RSR2™ System Installation Instructions

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1. Site Location

The ideal site will be level, with a clear view of the entire sky dome down to the horizon in all directions. That is, there should be nothing that will obstruct the RSR2's (pyranometer's) view of the entire sky, or reflect additional light onto the sensor at any point of the day.

Since this is seldom possible in reality, pay most attention to ensuring that at no time of the day is there anything directly blocking the path between the sensor and sun itself.

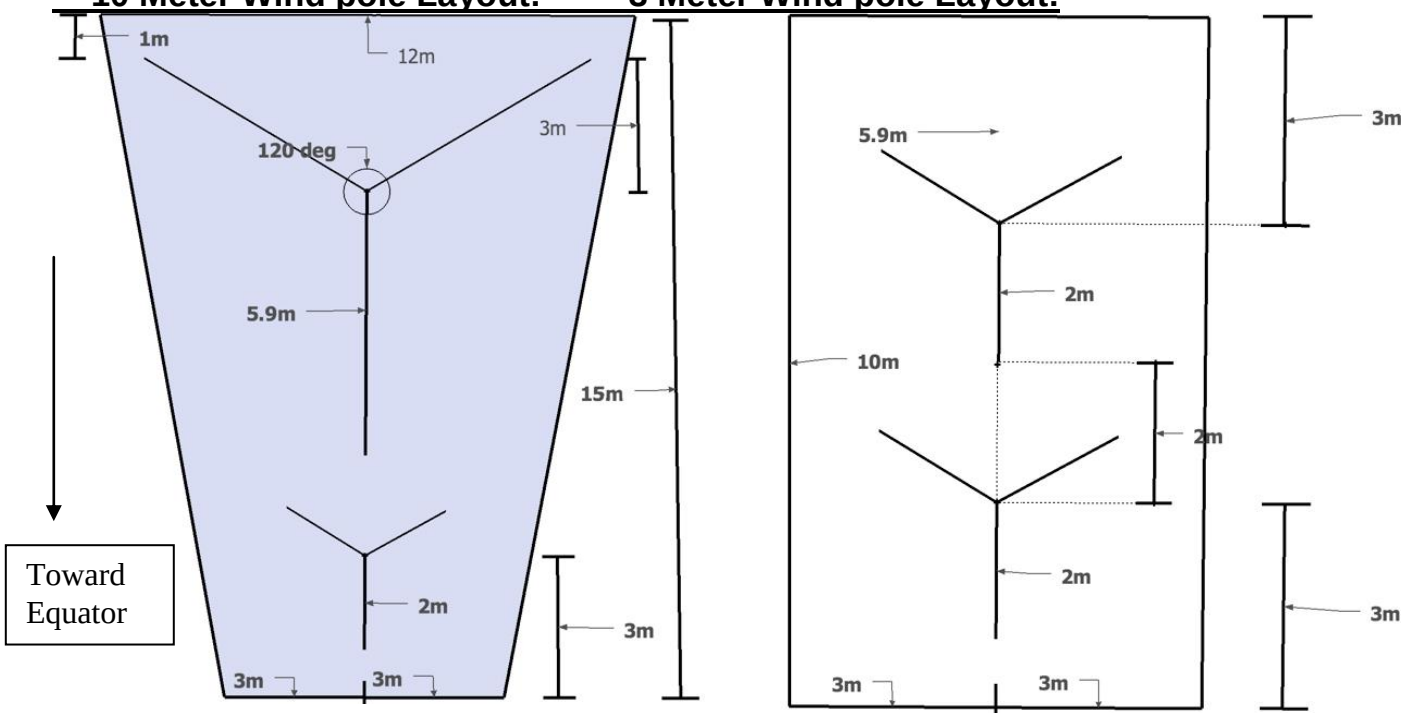
Note that in most non-arctic locations the sun rises in the 90-degree sector from northeast to southeast and sets in the sector between southwest and northwest. Note also that obstructions rising from the horizon which block the sunrise or sunset up to an angle of about 10 degrees from true horizontal can usually be tolerated as most solar power technologies cannot utilize direct beam energy below such low angles.

