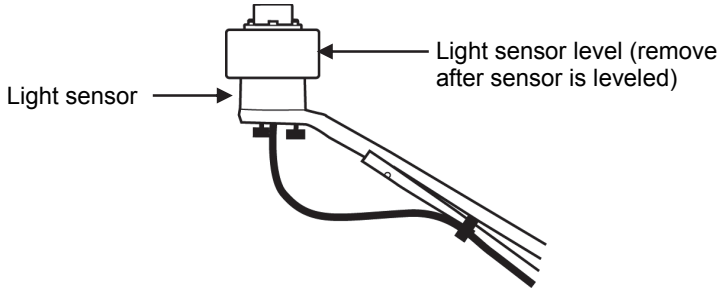


Figure 38: Light sensor and light sensor level

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

This section explains how to finish the Micro Station setup.

1. Plug the sensors into the logger if you haven't already done so. For details on inserting sensors, see the *Logger and smart sensor setup instructions* section in Chapter 2 on page 5.
2. 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.
3. Check that the batteries are securely seated in their holder with the battery strap in place.
4. 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.

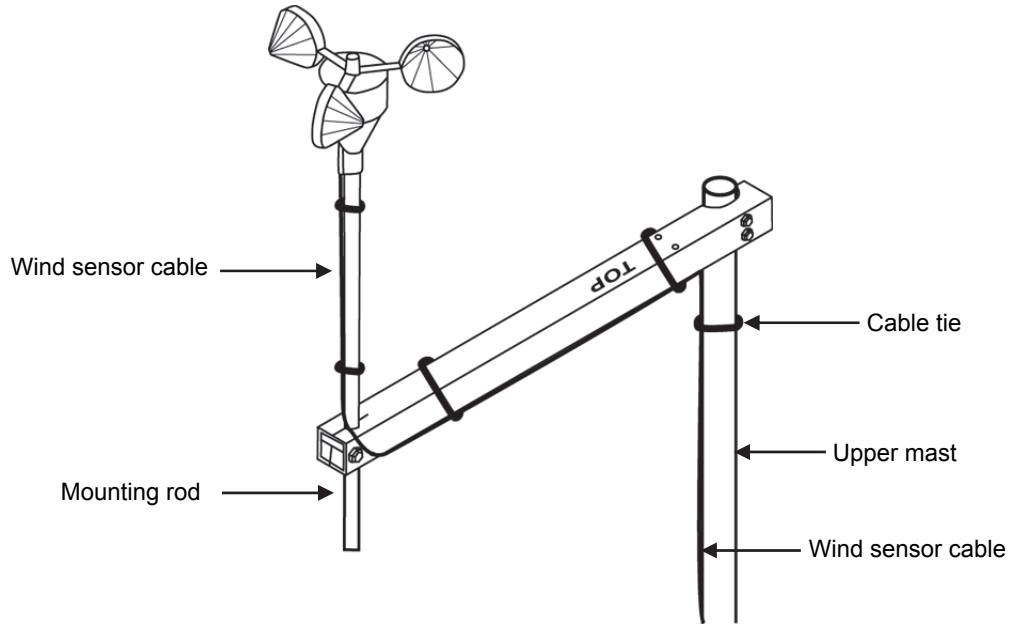


Figure 39: Securing the wind sensor cable

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

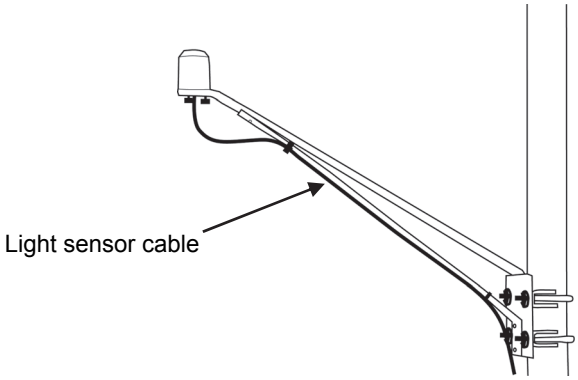


Figure 40: Securing the light sensor cable

6. Use cable ties to secure cables to the mast (see Figures 41 and 42). Also secure any cables running to remote sensors to the mast or to one of the tripod legs.

