

ScorpionAntennas.com

Scorpion

Installation
Manual





Thank you for selecting *Scorpion* as your antenna!

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All **Scorpion** antennas, SA- 680, SA-680S “shorty” and the SA6-160, are supplied with a 6 foot whip, allowing efficient operation 10 through 80 or 160 meters. In addition, all antennas are shipped with 20 feet of antenna control cable, control box with two #31 type material split beads for the antenna coax and control cable decoupling, a cigarette lighter adaptor with fuse holder, and a shunt coil for antenna impedance matching.

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. This material is extremely expensive, it is dense and heavy.

Our finger stock and coil support housing is 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 very expensive special order tin plated Beryllium Copper that maintains 37 pounds of combined pressure on the coil at all times.

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

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

Our coil form is 1/4 inch wall Industrial grade phenolic that has a special resin base formula that is manufactured to our specs. Our coil alone weighs 4.5 Lbs wound with wire.... so we use two double sealed ball bearings for the coil support.

Our coil cover wall is the thickest in the industry, it is made of .125 inch Lexan. This is the same type material that is used for bullet proof windows on armored trucks, only a lot thicker.

We are the only manufacture that includes counterpoise or radial wire connecting bolts built into the base of our antennas. This makes backyard, field day or camping install of counterpoise or radial wires a snap.

Our antennas have a reed switch installed for use with digital display antenna controllers. We use two magnets mounted on the motor coupling that generate two pulses per revolution.....this equates to better antenna positioning from a Digital Antenna Controller

The SA-680 coil has a Q of 410 and is wound with #10 gauge tinned wire, at 6 turns per inch.
The SA-680S and SA6-160 coils have a coil Q of 380 and are wound with #14 gauge tinned wire, at 10 turns per inch.

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). There are 15 Phillips head wood screws safely holding the antenna in the shipping tube. Eight at the bottom of the tube, 3 in the middle of the tube and 4 at the top of the tube. All were located under the packing tape that you just removed. Please 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.
- 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 the 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 pull the antenna out of the tube threaded rod end first!
- 11). The 6 foot whip can now be removed from the body of the antenna.



Pre-installation Maintenance

Before the antenna can be installed on any vehicle mount, a few maintenance chores must be performed. Please read the complete list before proceeding.

A). Hold the wood support with one hand and remove the ¾ inch nut from the threaded rod.

B). On the top of the antenna, there is a 3/8x24 shipping bolt and washer holding a wood support. Under the wood support is a 1 inch long stainless steel coupling nut. Use a backup wrench on this stainless steel coupling nut, carefully remove the shipping bolt and washer.

Warning: Do not try to remove the 3/8X24 all-thread stud at the top of the antenna! Doing so will damage the antenna, and will not be covered under warranty. This stud keeps the Lexan® cover held in place by the large stainless steel coupling nut, and is permanently attached to the Delrin® coil end cap with a locking set screw. The wire from the coil is also attached to this stud on the other side of the Delrin® end cap.

Note: The stainless steel coupling nut should not turn. If the coupling nut becomes loose, hold the clear Lexan coil cover and retighten it. When removing any whip or capacitance hat from the antenna, always use a backup wrench on this coupling nut to prevent loosening.

Advisory: There is a bead of clear silicon sealer that has been applied under the Lexan® coil cover to keep out water. If the Lexan® coil cover needs to be removed and/or replaced, please call our Customer Service department for detailed instructions.

Antenna Installing Tips

Your **Scorpion** antenna is manufactured to an exacting standard, utilizing top-quality components. Its inherent high Q means you'll get the best performance money can buy. However, any HF mobile antenna is only as good as its installation. What follows are a few things to keep in mind when choosing where, and how to mount your **Scorpion** antenna. Please go to *Breedlove mounts, Jerry has Scorpion Antennas listed on the main page of his site. He manufactures special mounts that will work with our heavy antennas.* <https://breedlovemounts.com/>

The **Scorpion** antenna weighs nearly 18 pounds, and requires a very sturdy mounting structure. This eliminates magnet mounts, trunk lip mounts, and similar mounting schemes. Remember we use a ¾ inch by 10 thread pitch piece of Stainless allthread at the base of our antenna for mounting. You cannot mount our antenna on a 3/8 by 24 mount designed for a smaller antenna.

Even the largest of vehicles present a marginal image plane for any HF mobile antenna. To maximize the image plane, it's important to remember this basic fact; it is the mass under the antenna. The absolute best place to mount an antenna is dead center on the roof. With our 18 pound antenna this is not possible, so we use and we will recommend the best mounting location available, please call us for assistance.

