

ScorpionAntennas.com

Scorpion

Home
Installation
Manual





Thank you for selecting *Scorpion* as your antenna!

Ron Douglass, NI7J

<http://www.scorpionantennas.com>

scorpionantennas@cox.net

623-326-8780



All *Scorpion* antennas, SA-680, SA-680S “shorty”, and the SA6-160, are supplied with both 6 and 2 foot whips, allowing efficient operation through 6 meters. In addition, all antennas are shipped with 20 feet of antenna control cable, control box, a ferrite split bead for the control cable, cigarette lighter plug with built in fuse holder, and a shunt tuning coil.

The antenna body is constructed of .065 inch wall, 304 stainless steel providing high strength and durability for a long trouble-free life. The finger stock and coil support housing is CNC machined and hand polished 6061-T6 aluminum.

We use Delrin® for the base insulator, the motor support, the ball bearing support, and for the upper coil cap which supports the whip. We are the only manufacture that installs a Delrin coil end cap on all of our antennas. This allows the coil to be more efficient and maintain its high Q or quality rating.

Our finger stock is a special order tin plated beryllium copper and maintains 37 pounds of combined pressure on the coil at all times. We are once again the only antenna manufacture that states tuning the antenna at 1500 watts of CW power is not an issue.

We use a Pittman, industrial-grade motor that has steel gears in its gear box and a seven segment commutator in the motor. We install capacitors on the motor leads so tuning the antenna by ear is static free. And, we’re the only antenna manufacture using two, double-sealed ball bearings for our coil support.

We use a 3/8 by 16 Stainless leadscrew in conjunction with an oilite bronze nut that is ¾ of an inch in length. This assembly moves the coil in and out of the stainless steel tube when rotated by the motor. The all-thread is lubricated with DuPont Krytox Teflon® grease which will withstand a minus 30 to a plus 475 degrees Fahrenheit.

For our coil forms, we use a 1/4 inch wall, industrial-grade, 3 inch diameter, phenolic tube. Our heavy resin base formula is specially manufactured to our specs assuring superior strength, and long life.

Our SA-680S “shorty” and the SA6-160 coils provides a coil Q of 380 and are wound with #14 gauge tinned wire at 10 threads per inch. The SA-680 coil provides a coil Q of 410 and is wound with #10 gauge tinned wire, at 6 threads per inch. All of our models offer superior performance guarantee.

We use the thickest coil cover in the industry. Our coil cover is made from 1/8 inch wall Lexan®, the same material that is used for bullet proof windows on armored trucks.

All of our antennas come equipped with an antenna position reed switch, providing two pulses per revolution of the Pittman Industrial grade motor for better antenna positioning.

Unpacking and Installing the *Scorpion* Antenna

Please read these instruction sheets 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. Damage thus caused is not covered under warranty.

- 1). Remove the packing tape from both ends of the shipping tube.
- 2). Depending on the model, there are up to 24 Phillips-headed screws holding in the shipping tubes end caps. Remove all of these screws.
- 3). Using two of the removed screws, partly thread them into the end caps. These screws can then be used to pull out the end caps.
- 5). Remove the end caps carefully!
- 6). **AT THIS POINT DO NOT TRY TO REMOVE THE WHIPS, THEY WILL NOT SLIDE OUT!**
- 7). Remove all the contents at the top end of the tube. This includes the Antenna Controller, Shunt Coil, and antenna control cable.
- 8). At this point, you should see the 3/4 inch all-thread, washer and nut at the bottom end of the tube. The whip is at the top end of the tube.
- 9). Place the shipping tube in the upright position. Note the arrows and the word Top printed on the tube.
- 10). 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.
- 11). Lay the tube on the floor, and pull the antenna out of the tube all-thread end first!
- 12). The whips can now be removed.

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 web site:

<http://www.scorpionantennas.com>

Scorpion Antenna Home Installation

Remove nut, washer and lock washer from the 3/4-10 inch all-thread at the base of antenna.

