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CGE Cable Replacement Kit – New Board-less Design
Basic Kit Version (Hole Drilling Required)

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Contents

CGE Cable Replacement Kit
Basic Kit - New Board-Less Design

What Does This Kit Do?
Replace and relocate the factory shielded Ethernet cables (and the circuit boards that they connected to) with 8-pin (plus ground) “military style” circular cable connectors. These connectors have threaded locking rings that cannot be pulled out by accident (or even with brute force for that matter).

Since you are no longer going to be using those silly shielded patch cables you won’t be needing the circuit boards where the old cables plugged into. Instead, you will replace the boards with the wiring harnesses included with the kit

The benefits of this cable solution are astonishing. The new connectors cannot be pulled out of their sockets and make good, solid contact. Relocation the cable connection to the side of the housings avoids sharp bends in the cables.

Preface
If you are like me, it only took 2 months before my brand new CGE mount began giving me heartbreak. I made many wrong assumptions about what the problem might be but in the end it was the cables and their failure to make proper electrical contacts that was the real cause of my misery.

Celestron’s design choice to use Ethernet patch cables is bad enough, but to place the connection points where they need to make a 90° bend is just plain bad design (especially on the DEC cable that rubs against the RA shaft housing). I subscribe to several astronomy web forums and the CGE cable problem is, by my estimation, the most commonly reported problem in search of a solution.

Like many others, I tried the VIP cables and the bending of the metal shield, paper clips, bubble gum, etc., but ultimately all solutions failed to offer a permanent fix. Those cables (of any brand) are stiff and simply do not want to bend (especially in cold temperatures) and the result is that they will not maintain a good connection in the RJ45 socket.

For me, the solution was to use an entirely different type of cable connector and to relocate the cable connectors to an orientation that did not require them to bend at sharp angles. I chose to use the same

connectors that I have used in many of my electrical projects. In this case I would use the 8-pin version of what I call a “military style” connector.

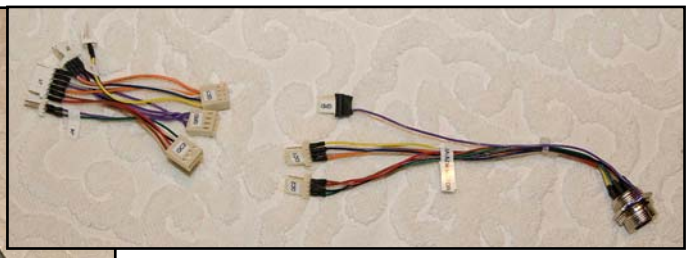
Disclaimer

Installing the cable replacement kit will certainly void your Celestron Warranty.

The kit is offered as a service by a private individual, not a company. As such, I (Gary Bennett) cannot assume any liability. Each kit is tested on my own mount prior to shipping, but I cannot offer any guarantees other than it will work on your mount if installed correctly.

I have provided some troubleshooting tips at the end of this installation guide. Problems are usually something really simple such as reversing RA/DEC. I have made plenty of mistakes while developing this kit and can tell you that it is very unlikely that any harm will be done by simple mistakes.

Kit Components



- Wiring Harnesses:
  - Motor housing (2)
    - DEC/ALT Motor
    - RA/AZM Motor
  - Electronics pier (1)
    - DEC/ALT
    - RA/AZM
- External cables (RA and DEC) with 8-pin circular connector plugs and locking rings (*optional “Right-Angle Plugs are shown in the above photograph*).
- Aluminum pier chassis connector mounting plate with hardware
- Cable ties (6)
- Adhesive cable tie mounting pads (4)
- Screws, washers, nuts (2 each) for attaching the aluminum pier mounting plate.

Optional Components

Optional Right Angle Plugs

The right-angle plugs option would be especially useful for those who have either/both:

1. Side-by-Side/Tandem dove tail plates with accessories that mount underneath the dove-tail plate. As illustrated in the photo below, the Telrad mounted to the under side would interfere with the standard plug cable (it sticks straight out) when the scope slews in DEC. The right-angle plugs keep the cable pointed down and out of harms way.
2. Where counter weights are mounted high up on the counter weight shaft, the lower profile right-angle connectors prevent counter weights from snagging the RA cable when the scope slews in RA.