We have done many vehicle installs where the antenna is mounted off to the side of the vehicle a few inches on an L type bracket that is welded to the frame. This type of install works just fine with no issues, "see our site for photos"! On pickup trucks, we always recommend mounting at the hand rail height for best efficiency!

While a large number of Amateurs use variations of a trailer hitch mounts, it is the least advantageous location. If you drive a pickup truck there are many mounting locations that will work quite well if the bed of the truck is properly bonded using tinned plated braid (strapped) from the frame to the body.

If you drive a van or a motor home, front mounting is preferred. This assures that the loading coil will not be shielded by the body of the van which improves performance. Mounting the antenna with the coil exposed next to any type of metal will not only detune the antenna, it will kill the signal because of the coupling effect to the metal surface. We have experienced that mounting the base of the antenna in the bed of a truck with the Stainless tube of the antenna within a few inches of the side rail was not an issue. If the antenna was mounted in the bed of the truck and *the exposed coil was within a few inches of the truck's cab, then there would be a coupling issue to avoid.* With the antenna in the down position, be sure to have the black cap on top of the antenna 12 inches above the cab or metal surface to insure the coil will not be next to a metal surface. *Contrary to popular belief, this mounting location does not increase the level of ignition noise.*

Make sure the top of the antenna is at least 12 inch above the roof line with the antenna in its down position so coil coupling is at a minimum! If you park in a garage try to get the antenna as high as possible for door clearance and use a quick disconnect fitting to remove the whip.

Install the Shunt Coil only after you have installed the Antenna on your vehicle. This will keep the coil from being damaged when mounting the antenna. If you forget to install the shunt coil you will see a high SWR when trying to tune the antenna for a low SWR, especially on the 40 or 80 meter bands.

A ground strap will have to installed between the base of the antenna (using one of the 8 button head bolts at the base of the antenna), and the body/frame structure. At a minimum, this should be tinned copper braid, 3/4 inches wide. The use of solid copper flat stock that is .010 to .030 inch thick and 1 inch wide will actually work better due to RF skin effects. **Remember, an ohm meter continuity check is not a guarantee that you have a good RF GROUND!**

One of the best things you can do is bond all of the body parts, doors, hood, and trunk to the main body and increase the size of the bonding strap from the engine to the frame or body. Bond the muffler system in three places by using muffler clamps and bonding straps to the frame. Bond at the “Exhaust pipe next to engine, next to the muffler and the tail pipe”! The exhaust system is insulated from the frame because it is hanging on rubber grommets. The engine and transmission are insulated from the frame by rubber mounts. Bonding of the vehicle parts and muffler system will help to get rid of engine noise, and other types of interference.

DX Engineering carries bonding straps and muffler clamps! If you still have bad radio interference from your vehicle, check with your dealer, as they have vehicle interference information for communication radio installs.

It isn't necessary to sand off all paint and primer when installing bonding straps. Doing so may damage the zinc undercoat which can cause connections to rust. The best way to assure a good connection is the liberal use of stainless steel star washers and the use NOALOX by IDEAL available at Home Depot or a similar anti-oxidizing agent. Coat the star washer, end of strap and the bolt with NOALOX to help stop corrosion on all bonding joints. The NOALOX works really well, wait until you try to remove it from your hands!

Please remember our SA-680 shorty antenna weighs in at 13 pounds.

Our SA-680 and our 160 meter antenna weighs in at 18 pounds.

Our antennas need to have a RIGID MOUNT!

We Recommend using nothing smaller than 2" by 2" by 3/16" wall thickness....square tube for all right angle mounts that are attached to the frame of the vehicle and extend out to the side of the vehicle.

Please Do Not take a chance with a lighter or smaller mounting material for your mount....it could break off and go through someone's windshield !

"See our mobile photo gallery" and "Antenna Mounting" for more ideas.

In our accessories page we have a 1" national pipe thread stainless Pipe Adaptor with a 1" pipe thread on one end and 3/4" standard bolt thread on the other used for antenna mounting. Heavy wall threaded pipe "*Electrical or Plumbing type*" of your choice can be screwed into our stainless pipe adaptor. The antenna threaded rod along with the 3/4" by 10 TPI stainless threaded rod is screwed on to the other end of the stainless Pipe Adaptor.

We have customers that use two of the stainless Pipe Adaptors for mounting the antenna.....one adaptor is used at the bottom of the antenna and the other is mounted or welded to a plate that is bolted to the vehicle. This allows you to use different length pre-cut and pre-threaded pipe nipple for your install from Home Depot.