Finally, choose a site which will minimize the percent of the sky dome which is obscured by hills, mountains, trees or vegetation, structures or other objects.

2. **Equipment Layout**

If you have purchased a wind sensor, you will be mounting it true north (or true south in the southern hemisphere) of the RSR2 mounting apparatus. See the charts below for a birds-eye view of the layouts and necessary distances.

10 Meter Wind pole Layout: **3 Meter Wind pole Layout:**



3. **Assembling and Installing the Mounting Apparatus**

RSR2 Tripod Tube Contents:

(1) Disassembled Aluminum Tripod
(3) Round Tripod Feet
(2) Enclosure brackets
(1) Head flange with 4 bolts attached
(1) Stanley 6 in 1 Screwdriver
(2) U-bolts
(1) Ground cloth
(1) "Duck Bill" earth anchor
(1) Duck Bill drive rod

A. Tripod Mount

i. Remove contents from shipping tube; note that the Tripod is wrapped in a square ground cloth that is placed under the tripod during setup to help prevent small inadvertently dropped parts from being lost in grass or sandy ground. It is left following installation to prevent vegetation growth under the RSR2 system.

ii. Screw together Tripod Legs

iii. Locate the tripod anchor point

iv. Drive in the Duckbill Anchor

*Optional equipment

Once you have located the precise position of the tripod. Find the center, mark it, and move the tripod aside. To secure the tripod, you will need to pound the "duckbill" anchor.
If it has not already been done, insert the Duckbill Driving Rod into the open slot in the Duckbill anchor. Pull the anchor's steel cable along the edge of the Driving rod and at its end, fasten it to the rod with electrical tape (this will ensure that the rod does not detach from the anchor during the driving process).
Now place the bottom of the anchor on the ground in the center of the tripod location. Begin driving the anchor into the ground at a 45 degree angle by pounding the Driving Rod with a sledgehammer (see diagram for details). Depending on the hardness of the soil, this process can take some time. Persevere. When most of the anchor and cable are underground so that only the part with the electrical tape are is visible, cut the tape. Continue pounding until only the loop is above ground. Pull out the driving rod, place it through the anchor loop and tug until you feel the anchor move slightly. The anchor is now secure.

Ballast Mount

*Optional equipment

Pipe Mount

Pipe mount is the same as the ballast mount but without the ballast tray. User must secure bottom flange to a solid foundation with four masonry screws into a masonry surface or thru bolts into a drilled structural steel beam.

4. **Mounting the Enclosure**

A. Open the Sensor Module Enclosure, and remove all unattached contents.

B. Attach metal Brackets to the back of the enclosure.

C. Use the U-Bolts to attach the enclosure brackets to the center tube. Attach it on the north side of the tripod, below the intersection of the leg and the center pipe.

RSR Enclosure Box contains:
(1) Irradiance, (Vynckier) NEMA enclosure and backplane
(1) Campbell Scientific CR800 (or CR1000) Datalogger (affixed to the backplane)
(1) Irradiance Motor controller (affixed to the backplane)
(1) White, Triangular Head Unit Mounting Yoke (3D)
(1) Vaisala barometer * (affixed to the backplane)
(1) Campbell Scientific Air Temperature and Relative Humidity Sensor (CS215), or Air Temperature Sensor (CS107) mounted in Gill Shield to avoid exposure of sensor to sunlight.

*Optional equipment

5. Mounting Other Components

A. Head Unit

i. Attach the black Shadow Band arm to the head unit.

ii. Affix the top flange to the top of the Center tube.

iii. Connect the antenna backplane under the head yoke. Attach the antenna cable to the bottom, run it into the enclosure and attach to the modem.

iv. Attach the Yoke to the top flange. Place wireless modem antenna it in between the Yoke and top flange before screwing them together.)

v. Screw the Head Unit into the Yoke. (If attaching a Secondary irradiance sensor*, place the sensor between the head unit arms and the yolk on one side.)

vi. Tighten the screws and level the sensor(s); ***remove the protective red cap!***

vii. Run the cables down the pole and through the bottom of the enclosure.

vi. Attach the loose wires into the datalogger; plug the cable into the motor controller.