Check the 1/4-20 **RED** colored button head locking bolt at the base of the antenna for tightness. This locks the quick connect stud into place and keeps it from rotating.

Warning: 1.5 inches of leadscrew must remain inside the aluminum quick disconnect stud.

Referring to the photo, connect the supplied bonding strap to the base of the antenna using one of the eight 1/4 -20 button head bolts. This requires a 5/32 inch Allen wrench. Install the Counterpoise Adaptor Ring then connect the other end of the bonding strap to it with the supplied 1/4-20 button head bolt.

Screw on the white Delrin insulating bushing and tighten. Install the whip. For the SA-680 6-80 meter antenna use a 12 turn shunt coil when the antenna is installed at the 7 ft height and a 13 turn shunt coil @ 30 ft. For the SA6-160 the 6through 160 meter antenna uses a 13 turn shunt coil when the antenna is installed at the 7 feet height and the 15 turn shunt coil @ 30 ft.

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. Slide the mast clamp on to the mast. Install the antenna into the end of the mast, then slide mast clamp into place and tighten. The mast clamps all-thread will tighten down on the Delrin insulating bushing keeping the antenna from rotating.

Warning: Do not over tighten the bolt or you may break through the Delrin® bushing. Tighten the bolt Just enough to keep the antenna from rotating.

Install the antenna on the mast and test it to make sure it will travel up and down with no issues. This will test for any shipping damage which might have gone undetected. Using the antennas control box, move the coil all the way up so the entire coil is exposed “80 meter position”. Now move the coil down inside the antennas stainless housing “10 meter position”.

If you are operating at 100 watts or less use the split type choke on the control cable see next paragraph.

If operating at over 100 watts wind a toroid as shown or order one from *Scorpion* Antennas.

Install the supplied clamp type RF choke (ferrite split bead) on the control cable within 8 inches of the antenna. Try to wrap as many turns as possible of the control cable inside the bead. As seen in the photo, you should be able to get three wraps of cable through the choke. If the supplied ferrite split bead is not installed on the control cable, the control cable will have common mode currents on it. This will cause tuning issues and allow RF to travel back into the shack that can damage your antenna controller.



Warning: If power of over 100 watts is going to be used, an FT-240-77 ferrite toroid (available from [Amidon](#)) or purchased from *Scorpion* Antennas will be needed at the antenna on the control cable, and another one next to the antenna controller. We offer a pre-wired ready to go toroid choke for your control cable for only \$19.95.



“The 4 pin antenna connector in photo not included”!

Remember, if the choke is too small for the amount of RF power being applied, the ferrite material will saturate, and become very hot! This will allow common mode currents to flow on the control cable. This can cause RFI problems, RF burns and could damage your antenna controller, regardless of make or model.

When winding the toroid for high power operation you should have one starting point at the 7 o'clock position. Wrap the cable side by side all the way around the ferrite toroid to the 5 o'clock position. Use plastic wire ties to hold the ends of the cable in place. Keep the two ends of the cable separated; if they touch the RF will bypass the toroid.



A field strength meter will be needed to test your control cable with the radio in CW mode at 100 watts, or at the power you will be operating at. Do not use AM, 25 watts is not enough. With the radio transmitting, and the field strength meter's antenna next to the control cable, you should see almost no deflection on the meter. If you do, you still have an RF issue which must be resolved.

When transmitting at any power level, the antenna coax feed line will require an RF Choke or "Current Balun" to be installed at the base of the main antenna and insulated from ground. Do not allow a coax connector or the coax shield to touch the metal mast or mounting pipe, this will detune the antenna.



We offer a 16 inch piece of Belden 9913 coax with 10 beads of the #77 material with connectors installed for \$49.00. Commercial units are also available, or use what's commonly referred to as an ugly balun.

It consists of about 25 feet of coax, wound around a 4 inch piece of PVC drain pipe. An example is shown in the



photo. Note that the balun is mounted away from the mast to avoid detuning. You should check the coax for common mode currents as described above.