If the threaded pipe nipple is longer than 6 inches you will need to support the pipe nipple! "See our mobile install photo gallery for these type mounts."

The RF Choke

The motor control leads on our HF mobile antennas are in close proximity to the RF current traveling on the stainless tube. These leads must have the RF or common mode removed to stop the travel of RF on these control leads. We decouple them with clamp on 31 type material beads so the antenna does not see them as an active radiating part of the antenna. By doing so we also help to stop common mode from migrating into the cab of the vehicle. This is accomplished by installing the two supplied 31 type clamp on chokes. These chokes are ample for 100 watts of power. Additional chokes will be needed if higher RF power is used.

Install one of the two supplied 3/4 inch ID 31 type material clamp type chokes on the coax and one on the antenna control cable.

5 to 6 turns of RG-8X providing 4 inch loops through the choke is needed to decouple the coax from the antenna.

If higher power is used, install two 3/4 inch ID 31 material clamp type chokes one on the coax and one on the control cable inside the vehicle where the coax and antenna control wire just enter the vehicle. This will help stop Common Mode from entering the vehicle. With 500 watts of power you may need to install additional chokes. If you have any other antenna installed on the vehicle with coax entering the vehicle it will need to be choked also, to stop any common mode that occurs in the near field that will migrate onto the outside shield of of any coax used!

If you have an 18 gage two conductor wire at hand and wind at least ten turns through a 31 material 3/4 inch ID clamp style choke, it will increase the impedance of the choke many times over. For every loop through the choke the impedance will square. This will help if you are experiencing common mode current or high SWR. Use the #18 gage 2 conductor wire instead of the 2 conductor cable that is supplied with the antenna.

In cases when high power is used, it become necessary to decouple the coax and the control cables just as they enter the inside of the vehicle. Remember: the coax and control cable are in the near field! The #31 material clamp type choke will work well for this issue. Make sure both coax and control cable have the chokes installed

at the same distance from where they enter the vehicle. If the chokes are staggered, common mode will transfer from one of the RF hot cables to the other.

Antenna Wiring Color Code

With the yellow wire positive and the green wire negative the antenna coil will travel downwards going towards the 10 meter band. With the green wire positive and the yellow wire negative the antenna coil will travel upwards 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. If the Antenna goes the opposite direction then the connection of the yellow and green wire must be exchanged.

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

The brown and white wires go to a Normally Open reed switch that closes two times per revolution of the motor coupling. This reed switch is compatible with all currently manufactured controllers which require a switch closure to return a voltage pulse to the controller that will update a digital display.

If the Brown and White wires are not used, DO NOT CONNECT THEM TO THE BODY OF THE ANTENNA! RF coupling to these wires by close proximity of the RF HOT Stainless tube is not an issue.

Connection of these wires to the RF HOT Stainless tube or antenna body will transmit either 100 watts or 500 watts if an amp is used, into the reed switch with severe RF CURRENT coupling to the Motor.

IF YOU CONNECT THE BROWN & WHITE WIRES TO THE BODY OF THE ANTENNA, YOU WILL VOID YOUR WARRANTY!

Installing and Tuning the Antenna Matching Coil

Your *Scorpion* antenna comes supplied with a base matching coil, sometimes referred to as a shunt coil. The shunt coil is almost invisible from the 20 meter band and higher frequencies.

The photo at right shows the proper mounting location of the shunt coil on the antenna. The shunt coil transforms the input impedance closer to 50 ohms to match that of the transceiver. Since the input impedance varies with each installation, the inductance of the coil might have to be adjusted. This is done by changing its overall length a small amount.



Adjusting the Shunt Coil using an SWR meter “80 meter antennas only”

With the shunt coil as is...the Micro Henry value will be at its maximum. This will give you a lower SWR on the low bands such as 75/80 meters.

Do a test with the shunt coil on the 40 and 80 meter bands before adjusting the coil.

If you have high SWR on 40 meters and your 80 meter band has a low SWR...try spreading the shunt coil apart a little “VERY LITTLE” then retest. You will notice that the SWR at 40 meters will **decrease** a small amount or a lot depending on how much you spread the shunt coil, and the 80 meter SWR will **increase** a small amount.

“If your SWR is HIGH on 80 meters and it increases when you spread the coil then you need a coil with one more turn for a higher Micro Henry value”.

It's a balance of the SWR between the bands and this takes a few minutes of adjusting to find that sweet spot. If it is under 1.5:1, you're done. If it isn't, you may have to compromise between the 40 and 80 meter settings .
Please adjust your antenna for the LOWEST SWR for Absolute Maximum Performance!