This is an extreme example, but this customer elected to use an alternate mounting location for his RA chassis connector to avoid the counter weight snagging the RA cable that would normally exit the side of the RA motor housing. In most cases, a right-angle plug would be sufficient.

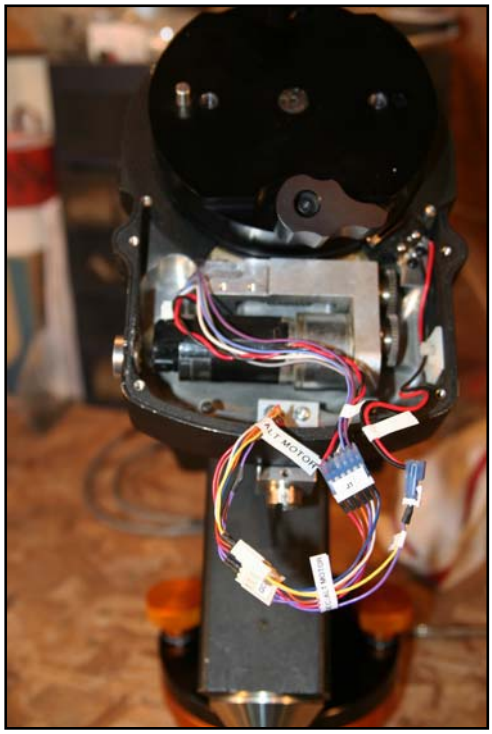
Optional “Drill-Less” Adapter Blocks

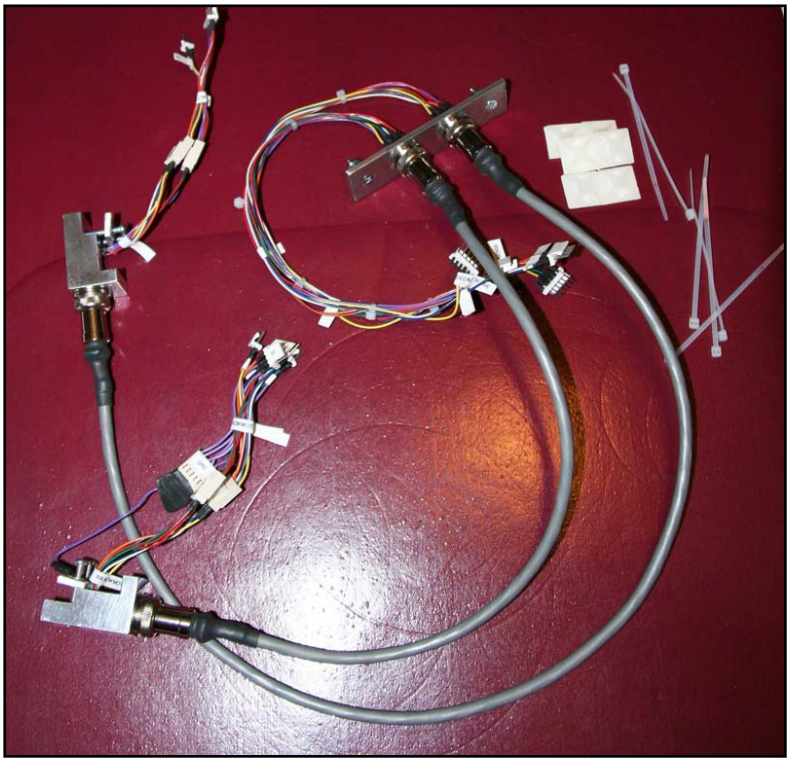
This is by far the best option for installing your cable replacement kit. No hole drilling required, and the entire kit installation can be done in under 1 hour.

The adapter block uses the existing square hole (where the old cables used to plug in) and requires only 2 screws with a simple bracket that fastens to the inside of the motor housing.

