

ScorpionAntennas.com

Scorpion

Home Installation Manual





Thank you for selecting Scorpion as your antenna!

Ron Douglass, NI7J

<http://www.scorpionantennas.com>

info@scorpionantennas.com

623-326-8780

The Scorpion SA- 680 antenna is supplied with a 6-foot whip, allowing efficient operation at 10 through 80 meters. In addition, all antennas are shipped with 20 feet of antenna control cable, a control box with two #31 material split beads for the antenna control cable decoupling, a cigarette lighter adaptor with a built-in fuse holder, and a shunt coil for antenna impedance matching. *The Home install units are supplied with 50 feet of two conductor cables. Four conductor cables may be substituted for a marginal fee.*

Our antenna body is .065-inch wall 304 Stainless Steel, the strongest in the industry!

We use Acetal, better known as DuPont Delrin®, for the base of the antenna, the Pittman motor support, the ball bearing support, and the upper coil cap that supports the whip. Delrin is very dense and heavy!

The finger stock and coil support housing are polished 6061-T6 Aluminum. It houses the tin-plated finger stock and a one-inch-wide phenolic coil support. The housing also works as a heat sink during high power operation. The finger stock is tin plated Beryllium Copper that always maintains 37 pounds of combined pressure on the coil.

The antenna coil drive motor is the commercial grade Pittman quality motor that uses only steel gears in its gear box, not plastic. We install capacitors on our motors so tuning the antenna by ear is static-free.

The antenna coil is driven with a piece of polished 316 grade 3/8-16-inch thread pitch stainless threaded rod. The threaded rod is lubricated with Teflon grease that will withstand minus 40 to a plus 475 degrees Fahrenheit.

Our coil form is 1/4-inch wall Industrial grade phenolic that is manufactured to our specs. Our coil alone weighs 4.5 pounds wound with wire. For longevity we use two double-sealed ball bearings for the coil support.

Our .125-inch coil cover wall is the thickest in the industry and is manufactured with the same type of material used for bulletproof windows on armored trucks. We are the only manufacturer that includes counterpoise, or radial wire connecting bolts, built into the base of our antennas. This allows the install of backyard, field day, or camping counterpoise or radial wires to be easy and hassle-free. Our antennas have a reed switch installed for use with digital display antenna controllers. We install two magnets on the motor coupling that generate two pulses per revolution.... which results in better antenna positioning using a Digital Antenna Controller.

The SA-680 coil has a Q of 410 and is wound with #10-gauge tin plated wire, at 6 turns per inch.

Unpacking and Installing the Scorpion Antenna

Please read these instructions completely before opening the shipping tube!

Your *Scorpion* antenna was carefully packaged to prevent damage during shipping. Failure to follow the directions could damage your antenna. Resulting damage is not covered under warranty.

- 1). Remove ALL packing tape from the shipping tube.
- 2). There are eleven Phillips head wood screws safely holding the antenna in the shipping tube. Six at the bottom of the tube, two in the middle of the tube and three at the top of the tube. All are located under the packing tape. Please remove all screws.
- 3). Using two of the removed screws, partly thread them into the wood end caps. These screws can then be used to remove the end caps with a claw hammer, “like pulling nails”.
- 4). Remove the end caps carefully!
- 5). *AT THIS POINT DO NOT TRY TO REMOVE THE WHIP, IT WILL NOT SLIDE OUT!*
- 6). Remove all contents at the top end of the tube. This includes the antenna controller, shunt coil, and antenna control cable.

7). At this point, you should see the $\frac{3}{4}$ inch threaded rod, washer, and nut at the bottom end of the tube. The whip is at the top end of the tube.

8). Place the shipping tube in the upright position. Note the arrows and the word Top printed on the tube.

9). The antenna will be stuck in the shipping tube from the indents of the wood screws on two more wood supports that hold the antenna inside the shipping tube. Slightly bump the tube on the floor. This should release the antenna from the tube.

10). Lay the tube on the floor and remove the antenna from the tube $\frac{3}{4}$ inch threaded rod end first!

11). The 6-foot whip can now be removed from the body of the antenna.

The following pertains only to home installation. If you're mounting your *Scorpion* antenna on a vehicle, please follow the mobile install instructions, you may download a .pdf version from our website.

Scorpion Antenna Home Installation

Remove nut, washer, and lock washer from the $\frac{3}{4}$ -10-inch all-thread at the base of the antenna.



Connect the supplied bonding straps to the base of the antenna using one of the seven ¼ -20-inch button head bolts. This requires a 5/32-inch Allen wrench. Install the Counterpoise Adaptor Ring then connect the other end of the bonding straps to the two 1/4-20-inch bolts located on the counterpoise adaptor ring.

