may not be counted. Take advantage of curbs, dividers or other traffic restrictions. In extreme circumstances it may be necessary to install dividers or markers to channel the traffic over the counters. Keep in mind, you must have line-of-sight from the Groundhog to the nearest LBU which can be no further than 200 meters (600 ft.) away.

The LBU's may be installed on self-supporting or guyed towers, existing towers, new or existing poles or on rooftop base mounts. Regardless of the method, the LBU must be within 200 meters and have line-of-sight to the Groundhogs reporting to it. This Groundhog LBU must then have line-of-sight and be within 10 miles of the Master Data Collection LBU or equally to a Repeater LBU that then reports to the Master Data Collection Site. In some cases it may be many miles from the Groundhogs to the Master Data Collection Site. If this is the case it might require too many repeaters to be economically feasible. In this case, existing telephone lines or a cellular connection and a modem should be considered as workable alternatives. All LBU installations should be situated or protected to keep unauthorized persons from climbing on the equipment and also prevent vandalism.

Mark the proposed locations of all your Groundhogs, LBU's, Repeaters, Master Data Collection Site, etc. on a good map with a known scale. Verify the distances involved and double check for any site obstructions. The example shown will give you an idea of a typical Wireless Data Collection Site.

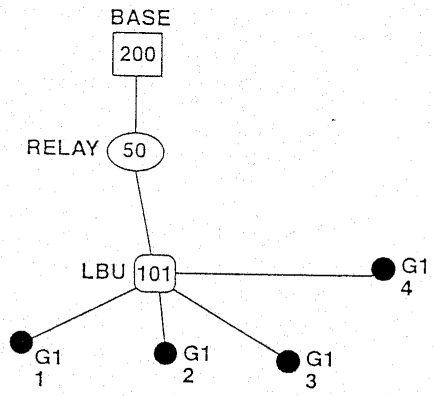


Figure 5

Select the appropriate antennas for your Master Data Collection and all Repeaters or other LBU's. In most cases, a Model BA-04 Omnidirectional antenna with 4 dBd Gain will be adequate. For longer distances, or if outside RF interference is present a yagi directional antenna may be required. Contact Nu-Metrics if you are unsure which antenna is right for you.

Once you are confident of your site plan, you can proceed with the installation, beginning at your Master Data Collection LBU and working outward toward the Groundhog counters.

TOOLS YOU WILL NEED DURING THE INSTALLATION

To save time and effort, make sure you have the tools you will need. This may include but may not be limited to:

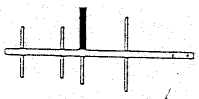
- Portable Electric drill and drill bits
- Screwdrivers (Phillips and flat-headed)
- Adjustable wrench or selection of open ended wrenches
- Hammer
- Chisel
- Crescent Wrench
- Level (2 or 3 Ft.)
- Black weatherproof tape for connectors
- Ropes *(continued)*

- Measuring Tape (25 ft. or longer)
- Ladders (Step and Extension)
- Heavy rubber gloves
- Safety goggles
- Hard hat and safety shoes

4.0 MOUNTING THE ANTENNA

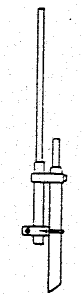
Be sure to take all precautions necessary before performing any installation. Please read through all of the steps provided and then perform the installation using the method given, or any variation of these methods given any special circumstances that may arise. The instructions given in this manual assume you will be installing the antenna with a partner. Installation of the antenna should be done on the ground, unless you can obtain a bucket truck, or if the installation will be done on a roof. Once again, feel free to slightly modify these instruction to better suit your specific situation.

4.1 MOUNTING A YAGI ANTENNA



1. Using the U-bolts provided, place both of the U-Bolts around the antenna mast and through the antenna mounting bracket. The top U-bolt should be positioned approximately 1" below the top of the antenna mast and the lower U-bolt should be approximately 5" below the upper U-bolt. Be sure to place the beveled side of the antenna base towards the antenna mast using the bolts provided. Fasten the U-bolt to the bracket on the Yagi to hold it in place.
2. Next, take the 1' antenna cable located at the bottom of the antenna and tighten this cable into the 11' antenna feed cable provided.
3. Once you have tightened the two cables together, the connection must be protected against moisture and corrosion. Use the specified connector sealant or self-sealing rubber tape to seal out any moisture from getting to the connection.
4. Next, you need to make a drip loop with the 1' cable letting the longer cable hang free. This will allow any water to collect at the bottom of the drip loop and drip off of the wire.
5. You should run the antenna wire along the left side of the antenna mast. This wire will enter your BSR-2 cabinet on the left side once it is installed.
6. Use the black wire ties provided to attach the cable wire to the antenna mast 2" below the wire connection and approximately every foot down the antenna mast until you reach the top of the solar panel.

4.2 MOUNTING AN OMNI-DIRECTIONAL ANTENNA



1. Using the U-bolts provided, place both of the U-Bolts around the antenna mast and through the antenna mounting bracket. The top U-bolt should be approximately 1" below the top of the antenna mast. The lower U-bolt should be approximately 5" below the upper U-bolt. After mounting the two brackets to the pole, slide the antenna through the brackets from the bottom to the top. Once the antenna is in position, tighten the bolts to hold the antenna in place.
2. Now you need to take the 1' antenna cable located at the bottom of the antenna and tighten this cable into the 11' antenna feed cable provided.