The polished aluminum adapter blocks also look very hansom.

Please take the time to review the installation guide for the “Drill-Less” option. Take note of how easy (much fewer steps) the installation is compared to the “Standard Kit”.





Brief Overview

Installation of the CGE replacement cables will cure the problem with mount failure due to poor or misaligned connection of the factory original CAT5E Patch cables.

This installation guide provides a step-by-step instruction on how to install the cable replacement kit. Here is a brief rundown of what you are about to do:

- Remove motor housing cover plates
- Lift the lid off of the electronics pier
- Label the cables (use the labels at the end of this install guide and tape to the cables) connecting to the factory circuit boards that you are about to remove:
    - Electronics Pier
        - DEC/ALT Motor
        - DEC/ALT Sense
        - RA/AZM Motor
        - RA/AZM Sense
    - DEC/ALT Motor : **J1** (6 pin) **J3** (2 pin)
    - RA/AZM: **J1** (6 pin) **J2** (4 pin) **J3** (2 pin) **J4** (2 pin)
- Remove factory original circuit boards inside each motor housing and electronics pier
- Drill a hole (drill location templates are supplied) in the side of each motor housing (West side of the mount).
- Mount the chassis connectors (wiring harnesses)
    - Motor housings using the holes you just drilled.
    - Electronics Pier: Fasten the aluminum chassis connector mounting plate (the plate and mounting screws/nuts are included in the kit).
    - Place a bead of clear caulking around the pier chassis connector mounting plate
- Plug in the cables into the ends of the new wiring harnesses.
- Reinstall the motor housing cover plates
- Reinstall the lid on the electronics pier
- DONE !

NOTE: For those who prefer to have the electronics pier on the East Side of the mount, just reverse the drill locations for the chassis connectors (swap the drilling templates)

Peace of mind suggestion

Drilling holes into the motor housings is a big step and you may be asking yourself “is this thing really going to work?”. You can give yourself some extra confidence by first testing the replacement cables before you commit to drilling the holes.

You can do this in about 10 minutes by simply connecting all of the kit components externally. Just unplug the cables from the factory original circuit boards and plug them onto the new wiring harnesses. You don’t even need to remove the original circuit boards. Just let everything “dangle over the side” and turn on the mount.

Tools Required:

- Drill bits:
  - 1/16” and ¼” bits to use as “starter holes’
  - 5/8” bit for chassis connector mounts.
- Screwdriver (Philips)
- Alan (hex) wrenches (SAE): 5/64” (motor housing cover plate) and ¼” (saddle plate)
- Needle nose pliers
- Thin bladed knife
- 19mm or ¾” wrench – thin “light duty” type will work best
- Pliers or channel locks
- Paint can opener (the simple one you get free when you buy a can of paint @ Home Depot)

Materials Required:

- Clear silicone caulking (the kind you use in the bathroom, only clear). This can be purchased in small squeezable tubes or larger tube for use with a caulking gun.
- Double sided foam (1/8”) tape. Approx 6”
- Electrical tape

Time for Surgery

The first step is to remove the lid from the electronics pier and the motor housing covers.

Motor Housings:

Remove the 4 screws on the housing cover using a 5/64" hex wrench (Allen Key). On the DEC housing you will also need to remove the saddle plate by removing the 2 bolts with a ¼" hex wrench.