Screw on the white Delrin insulating bushing and tighten. Install the whip.

For the SA-680 our 80-meter antenna uses an 8 turn shunt coil when operating on 10-80 meters.

The antenna mast or tripod must have a 3/8-inch hole drilled in it approximately 1-inch from the top edge of the mast. For tripod installs, slide the antenna with the supplied insulating bushing onto the tripod. Align the tripod hole with the insulating bushings hole and insert the retaining pin. Install the Balun Designs balun you purchased from them onto the mast of the tripod.

Using the antenna's control box, move the coil all the way up so the entire coil is exposed to an “80-meter position”. Now move the coil down inside the antenna's stainless housing to the “10-meter position”.

The Balun Design 1115 common mode choke decouples the coax from the antenna and helps to stop the common mode from traveling back into the shack.

Warning: If power of over 200 watts is going to be used, another Balun Design 1115 common mode choke will need to be installed at the entrance of the shack with a copper plated ground rod. The control cable will need additional 31 material chokes installed just inside the shack to stop common mode.

Remember: If the common mode choke is too small for the high RF power being generated, the ferrite material will saturate, become very hot and will not stop the common mode depending on material type. Once this happens common mode currents will flow on the control cable or coax outer shield. This can cause RFI problems, RF burns and could damage your antenna controller, regardless of make or model.

The MFJ-805 common mode meter works very well for detecting common mode on coax or cable.

Remember: After decoupling the coax and control cable from the antenna, both are still in the near field of the antenna. The stronger the RF field "if higher power is used", the stronger the near field and the greater the coupling to both the coax and antenna control wires. This RF current that is present on the outside of the coax shield and control wire should be stopped at the shack using 31 type material beads, toroid or by using a homemade ugly balun.

The *Scorpion* Antenna control box can be connected to any 12-volt DC power source. Some power supply manufactures have a 12-volt accessory outlet built into the front of the power supply that the antenna power can be plugged into. If yours isn't equipped this way, replace the accessory plug with the proper type to match your supply. Install a 1-amp fuse in the antenna control power line.

With the yellow wire positive and the green wire negative the antenna coil will travel down going towards the 10-meter band. With the green wire positive and the yellow wire negative the antenna coil will travel up towards the 80-meter band.

With the control box in your hand and the cable towards your body, pushing the top of the rocker switch the antenna coil should go up; this is going towards the 80-meter band! If the antenna goes the opposite direction the connection of the yellow and green wire should be reversed.

Installing the Counterpoise Antennas

Warning: Do not apply DC voltage across the brown and white wires as it will damage the reed switch.

10 meters @ 28.500 MHz. Adjust to 42 inches
12 meters @ 24.950 MHz. Cut whips to 24 inches. Adjust to 19 inches. Single 12-meter antenna used to adjust to 42.5 inches.
15 meters @ 21.200 MHz. Adjust to 42 inches. NOTE: 15-meter antennas not required if 40-meter antennas are installed, 15 works on harmonic of 40 meters.
17 meters @ 18.125 MHz. Cut whips to 42 inches. Adjust to 36.5 inches.

20 meters @ 14.200 MHz.
Cut whips to 42 inches. Adjust to 30.5 inches.

40 meters @ 7.2 MHz.
Cut whips to 39 inches. Adjust to 36 inches.

80 meters @ 3.6 through 4.0 MHz see text.

Tuning can be accomplished using a standard SWR meter. However, it is an exhausting exercise requiring several hours of live transmitting, at low power. The easiest method is to use an antenna analyzer like the MFJ 259B/269 or similar. In order to speed tune, have a DC battery power source available at the antenna.

Do not use a 120-volt AC extension cord and power supply; it will act as part of the antenna and disrupt the tuning process as it will be in the near field of the antenna.

There are eight supplied counterpoise antennas. Their loading coils vary in length, from just a couple of inches as is the case for the 17-meter ones, to the full length such as the 80-meter ones. The protruding part of the whip should be set at the lengths shown in the chart, but there is a caveat. *The tail end of the whip must not protrude into any part of the loading coil, or it will become a heating element.* Therefore, their overall length will need to be trimmed. Here's how to do it correctly.

Mark each whip with a permanent marker using the length shown in the chart. Cutting the whips to the shown measurements assures you will not have any part of the whip inside the counterpoise coils if properly adjusted to the above measurements.

For the 80-meter antennas the full 48-inch whip leaving just enough of the whip to be held with the two set screws will put you at about 3.6 MHz. 38-inch whips will put you at about 3.8 MHz. 35-inch whips will put you at about 3.9 MHz. These measurements will get you close. An SWR of 1.1:1 can be obtained by making whip length adjustments to your favorite frequency on any band.