3. Once you have tightened the two cables together, the connection must be protected against moisture and corrosion. Use the specified connector sealant or self-sealing rubber tape to seal out any moisture from getting to the connection.

4. Next, you need to make a drip loop with the 1' cable letting the longer cable hang free. This will allow any water to collect at the bottom of the drip loop and drip off of the wire.

5. You should run the antenna wire along the left side of the antenna mast. This wire will enter your BSR-2 cabinet on the left side once it is installed.

6. Use the black wire ties provided to attach the cable wire to the antenna mast 2" below the wire connection and approximately every foot down the antenna mast until you reach the top of the solar panel.

5.0 MOUNTING SOLAR PANEL TO ANTENNA MAST

Note: When installing the solar panel, be aware that they generate maximum power when facing the sun directly. The fixed position which approximates this ideally over the course of the year, thus maximizing annual energy production, is facing due South (in the Northern Hemisphere) or due North (in the Southern Hemisphere) at the angle listed in Table 1. These orientations are true North and South, not magnetic North and South.

Table 1 shows the fixed angle above horizontal at which panels should be installed in order to maximize annual energy output. The panel's position for your specific location is a simple interpolation of the figures in the table. At some installations, it may be cost effective to adjust the tilt seasonally. At most latitudes, performance can be improved during the summer by using an angle flatter than the chart's recommendations; conversely, a steeper angle can improve winter performance. If panels are not cleaned regularly, it is recommended that they not be mounted at an angle flatter than 15 degrees. Flatter angles cannot take full advantage of the cleansing action of rainfall. Dirt accumulation on the panel's front surface can reduce the light energy collected by the panel, decreasing its power output. If the panel surface becomes dirty, gently clean it with a soft cloth or sponge using water and a mild detergent. Do not use a scrub brush; it may damage the panel surface. Wear rubber gloves to protect against possible electric shock.

Locate the panel as free as possible from shading during all seasons, particularly during the middle (the most energy-productive) part of the day.

LATITUDES

DATE	0°	8°	16°	24°	32°	40°	48°	56°	64°	72°	80°
June 21	23	15	7	0	8	16	24	32	41	49	57
May 21 or July 21	20	12	4	4	12	20	28	36	44	51	60
April 21 or August 21	12	4	4	12	20	28	36	44	52	60	68
March 21 or September21	0	8	16	24	32	40	48	56	64	72	80
February 21 or October 21	11	19	27	35	43	51	59	67	75	83	–
January 21 or November 21	20	28	36	44	52	60	68	76	84	–	–
December 21	23	32	39	48	56	64	72	80	87	–	–

Table 1- Solar Panel Position Angles (degrees above Horizontal)

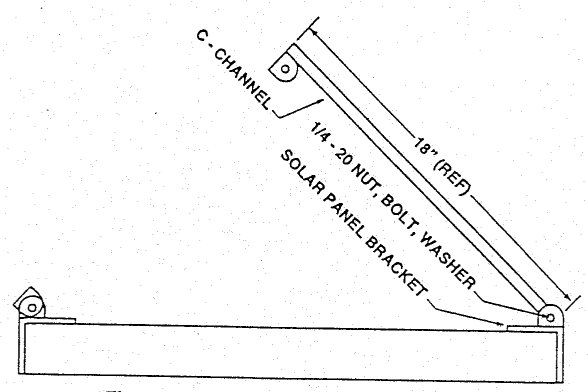


Figure 6 - Solar Bracket Arm to Panel

1. Fasten the lower arm bracket to the antenna mast (between the two BEC-02 brackets). Note: This solar panel location is recommended as the most convenient. Actual conditions may require alternate mounting due to shading, obstructions from solar energy, vandalism, etc.

2. Install the upper solar panel bracket on the antenna mast approximately 18 inches from the lower bracket using the 1/4-20 U-bolt, nut and washer. Do not tighten completely at this time.

3. Secure the Solar Panel to the lower and upper brackets using 1/4-20 bolts, nuts and washers and tighten securely.

4. Refer to Table 1 and adjust the solar panel by moving the upper bracket up or down the antenna mast until the face of the panel is on the correct degree angle as determined from the Table. Tighten the upper bracket securely.

5. Connect the antenna feed line cable to the connector on the short cable at the base of the antenna. Note: All external antenna connections must be protected against moisture and corrosion. Use specified connector sealant or self-sealing rubber tape.

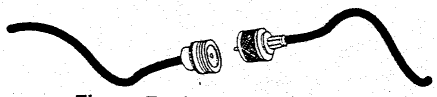


Figure 7 - Antenna Connection

6. Route the antenna feed line cable down the mast. Fasten to the mast with black cable ties. (Note: black cable ties are UV resistant, if other ties are used they will break down over time due to exposure to sunlight).