B. Battery

Remove the battery from its box and place it inside lower right side of the enclosure. Do not plug it in yet! Be careful to avoid short circuiting by keeping the metal battery terminals and connectors covered.

C. PV power supply

Connect the PV mounting sleeve to the south facing tripod leg or ballast tray support. Run

the cable into the enclosure. Do not plug it in yet!

D. Sierra Wireless Airlink Wireless Modem

Place the pre-armed[1] modem inside the enclosure. Usually a good place is to rest it on top of the RSR2 Motor controller just below the datalogger. (See battery picture, modem is blue device on right side).

Connect the modem's 9-pin port to the datalogger's RS232 port, (NOT the datalogger's "CS I/O" port, which looks identical). Note this connection must be using a Null Modem cable, or a Null Modem fitting and a "straight through" serial cable.

F. Air Temperature and/or RH Sensor

i. Attach the Gill Shield protector to the center pole - above the enclosure and underneath the PV panel (which should be mounted on the leg facing the equator).

ii. Unscrew the piece blocking the opening. Reverse as needed to enlarge opening. Insert the temperature gauge all the way into the gill shield protector. Screw in the plastic piece to secure the gauge. Be extremely careful not to break the white tip of the sensor; it is fragile!)

ii. Connect the wires to the Data Logger.

[1] The modem should be programmed and service set up prior to field deployment. Getting the settings correct can be a major challenge. Seek assistance from cellular service provider that has coverage at the site.

G. Barometric Pressure Sensor

If not already connected, use the included screw to attach it to the backplane in the enclosure, to the right of the datalogger. Connect the wires to the Datalogger. Be sure that the connector into the barometer has the screws facing upwards (away from the enclosure backplane) and that all the screws in this connector are tight as this has been a problem causing incorrect pressure readings.

6. Powering the System

A. Make sure everything is properly and neatly wired and that all connections are correct.

B. VERY IMPORTANT! Move the Shadow Band Arm to its highest position above the Licor pyranometer sensor.

C. Connect the battery to its plug.

D. Plug the PV cable into the SunGuard Solar Charge Controller

7. Configuring and Programming the Datalogger

The Campbell Scientific data logger must be configured and then programmed for each site.

A. Data logger Configuration

This can be done either using a direct PC to data logger connection with a straight through 9-pin serial cable the data logger's RS232 port, using Campbell Scientifics' "Device Configuration" Software, or using a Campbell Scientific CR1000KB hand held keyboard display. The only setting which needs to be changed from the factory defaults is the data logger's "PakBus" address. We recommend that it be changed from the factory default value of "1" to the RSR2 head unit serial number (2 to 4 digits found on the label affixed to the RSR3 head unit).

B. Data logger Programming, and Clock Setting

A custom data logger program provided by Irradiance must be uploaded into the data logger in order to properly run the system. This program must be altered before uploading to include the correct geophysical coordinates of the system as well as certain sensor-specific factors for purchased system configuration.

Campbell's LoggerNet or PC200W Software

The next step is to load Irradiance's RSR2 program code into the Datalogger. This is typically done before or during the mechanical installation of the RSR2, but once operating on a conventional network (telephone, wired or wireless Internet) programming can be modified remotely. Typically the RSR2 will have some communications device for this and for data collection purposes. If

programming is done locally (not over a network) the easiest way to link the PC (with the program code) and the Datalogger is again with a simple serial RS232 cable.