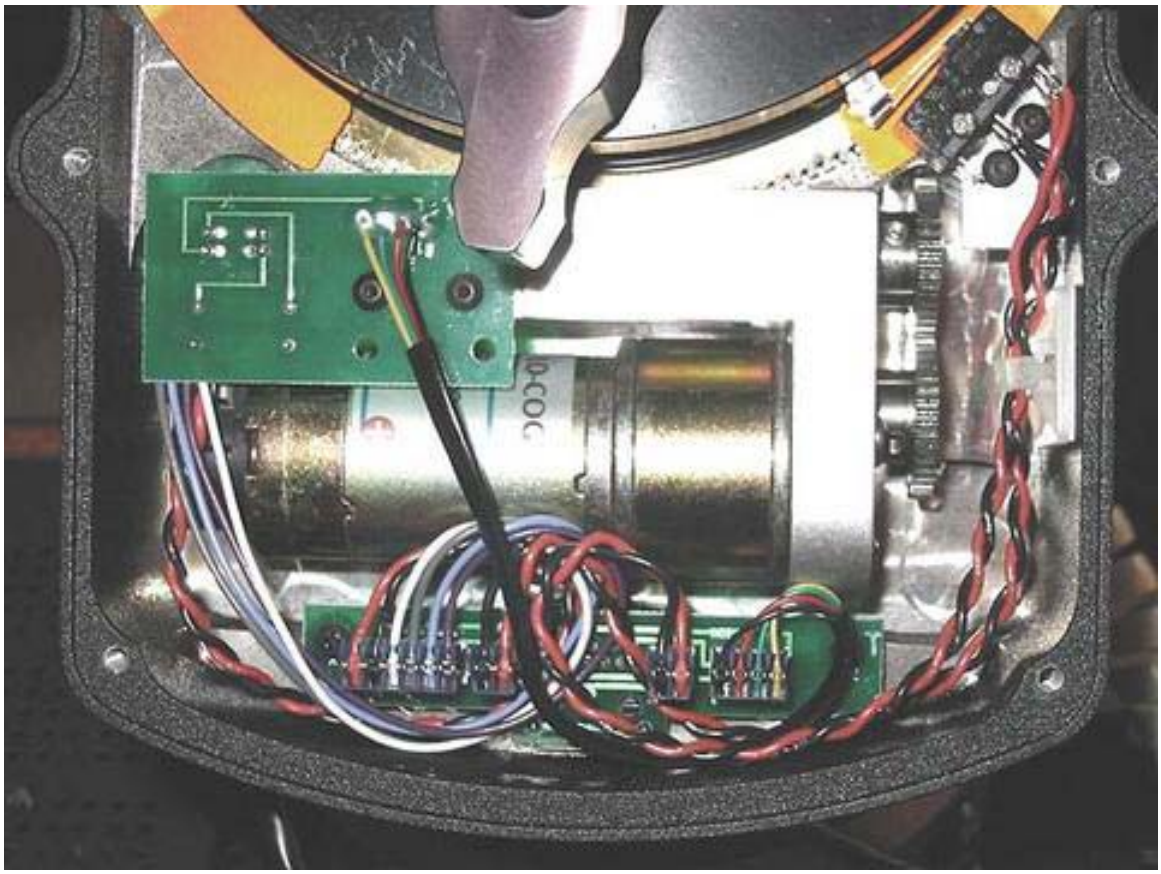
You will be removing the original factory circuit boards.

FYI, the wiring harnesses for RA and DEC are install the same way except the RA has an extra sensor switch so you will see that it has 2 additional cables so the harness has 2 additional connectors + a ground wire soldered to the chassis connector retaining nut.

Before detaching the cables, label each cable (J1/J2/J3/J4) so that you will know which is which. The original circuit board is labeled (J1, J3, etc) and the new wiring harness is labeled the same way. Use the "labels" at the end of this guide for this. Just print the page, cut off the label, and tape it to the cable.

RA/AZM has 4 cables: **J1** (6 pins) / **J2** (4 pins) / **J3** (2 pins) / **J4** (2 pins).
DEC/ALT has 2 cables: **J1** (6 pins) / **J3** (2 pins)

Now detach the cables and remove the board by removing the 2 screws. Underneath the board you will see plastic a "stand-off" at each end. The boards, screws, and plastic "stand-offs" will not be used so pack them away.



