

ScorpionAntennas.com

# *Scorpion*

Installation  
Manual

# Thank you for selecting *Scorpion* as your antenna!



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The Scorpion SA- 680 is supplied with a 58.5-inch whip, allowing efficient operation at 10 through 80 meters. The antenna is shipped with 20 feet of antenna control cable, antenna controller, two #31 material split type beads for antenna control cable, coax RF decoupling, a cigarette lighter adaptor with a built-in fuse holder with a 1 amp fuse, and a shunt coil for antenna impedance matching.

Our antenna body is .065-inch wall 304 Stainless Steel making it 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.

Our finger stock housing is built using 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 a special-order tin-plated Beryllium Copper that always maintains 37 pounds of combined pressure on the coil.

The antenna coil drive motor is a Commercial Grade Pittman motor that only uses steel gears in its gear box, not plastic. This motor sells for over \$100.00. We do install capacitors on our motors so tuning the antenna by ear is static-free.

The 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. The coil alone weighs 4.5 pounds wound with tin plated #10 gage wire. Two double sealed ball bearings are used for the coil support.

Our .125-inch polycarbonate coil cover wall is the thickest in the industry.

We are the only manufacturer that includes counterpoise or radial wire connecting bolts built into the base of our antennas. This allows the backyard, field day, or camping install of counterpoise or radial wires to be easy and hassle-free.

Our antenna line has 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 which results in better antenna positioning when using a Digital Antenna Controller such as the Tunematic.

The SA-680 coil sports a Q factor of 410 that is wound with #10-gauge tinned wire, at 6 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. Resulting damage is not covered under warranty.

- 1). Remove the packing tape from both ends of 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. Next remove all wood screws.
- 3). Using two of the removed wood screws, partly thread them into the end caps. One of the wood screws can then be used to pull out the end caps using the claw end of a hammer. Just like removing a nail!
- 4). Please 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 safely 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.

At the bottom of the antenna are eight button head screws. Use a piece of braid attached to one of the button head screws at the base of the antenna and bond it to the vehicle.

Hold the wood support with one hand and remove the  $\frac{3}{4}$  inch nut from the threaded rod.

On the top of the antenna, there is a  $\frac{3}{8}$  x 24-inch shipping bolt and washer holding a wood support. Under the wood support is a 1-inch-long stainless-steel coupling nut. Using a backup wrench on this stainless-steel coupling nut, carefully remove the shipping bolt and washer.

Warning: Please do not try to remove the  $\frac{3}{8}$  inch by 24 threaded rod under the coupling nut at the top of the antenna! Doing so will damage the antenna and will not be covered under warranty. This stud keeps the Polycarbonate cover held in place by the large stainless steel coupling nut! It 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 or Black polycarbonate 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 silicone sealer that has been applied under the polycarbonate coil cover for weather protection. If the polycarbonate coil cover needs to be removed and/or replaced, please contact us for detailed instructions.

## *Antenna Installation Tips*

Your *Scorpion* antenna is manufactured to an exact 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. The following tips are a few things to keep in mind when choosing where, and how, to mount your *Scorpion* antenna.

The *Scorpion* antenna weighs 18 pounds and requires a very sturdy mounting structure. This eliminates magnet mounts, trunk lip mounts, and similar mounting schemes. We install a  $\frac{3}{4}$  inch by 6 thread pitch section of Stainless thread rod at the base of our antenna for mounting. You cannot mount our antenna on a  $\frac{3}{8}$  by 24-inch mount that is 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 an 18-pound antenna this is not feasible, so we recommend visiting our site's photo gallery for ideas on mounting to your vehicle or call us for assistance.

We have several truck/van customers that have mounted the antenna to the side of the vehicle using an L type bracket that is welded or bolted to the frame. This type of install works very well. Another ideal mounting location on a truck is the top of the bedrail, we always recommend this mounting position for best efficiency!

While a large number of amateurs use variations of trailer hitch mounts, it is the least advantageous location. If you drive a 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) to the frame.

If you drive a van or a motorhome, front mounting is preferred. This assures that the antenna's large coil will not couple to any metal near the antenna. Mounting the antenna with the coil exposed next to any type of metal will detune the antenna with a reduction of RF energy radiated! 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 several inches of the truck’s cab, then there is a coupling issue to avoid.

With the antenna in the down position, be sure the top of the antenna is 12 inches above the cab or metal surface to ensure 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!*

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.

A ground strap is required to be installed between the bottom of the antenna (using one of the eight button head bolts at the bottom), and the body/frame structure. At a minimum, this should be tinned copper braid, 3/4 inches wide, try to keep it less than 18 inches long. The use of solid copper flat stock .010 to .030 inch thick and 1 inch wide will work better due to RF skin effects. *Remember, an ohm meter continuity check is not a guarantee that you have a good RF GROUND!*

It is very wise to bond all 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 is required to sand off all paint and primer when installing bonding straps. If you are using a 3/4 inch tin plated braid then use 3/4 inch O.D. Stainless Fender Washers, one on each side of the braid then attach to the frame or bonding location of clean exposed metal.

Home Depot offers self-tapping screws that work very well.

Look for the TEKS brand self-drilling and self-tapping #14 by 3/4 inch in length.