Cutting the whips is best done with small bolt cutters or a cutoff wheel. Do not use Diagonal cutter pliers “Dykes” or electrician side cutters for cutting the whips; you will ruin the cutting edge of the pliers! When installing the whips, lightly tighten down just one of the set screws. Both set screws will be tightened later, once the SWR is set for each band.

Use a small amount of NoOx® or similar anti-corrosive compound on the threads of the counterpoise antennas. Take your time when screwing in the counterpoise antennas, as the threads are easily damaged, and please don't over tighten them, just snug is fine! *We use quick disconnects on our counterpoise antennas for fast setup and breakdown at swap meets and Amateur functions.*

Note: After you have cut and installed the whips, install the 17-meter adjustable antennas on the Counterpoise Adaptor Ring first. They should be 180 degrees from each other.

Next, install the 20-meter adjustable antennas at 90 degrees from the 17-meter adjustable antennas. You can now add the 40-meter adjustable antennas then the 80-meter adjustable antennas to the counterpoise adapter ring, but make sure they are 180 degrees from each other. *Note: The 40 and 80-meter adjustable antennas should always be 90 degrees apart from each other. Example: 40-meter east/west and 80-meters north/south!*

We recommend to our customers either use the MFJ-259/269 antenna analyzer or use a radio powered by a battery and not a power supply that requires an extension cord at the antenna site. The extension cord will act like part of the antenna and cause tuning issues. This will save you many trips to the shack readjusting the main antenna each time you make an adjustment to the adjustable counterpoise whips.

Note: One tuning issue that we noticed was that the DC motor power line and the main antenna control box cable were acting as a radial when tuning a 15-meter counterpoise antenna. This was only after we had lengthened the power lead and control cable to reach the portable battery.

We were using an MFJ-269 that transmitted microwatts. Each time we moved the main antenna coil the 269 analog SWR meter would deflect. #31 material clamp type RF Chokes from Amidon were installed on both cables. This stopped the 269 analog SWR meter deflection and the SWR of over 2.0:1 dropped to less than 1.5:1. This same type of problem has been seen on mobile installs also! We have also used a long screwdriver pushed into the ground with a bonding strap connected to the MFJ units ground lug...this works very well!

With the eight adjustable antennas of your choice installed, check the SWR on all bands that you have installed. If all bands tested are under 1.5:1 SWR you can stop and use the antennas as is or go to the following tuning procedure and make further adjustments to try and lower your SWR even further. Remember: When tuning the adjustable antennas you always start at 10 meters and end at 80 meters.

If you do not have 10-meter adjustable antennas installed go to the next band 12-meter antennas then the 15-meter antennas then 17-meter antennas until you have finished at the 80-meter band.

Make sure the whip on each similar band of the adjustable antennas has the same measurements. 80 meters being the only exception, and only if you want to try the whip offset adjustments listed below.

If you have set the antennas to the measurements listed and cannot get them under a 1.5:1 SWR then you will have to remove all the adjustable antennas and start with a single 10-meter antenna. If you do not have a 10-meter adjustable antenna, install the next band that you do have.

Always start adjusting with the 10-meter antennas and proceed to 80 meters!

Run the main antenna all the way down so no coil can be seen. Start at 17 meters, it's a popular band!

Install one 17-meter counterpoise antenna on the counterpoise ring.

If you have an MFJ-259/269 set it for the middle of the 17-meter band.

While monitoring the SWR meter or the MFJ- 259/269 run the main antenna coil up until you see the meter deflect. Adjust the main antenna up and down until you have the lowest SWR reading, if above 2.0:1 the counterpoise antenna whip will need to be adjusted.

Now adjust the counterpoise antenna whip inward about an inch. Adjust the main antenna up and down to find the lowest SWR, if the SWR went up, you will have to pull the whip out and retest. You are trying to reach an SWR of 1.5:1 or less with only one antenna and remember, "the lower the better" as this will make tuning easier when the second counterpoise antenna is installed. Once you have a low SWR with one antenna, measure the whip and use this data to set the whip length for the second 17-meter antenna.

Everytime you adjust one of the whips you need to retune the main antenna to see where the new resonant point is.

Once you install the second 17-meter antenna and test it you will see the SWR increase slightly. With both 17-meter antennas installed you will have to shorten both antennas to the same length then retest. Properly tuned antennas will be close to 1.1:1 standing wave. If you cannot get to at least 1.5:1 something is not right. Make sure the counterpoise antennas are set to the same length.

Now with the two 17-meter antennas installed and with a low SWR, let's do the same for 20 meters!