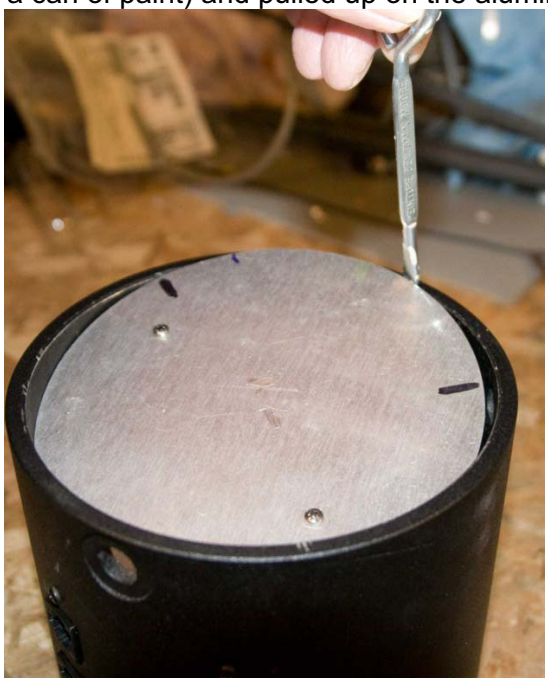
Electronics Pier

You will be removing the RJ45 connector board (where those nasty Ethernet cables plug in).

First, remove the pier lid. Before removing the lid make some reference marks so that it will be easy to reinstall the lid later on:

- Make a mark on the inside of the pier for the depth of the lid. I just ran a pencil around the top of the lid.
- Make a mark or 2 for orientation/alignment. I used the mount bolt holes as my reference point.

The pier lid is held in place with 2-sided foam tape in 3 places around the lid. I used a thin bladed knife (a table knife) to persuade the tape to un-stick itself from the side of the pier. Then I used a paint can opener (the kind you get free @ Home Depot when you buy a can of paint) and pulled up on the aluminum disk.

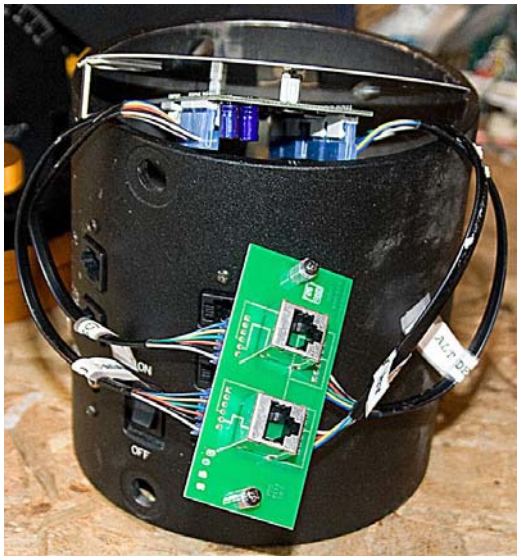


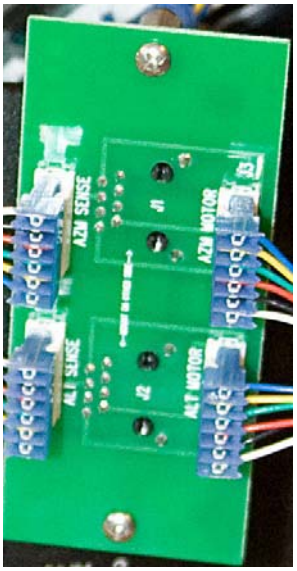
Now remove the 2 screws that hold the RJ45 connector boards.

The 4 cables that attach to the back of the board will be detached ***but first label each cable***: (***RA/AZM Motor, RA/AZM Sense***, ***DEC/ALT Motor, DEC/ALT Sense***). Use the "labels" at the end of this guide for this. Just print the page, cut off the label, and tape it to the wire.

You can now disconnect the cables from the circuit board.

You will not need the circuit boards or the 2 screws (or the stand-offs underneath) so reattach the screws to the board for safe keeping.





Mount the Chassis (Male) Connectors

Motor Housings

You will be drilling a 5/8" hole in the West side of each motor housing. I have used both a "proper" metal drill bit as well as a "wood spade" bit I find the wood spade works best (and it costs less too). Aluminum is fairly soft and the spade bit makes a nice neat hole.