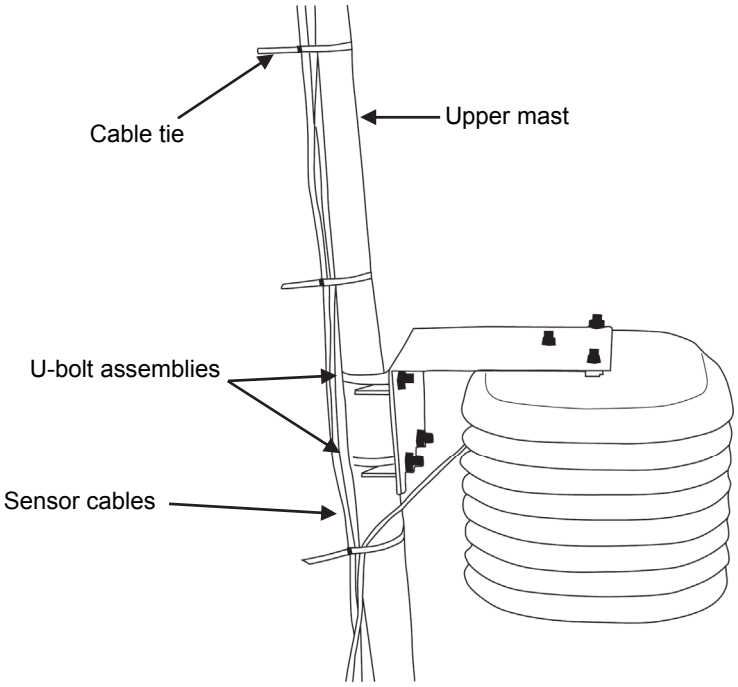


Figure 41: Securing the sensor cables on upper mast

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

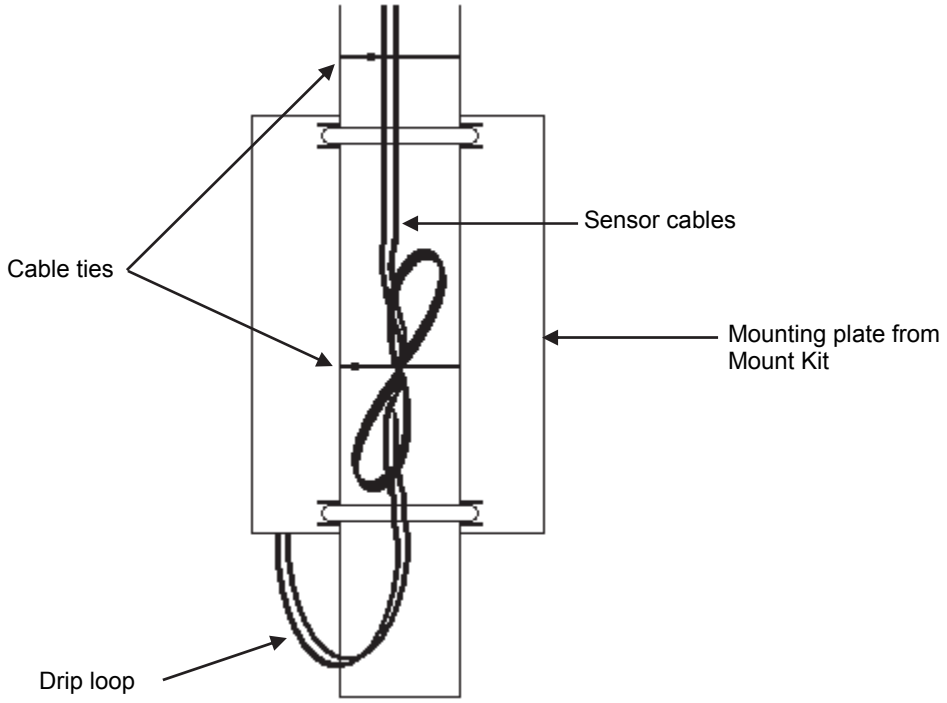


Figure 42: Finishing off securing sensor cables to the mast

8. All cables should be neatly secured to the mast when complete.
9. Recheck that all the U-bolts, nuts, and clamps are secure for the entire system.
10. 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.
11. 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.
12. Screw on the logger cover if you removed it earlier, making sure the desiccant pack is inside the logger enclosure to minimize internal condensation (remove desiccant pack from its foil pouch before installing). Make sure all logger openings are covered and the sensor dome nut is secure.

Chapter 5
Troubleshooting

The following chart lists common problems you may encounter with the HOBO Micro Station and possible resolutions.

Problem	Resolution
Individual sensors are not found or are missing in the logger software launch screen	• 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 100 meters (328 ft) of network cable.
All sensors are missing in the logger software launch screen	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	• 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	• 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 volt per cell when new; lithium batteries should be 1.6 volt per cell.

Problem	Resolution
Batteries die prematurely	• 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 *Estimating battery life* on page 16 for more details. • Check for damaged wiring and/or sensors. Damaged cables or connectors can result in complete or partial sort circuits that will rapidly drain batteries.
No status lights are flashing	• 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	• Check and replace the batteries. • Check communications cable connections.

Chapter 6
Maintenance, support, and service

This chapter explains:

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

Maintenance

Regular maintenance on the HOBO Micro Station is essential because it extends the life of the components and helps to ensure the accuracy of recorded measurements. When the Micro Station 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 Micro Station 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 Micro 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.
- **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

The desiccant pack included with the Micro Station is an indicating desiccant pack, 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 and has an even coating of silicone grease, 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. 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 some sensors. For more details on verifying sensor accuracy, refer to the Sensor Manuals included with the sensors.