Start with one 20-meter antenna; watch the SWR meter while operating the main antenna up and down to find the lowest SWR. Adjust the whip either in or out for lowest SWR reading. Do not forget to adjust the main antenna up and down for the lowest SWR every time you adjust the counterpoise whip. Now add the second 20-meter antenna, both antennas will be too long, shorten the same amount and make sure they are the same length. Monitor MFJ- 269 or the radio SWR meter until you have both antennas at 1.2:1 or less. Follow the instructions above for tuning all bands.

DO NOT GO BACK AND RETUNE THE PREVIOUS BANDS UNTIL ALL BANDS HAVE BEEN INSTALLED AND TUNED FIRST!

As you add antennas to the counterpoise ring the Capacitance and Inductance changes. Yes, they interact.

One band will affect the tuning of another band!

Always start at the *10-meter band* and end at the *80-meter band*.

After you have tuned all the bands then go back and check the SWR and make changes. ALWAYS start at the 10-meter band and then go to the next band ending at the 80-meter band!

If you pull off the 20-meter antennas and replace them with either 10 or 30-meter antennas you will have to start at the 10-meter band or the next band that you have installed with testing and tuning.

Take the time and tune all the bands for the lowest SWR!

Here is an option you might want to try: By offsetting the whip lengths by 1-inch or more, the antenna will become broader banded on the 75/80-meter band. For example: set one 80-meter adjustable antenna's whip to 38 inches and the other 80-meter adjustable antenna's whip to 39 inches. One 80-meter counterpoise is good for about 50 KCs of bandwidth. With two 80-meter antennas with the whip lengths offset you can get over 200 KCs of bandwidth!

Remember: If both antennas are not the same length using 80 meters and you are running high power, they are not sharing the load. The antenna that is resonant on that part of the band you are operating is going to carry the load. "See more on using High RF Power below!"

Using High Power on the Counterpoise Adjustable Antennas

Depending on the manufacturer, these adjustable type antennas all have a power rating. Our antenna manufacturer uses a larger #18 gage wire and rates their antennas at only 500 watts SSB!

Hamstick and the **Valor** brands use smaller size # 20 gage wire but have different power ratings...one is higher the other is lower?

The 80-meter antenna that we have manufactured must use 20 gage wire because of weight. 18 gage wires would have too much horizontal loading for our counterpoise use. We have the manufacturer add 6 inches of fiberglass rod to the end of our 80-meter counterpoise antennas so our customers will have a wider range of adjustment on the 80-meter band.

If you try loading and tuning 500 watts of CW power into any of these adjustable antennas with the heat shrink tube on the antenna it will start to melt quickly. We have tested our antennas using 500 watts in CW mode for a very short period and then examined to see how much heat is being generated.

Testing has proven that by removing the shrink tubing from the antennas coil section they will accept a longer transmit period before extreme heating takes place. The use of larger wire on our antennas also allows a longer transmit time, because the antennas are now able to dissipate more heat!

To increase the wattage rating of these antennas very carefully using a razor knife gently remove the shrink tubing from the coil area of the antennas. The shrink tubing on our 80-meter antennas will have to be removed because the entire antenna is a coil of wire.

Even though our counterpoise antennas are rated at 500 watts SSB with the shrink tube installed, we recommend using a dummy load for loading and tuning the amp if power over 200 watts is going to be used. CW power will heat the antennas faster than one might think!

Tune the *Scorpion* Antenna to the frequency that you will be operating at. Load and tune the amp into a dummy load, then switch over to the antenna. Tuning the *Scorpion* Antenna with 1500 watts of CW power applied is not a problem with the amount of pressure generated from the finger stock that we use, but at 1500 watts the counterpoise antennas will get *HOT very fast!*

We do have customers that operate with solid state amps using 400 to 500 watts and do not use a dummy load. No amp loading and tuning involved..."Their counterpoise antennas are still working with no issues so far". It's better to be safe using a dummy load for tuning your amp, versus smoking your counterpoise antennas!

Remember: If you split tune the 80-meter antennas so they are broad banded, only the antenna that is in resonance will carry the power that is being transmitted.

This can be tested at even 100 watts of CW power.

If the 80-meter antennas are tuned for an offset operation, a quick check can be performed by switching to the CW mode and transmitting on the end of the band that one antenna is adjusted for, let's say 3.8 MHz transmit for 20 seconds, then go out and feel the antenna's coil. One of them should be getting warm. If you cannot tell any difference then the transmit time will have to be increased. Do the same test at the other end of the band at about 3.9 MHz and you will now find the other antenna coil getting warm.

This same heating of a single antenna is magnified when using an amp. Take nothing for granted, it gets us into trouble every time. Take a little extra time to test and check to see what is happening with the antennas.... SWR Heating.... you will be glad you did!

If you are having issues with tuning, don't get discouraged, many times it's simply just something overlooked!

Please give us a call.

Thank you for purchasing our product!

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