The kit includes a template for marking drill locations for the motor housings. Take note of the suggested drill locations as some people chose to modify the instructions for their own needs. The following will make more sense when you are ready to start the installation:

When you remove the cover from the motors housing you will see that the aluminum you will be drilling is fairly thick. The chassis connector does not protrude very far inside and you need to be able to get the retaining nut to thread onto the connector. So the position used on the drilling template is a compromise between keeping the connector away from the encoder/gears while still being able to get the retaining nut to go on. If you wish, you can move the drill locations closer to the corners (away from the encoder/gears) but the aluminum becomes thicker as you get closer to the "rounded" corners. If you have a Dremel tool you can "hog out" some of the aluminum to allow the retaining nut to go on. Otherwise the suggested drill locations are fine. If needed, you can also eliminate the extra washer which will give you more thread for the nut.

The instructions also call for the chassis connectors to be installed on the West side of the mount (standing behind the mount, facing Polaris, the connectors will be on your left). This means that the chassis connectors will enter on the encoder side for DEC and Gear side for RA. Some owners prefer that the connectors be on the East side. Your choice. You'll have to "reverse" the drill locations if you want to switch sides.

Drilling the hole is not very difficult but time and care should be taken to ensure that you are drilling in the correct location. The DEC hole location is the most critical. The locations I have suggested (and also what the templates use) are based on the need to keep the connectors far enough away from the DEC encoder assembly and the spur gears on the RA. There is not a lot of maneuvering room (especially for the DEC). Going too far away from those components will mean that you will have difficulty with the chassis connector retaining nut as the aluminum thickens as you near the rounded corners. BUT..if you are not comfortable with your measuring/marking (template) skills, please error on the side of being further away from the vital components. The worst thing that could happen is that you may need to shave away some aluminum in the corner (ie: flatten off the "round") to make room for the retaining nut. A Dremel Tool makes easy work this.

The following photos show the location of the center point for each hole. You will also find a "size as" template at the end of this guide that you can use as a guide for locating where to drill the holes. The hole locations are different for RA and DEC so make sure you are using the correct template. Simply print the template, then cut it down to size and tape it to the side of the motor housing. The reference points are the top of the housing and the center point of the cover plate screw in the South West corner.

Some kit buyers chose to remove the motor block before drilling holes. It really isn't necessary, but if you feel you need to do this make sure you take careful note of the alignment of the motor bock:

- Scribe reference marks on both side of the motor block. Use these to align (horizontal) the motor block when reinstalling.
- You are also likely to find "film spacers". Keep track of where they came from and put them back where you found them. Some (not all) mounts also have a film spacer under the motor block.

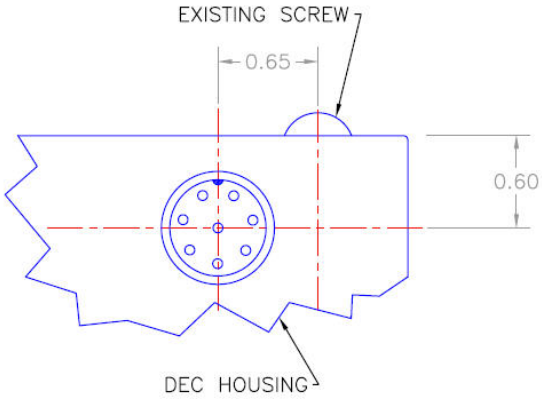
On the RA housing you may find that there is a cable tie (those plastic strap thingies) mount where you will be drilling the hole (they are not always mounted in the same place). If so, just cut the cable tie and pry off the adhesive pad and throw it away. Later on you will use a new one that was included in the kit.

Punch a divot at the center point with a sharp punch or a heavy nail that has a sharp point. Make the divot deep enough so that you drill bit won't skid after you start drilling.