160 meter antenna dual shunt coil enclosure install

“WARNING”, If you switch the dual shunt coil relay while transmitting you will Damage the relay contacts!

After removing the dual shunt coil enclosure lid you will then be able to use a hex or Allen wrench to hold the button head screws and remove the two holding nuts on the rear of the enclosure. The two nuts can now go into your favorite storage bin for your next project. *The 160 meter shunt coil is upper right with 80 meter shunt coil on left side inside enclosure. The dual shunt coil relay is located at the bottom of the enclosure.*

There are two locations on the antenna that you can mount the dual shunt enclosure. As seen in the photos, the small button head screw above the white Delrin insulator is a 10/32 thread and the button head below the white Delrin insulator is a 1/4-20. There are three locations for 10/32 button head screws, they are 120 degrees apart from each other around the antenna.



The black #10 gage wire the feeds RF current to the stainless tube is one location that cannot be used, the other two locations around the antenna are available. After locating your favorite side of the antenna to mount the shunt coil enclosure, remove the 10/32 and the 1/4-20 button head from the antenna. With the supplied button head screws in the dual shunt enclosure, align the enclosure to the antenna then tighten the screws. Now connect the control cable and have someone switch the 80/160 meter switch that is located on the top of the hand control box and listen for the relay to energize, you will hear a click. With the relay tested you can now install the enclosures cover. **Do not transmit while switching the 80/160 meter dual shunt coil relay!**

Our New sealed shunt coil enclosure

Follow our 160 meter dual shunt coil enclosure instructions located on the previous page for installing our new sealed shunt coil enclosure for our 80 meter antennas the SA-680s “shorty” and our SA-680 standard.



Controlling the Antenna

The supplied wiring harness comes equipped with a fused accessory plug already attached. However, for permanent installations, this **1 amp fused connection is required by the customer** to be made to a power source other than the accessory socket.

On the top of the 160 meter antenna control box is the 80/160 meter switch. When operating on 80 meters the switch must be switched to the 80 meter position. When operating on 160 meters the switch must be switched to the 160 meter position.

“WARNING” Do not operate this switch when transmitting, you will damage the dual shunt coil relay contacts.



Connect the fused power plug to the 12 volt accessory outlet in your vehicle.

Move the antenna coil all the way down (collapsed) by pushing the bottom (cable end) of the rocker switch.

“If the antenna moves in the upward direction, exchange the quick disconnect power lead connectors at the antenna”

Tune your radio to 20 or 40 meters. Push the top of the rocker switch; this will cause the antenna coil to start going up. Listen closely to your radio. As the coil is going up the white noise will start increasing. It will get louder as the coil becomes resonant on the band you are listening to so watch your S meter and adjust the antenna up and down for maximum receive signal strength.

If you are tuned to where you can hear a conversation the receiver will get louder faster because of signal strength. Once you tune by ear you will be surprised as to how close you are after you check the SWR.

With the coil all the way down in the Stainless tube you are positioned for 10 meters using the 6 ft whip. With the coil all the way up you will be at the bottom of the 80 meter band “3.5MHz” or “1.8 MHz” on the 160 meter band depending on the antenna you purchased when using the six ft whip.

With the 6 ft whip you will have continuous tuning from 10 to 80 meters or 10 to 160 meter depending on the antenna!

Either the 80 or the 160 meter antenna is most efficient with a 102 inch whip, *but you will only be able to tune as high as the 15 meter band.* Any band higher will require a 6 ft whip.

Any screwdriver antenna will perform better on the 40, 80 or on the 160 meter band with a 102 inch whip! Most people do not like a long whip that tall so we recommend using a capacitance hat of at least 36 inches in diameter. The capacitance hat has to be installed a minimum of 24 inches above these large coils, 36 inches is better still.

The antennas efficiency and performance will be increased when the least amount of coil is exposed.

Capacitance hats are designed to work there best on the 40, 80 and especially on the 160 meter band.

Our Caphat is supplied with three stainless rods that will enable a 36 inch hat. Our support shaft is 36 inches in length.

The best site we have found that is loaded with HF mobile install info is www.K0BG.com. Alan Applegate is the king of mobile install info. He will reply if you have a question about anything on his site. I would read everything on his site before doing any mobile install... YES it is that good!

Also, go to Tom Rauch www.W8JI.com. We have links for Alan’s and Tom’s site at the bottom of our home page under **Links**. Tom is the Engineer for DX-Engineering. Take a look at all of the mobile Antenna testing he has done...he has a lot of good info to study and learn from. You will not be sorry 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!

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