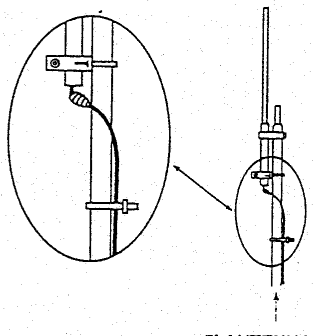


Figure 8 - Antenna Feed Line Cable

7. Route the antenna feed line cable up through the opening on the bottom of the BEC-02 equipment cabinet. Use the opening on the right if you are facing the front (door) side of the cabinet. Leave a "rain drip loop" on all lead in cables or wires.

8. Carefully connect the antenna lead-in cable to the connector on the LAC-4N Lightning Arrestor.

9. Insure that the RFM-915 for this location is the proper one and has been preprogrammed according to the instructions in the Groundhog Wireless System Operation Manual and Groundhog and RFM-915 Programming Guide. Set the RFM-915 on the top shelf on the BEC-02 Cabinet. Connect the cable from the other side of the LAC-4N Lightning Arrestor to the antenna connection on the RFM-915.

10. Plug the din connector from the batteries into the power jack on the RFM-915. The red Power LED on the RFM should be illuminated, indicating the unit is on. When receiving data the green LED will flash and when transmitting data, the Red Transmit LED will flash.

11. Make a final check to insure that the solar panel is facing in the correct position and angle for maximum exposure to the sun (Ref. Table 1) and correct if necessary. If using a yagi antenna, make a final check to insure the antenna is aligned with the Groundhogs or BSR-2 where your transmissions originate. Use additional cable ties to secure any wires or cables for a neat and secure installation. Once you have all the BSR-2 equipment installed you can proceed with Groundhog installations.

6.0 MOUNTING SOLAR PANEL TO THE WALL

1. Make sure the solar panel is mounted on a permanent structure facing due south.

2. Fasten the mounting bracket to the upper portion of the solar panel, making sure the mounting plate is facing down.

3. Fasten the other mounting bracket to the lower portion of the solar panel, making sure the mounting plate is facing down.

4. Bolt the top bracket to the mounting surface at least 9 feet above the ground.

5. Adjust the lower arm of the solar panel to the proper angle for your latitude

6. Bolt the lower bracket to the wall making sure the bracket is flush to the wall.

7. Purchase the appropriate fasteners to attach the solar panel cable to the wall you are mounting your equipment on. Attach the cable to approximately 1 foot below the BSR-2 box, be sure to run your cable down the right side of the box.

7.0 MOUNTING THE BSR-2 BOX

You will want to mount the BSR-2 box after the antenna and solar panel installations are completed. Installation of the equipment should be done after the BSR-2 box is mounted to the antenna.

There are three methods of mounting the BSR-2 cabinet. The BSR-2 can be mounted directly to the side of an existing structure using the brackets provided. The BSR-2 may also be banded to an existing pole. This installation is useful when you don't want any extra structures around the site. This manual will describe the most popular installation method, mounting the BSR-2 box to a LBU.

1. Locate the mounting plate. This thin piece of metal is approximately 1 foot square. Mount this plate to the back of the BSR-2 box using the shorter screws provided.

2. Once the plate is securely fastened to the box, open the door of the cabinet and place the longer screws through the four outer holes in the back of the cabinet.

3. Attach the nuts to the bolts as they pass through the other side of the lbu poles and tighten them.

4. Once all four screws are tightened, you will then want to proceed to the BSR-2 Box Equipment Installation Section 8.0.

MOUNTING BSR-2 BOX ON A WALL

1. Attach the four (4) mounting brackets provided to the sides of the BSR-2 in the holes provided.

2. Mount the BSR-2 box to the wall using lag bolts.

3. Refer to BSR-2 equipment installation steps

8.0 BSR-2 BOX EQUIPMENT INSTALLATION

Refer to Figure 9 for BSR-2 Equipment Installation

1. Take the solar panel cable and strip the insulation from the end of the cable. Separate the 3 color-coded wires (green, white, and black) and strip the insulation off their ends to expose 1/4" of copper wire.

2. Located on the inside of the BSR-2 box, you will find the terminal block. It consists of two rows of screw heads, six screws per row. Moving from left to right, attach the green wire to the lower row, second screw from the left. The white wire will be attached the the lower row, fourth screw from the left. The black wire will be attached to the far right screw on the bottom row.

3. Place the batteries on the right side on the bottom shelf of the BSR-2 cabinet in front of the terminal block.

4. Connect the red and black wires that are tied together inside the box to the batteries. BE SURE TO CONNECT THE RED WIRES TO THE POSITIVE TERMINAL ON THE BATTERY AND THE BLACK WIRES TO THE NEGATIVE TERMINAL. The positive terminal is labeled with a red color and the negative terminal is labeled with a black color.

5. The cable from the lightening arrestor will go from the lower shelf, through the divider and connect to the RFM. Connect this cable to the RFM at this time.

6. Take the power plug from the terminal block and attach it to the power port of the RFM.

7. Slide the RFM to the back of the BSR-2 cabinet and close the door. Be sure to use the key provided to lock the door. DO NOT LOSE THIS KEY. You will not be able to open your cabinet without one.