Note: Be sure the Stainless fender washers will fit the #14 TEKS self-tapping screws.

“Drill an 1/8-inch hole first to allow the TEKS screws cutting edge to drill through the frame or other metal with ease”. Always coat “soak” the connection point using Clear Automotive Lacquer from Ace Hardware or Home Depot as this will seal the connection point so water cannot wick its way to the connection point. The wonderful

thing about using clear lacquer is a year after the install you can inspect each connection point and see through the clear lacquer for corrosion.

## *The RF Choke*

The motor of all remotely controlled HF mobile antennas, including the *Scorpion*, operates above RF ground. This means that any time you transmit, there will be RF imposed on the control leads. These leads must have the RF choked from them.

*Install a 3/4-inch I.D. 31 material clamp type choke on the coax with 5 to 6 turns of RG-8X providing 5 to 6 four-inch loops through the choke that are needed to decouple the coax from the antenna.*

*If higher power is used, install a 3/4-inch I.D. 31 material clamp type choke on the control cable also.*

If you have an 18 gage two conductor wire at hand then 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 #18 gage 2 conductor wire instead of the 2-conductor control cable that is supplied with the antenna.

In cases when high power is used, it becomes necessary to decouple the coax and the control cables just as they enter the inside of the vehicle.

*NOTE: the coax and control cable are in the near field!* The #31 material clamp type choke will work well for this issue. Be sure both coax and control cable have the chokes installed at the same distance from where they enter the vehicle. If the chokes are not 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 down going to a higher band such as 10 meters.

With the green wire positive and the yellow wire negative the antenna coil will travel up or will be going to a lower band such as 80 meters.

If the antenna goes the opposite direction, then the connection of the *yellow* and *green* wire should be reversed.

Warning: If D.C. voltage is applied across the brown and white wires it 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 Pittman motor. This reed switch is compatible with all currently manufactured controllers that require a switch closure to return a voltage pulse to the controller which will update a digital display.

If the brown and white wires for the reed switch are not used, please do not connect them to the stainless body of the antenna.

RF coupling to these wires by proximity of the RF current on the Stainless tube is not an issue.

Connection of these wires to the RF current on the Stainless tube or antenna body will transfer RF into the reed switch with severe RF CURRENT coupling to the Motor.

## *Tuning the Antennas Impedance Matching Coil*

Your *Scorpion* antenna comes supplied with an impedance matching coil, referred to as a shunt coil. The inductance of this coil, and a little capacitance borrowed from the antenna, form an LC network. This network transforms the input impedance to 50 ohms to match that of the transceiver. Since the input impedance varies with each installation, the inductance of the coil sometimes needs to be adjusted. This is done by changing its overall length.

### *Adjusting the Antenna with the SWR meter*

With the shunt coil as is...the Micro Henry value will be at its maximum. This will give you a lower SWR on 40 and 80 meters.

Do an SWR band test with the shunt coil on the 40 and 80-meter bands before adjusting the coil.

Adjust your antenna to the LOWEST SWR for its maximum performance.

If you have a high SWR on 40 meters and the 80-meter band has a low SWR...try spreading the shunt coil apart a small amount, 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 goes higher 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 all set. If it's not you may have to compromise between the 40 and 80-meter settings.

## *Controlling the Antenna*

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

Connect the fused power plug to the 12-volt accessory outlet in your vehicle. The L.E.D. light on the plug lets you know if you have power going to the controller.

Move the antenna coil all the way down (collapsed) by pushing the bottom (cable end) of the rocker switch. Tune your radio to 20 or 40 meters. Push the top of the rocker switch; this will cause the antenna coil to extend. 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 on so watch your S meter and adjust the antenna up and down for maximum signal. If you are tuned to where you can hear a conversation, the receiver will get louder faster because of signal strength. Once tuned by ear you will be surprised as to how close you are after you check the SWR.

With the antenna's coil retracted in the stainless tube you are positioned for 10-meters with the 6 ft whip.



With the antenna's coil extended you will be at the bottom of the 80-meter band with the 6 ft whip. Using the 6 ft whip you will have continuous tuning from 10 to 80 meters!

The 102-inch whip is the most efficient, but the highest tune frequency will be the 17-meter band. Any band higher as in 10, 12, 15 meters will require a 6 ft whip.

Any screwdriver type antenna's performance will be increased on 17, 20, 40, 80 or 160-meter bands with a 102-inch whip!

When the least amount of coil is exposed, the antenna's efficiency and performance will be increased!

Most people do not like a long whip, so we recommend using a capacitance hat.

Capacitance hats are designed to work in place of a long whip length.

Our Capacitance hat support shaft is 36 inches in length.

The best site we have found for HF mobile install info is [www.K0BG.com](http://www.K0BG.com).

Alan Applegate's amateur site is amazing. 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!

Also, Tom Rauch's site [www.W8JI.com](http://www.W8JI.com) is a great resource as he is a well-known contester and engineer.

Tom has done a lot of mobile antenna testing, and his website features good info to study and learn from.

If you are having issues with tuning, don't get discouraged,

many times it's simply just something overlooked!

If you need help don't hesitate to call us.

Thank you for purchasing our product!

Ron Douglass NI7J

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