When using the *Scorpion* common mode beads, form a gradual radius in the coax starting at the antennas SO-239 to help relieve the strain on the coax as seen in the photo. For a permanent install use a good grade of electrical tape to seal the coax. We use Velcro straps to keep the coax and control cable in place for temporary installs. Wire ties work well for holding the coax and control cable to the mast. If wire ties are used, cover them with electrical tape for excellent UV protection.

The *Scorpion* Antenna control box can be connected to any DC power source ranging from 12 to 24 volts. Some power supply manufactures have a 12 volt accessory outlet build into the front of the power supply that the antenna power can be plugged into. If yours isn't so equipped, 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 10 meter band. With the green wire positive and the yellow wire negative the antenna coil will travel up towards 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.

Warning: Do not apply DC voltage across the brown and white wires you could damage the reed switch.

These wires go to a NO reed switch that closes two times per revolution of the Pittman Industrial grade motor. This reed switch is compatible with all currently manufactured controllers which require a switch closure to return a voltage pulse to the controller.

Installing the Counterpoise Antennas

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. To speed tuning, make DC battery power 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.

There are eight supplied counterpoise antennas. Their loading coils vary in length, from just a couple of inches as is the case of the 17 meter ones, to the full length as is the case of 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.

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 @ 7.200 MHz. Cut whips to 39 inches. Adjust to 36 inches.
80 meters @ 3.6 through 4.0 MHz see text.

Mark each whip with a permanent marker using the length shown in the chart. Cutting the whips to 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 really 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. We do stock the quick disconnects for our customers.

Note: After you have cut and installed the whips as per the listed measurements'. 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 adaptor 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 meter 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 ran into was the DC motor power line and the main antenna control box cable were acting as an antenna 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.

I was using a MFJ-269 that's transmitting microwatts. Each time we moved the main antenna coil the 269 analog SWR meter would deflect. 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!

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: 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 than the 15 meter antennas than to the 17 meter antennas until you stop at 80 meters.

Make sure the whip on each similar band of the adjustable antennas has the same measurements. 80 meters being the only exception, 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 of 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 off tuning with 10 meters and work your way to 80 meters!

Run the main antenna all the way down so no coil can be seen.

“Let's use 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 about 1.5:1 or less with only one antenna “the lower the better” 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.

Remember: Every time you adjust one of the whips you have 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 will increase slightly. With both 17 meter antennas installed you will have to shorten both of the antennas to the same length then retest. Properly tuned antennas will be close to 1.1:1 SWR. If you cannot get to at least 1.5:1 SWR, something is not right. Make sure the counterpoise antennas are set to the same length.

Moving and tuning the next band.

Now that you have the two 17 meter antennas installed and with a low SWR, let's do the same for the next band...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!

Here is why! 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 work your way to the "80 meter band"!

After you have set all of the bands then and ONLY then do you want to go back and check the SWR and make changes. ALWAYS start at the 10 meter band, make adjustments and then go to the next band...continue to "80 or 160 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 of 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. By this we mean, Example: set one 80 meter adjustable antennas whip to 38 inches and the other 80 meter adjustable antennas 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 on 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 manufacture of these adjustable type antennas all have a power rating. Our antenna manufacture 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 rating...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 wire would have to much horizontal loading for our counterpoise use. We have the manufacture 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 pretty quickly. We have tested our antennas using 500 watts in CW mode for a very short period of time 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 tube from the coil area of the antennas. All of 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 really quick!

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, verses 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, lets say 3.8 MHz. Transmit for 20 seconds, then go out and feel the antennas coil. One of them should be getting warm. If you cannot tell any difference than the transmit time will have to be increased. Do the same test at the other end of the band lets say 3.9 MHz. 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....SWRHeating....we will be glad you did!

If you are having issues with tuning, don't get discouraged, a lot of times its something simply over looked ...we know... we still do it!

Please give us a call.

Thank You for purchasing our product!

73s

Ron Douglass NI7J

scorpionantennas.com

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