Setup

Before setting up the path to any Datalogger, LoggerNet clock settings should be configured. All RSR2 operate on Universal Coordinated Time (formerly Greenwich Mean Time). Under the "Options" menu in Setup be sure to select the LoggerNet clock option "Use Greenwich Mean Time (GMT)". LoggerNet uses the PC's clock to set the Datalogger clock and the PC's clock and time zone must be accurately set within +/- 5 seconds, ideally within +/- 1 second[i]. IF THE CLOCKS ARE NOT SET ACCURATELY TO GMT THE RSR2 DATA WILL NOT BE CORRECT AS THE POSITION OF THE SUN IN THE SKY IS CALCULATED USING TIME AND THE LATITUDE AND LONGITUDE OF THE SITE AND IF THE SUN'S POSITION IS CALCULATED INCORRECTLY THE DIRECT NORMAL IRRADIANCE DATA WILL NOT BE CORRECT.

For communications and data retrieval the "Setup" program within LoggerNet is used to enable the PC to connect to remote Dataloggers to retrieve data and, if needed, make programming changes. The steps are to create a new "Root" which is typically an Internet Port (IP Port) or (much less common now) a telephone of TAPI Port. A PakBus Port is then added to (under) the IP port and finally a PakBus Datalogger (a CR800 or CR1000) is then added to this PakBus port. Please review the LoggerNet documentation for specifics and contact Irradiance if you need further assistance.

An alternate "path" to a local Datalogger can be accomplished with a simple COM Port (serial RS232) from the computer. It is possible to have two paths to a single Datalogger, with the COM Port used for setup either in advance or in the field during installation, then the IP Port for routine connections to remote, unattended site.

Establishing a schedule for data retrieval from an RSR2, and specifying the data to be retrieved is also configured with the Setup program.

Connect

Once a communications path to the Datalogger has been set up using LoggerNet, the connect program is used to initiate communications manually

Status

When LoggerNet is running on a PC, it will query the RSR2 stations that have been configured with the "Setup" program according to the collection schedule configured for each station. In the past (1990s) when most stations used telephone modems, a daily call at midnight local time was our standard. Now with Internet based connections, stations are polled hours or even more frequently to synchronize the data sets on the remote RSR2 Datalogger and PC running LoggerNet. The Status program presents summary information regarding recent communications with the remote stations and is useful for watching an entire network of stations to watch for anomalies in communications.

8. Verifying Proper Operation of the System

Correct operation is verified by using the connect program remotely to observe the real time measurements of the remote RSR2. The ability to "connect" to the station assures the integrity to the

communications path established in the “Setup” program and the measurement values confirm the plausibility of the data. Minor calibration errors are hard to detect, but usually when there are problems they result in measurements (usually if some setting, such as time or station position is not set correctly

9. Mount and Install Wind Sensor:

Potential Appendix Materials:

1. Head unit installation/sensor leveling guide
2. Wind installation instructions;
3. Necessary Tools
4. Wiring diagram with "how to read the wiring diagram" instructions that could read like this:

Notice that the wiring diagram corresponds to the Campbell Datalogger found in the Enclosure box. All of the possible instruments are listed, color coded, and represented on the chart. So, for example, when attempting to wire the ATRH, first locate it on the list. Notice the color that corresponds to it - Blue. Notice that each of the blue boxes on the diagram has a color written inside. These colors signify the color of the individual wire. Find all of the blue boxes on the diagram and insert the wires into the appropriate slots. Ensure all the wires are secure. Note: some slots may contain more than wire and may contain wires from several instruments.

Further Instructions:

Securing the tripod: Reposition the Tripod over the anchor. Use the turnbuckle to connect the anchor cable to the hole in the bottom of the tripod. Rotate the tripod so that one leg faces south. Tighten the turnbuckle. Next, pound two 10” stakes into each of the 3 tripod feet. The Tripod is now secure.

Necessary Tools
Included:
1 6 in 1 Stanley Screwdriver
1 ½” and 9/16” black Crescent Wrench
1 Bubble level
1 Small Red CS screwdriver (used for wiring the datalogger)
Sealing Putty

Not Included
Sledgehammer
Gloves
Wire Cutters
Box Cutters
Adjustable Crescent Wrench
magnetic compass

[i] Consider a service such as http://www.wintimesync.com on your PC running Loggernet.