> *NOTE: For those who prefer to have the electronics pier on the East Side of the mount, just reverse the drill locations for the chassis connectors. This means that the chassis connectors will enter the motor housing near the gears for DEC and encoder for RA. Reverse the drilling templates!*

For the DEC housing

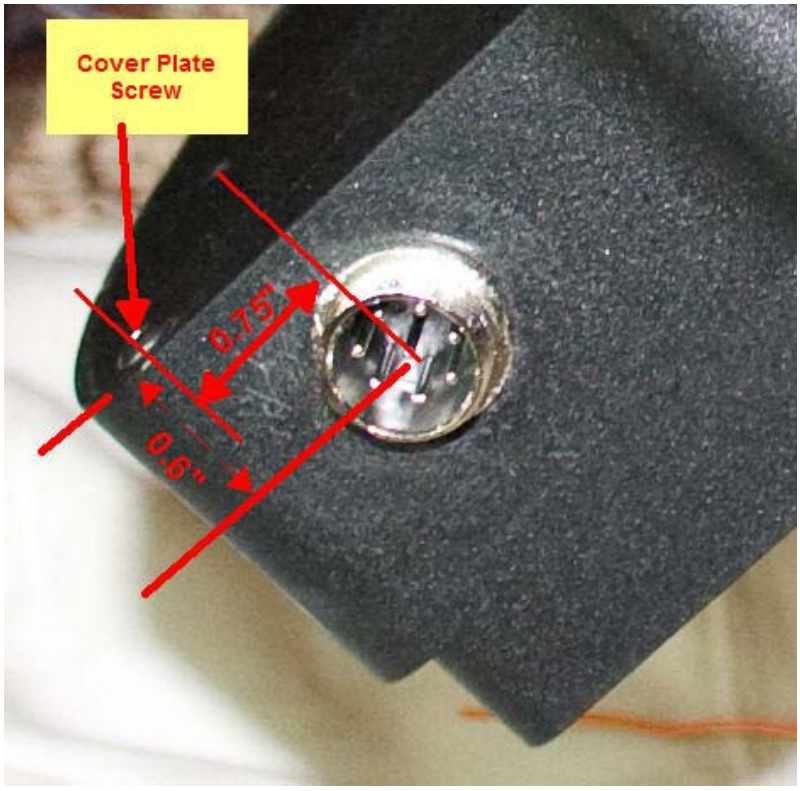
The center point for the hole is referenced with the top housing and the center point of the cover plate screw.
- From the top of the housing: 0.6” down
- From the center of the cover plate screw: 0.65” left



Use the “size as” template at the back of the guide. Tape it to the side of the motor housing. Before taping in place, align the template with the top edge of the housing and the center of the cover plate screw.

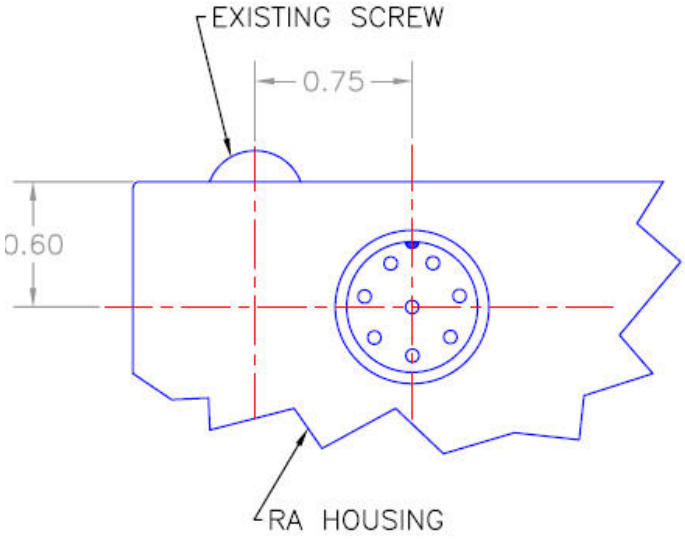
Now you can make your “punch divot” at the center of the chassis connector.

For the RA housing



On the other side of the hole there is a plastic cable tie down pad (a white adhesive square pad) that we will be relocating. Just clip the cable tie, push the wires out of the way and then pry the plastic pad off.

The center point for the hole is referenced with the top housing and the center point of the cover plate screw.
- From the top of the housing: 0.6” down
- From the center of the cover plate screw: 0.75” right



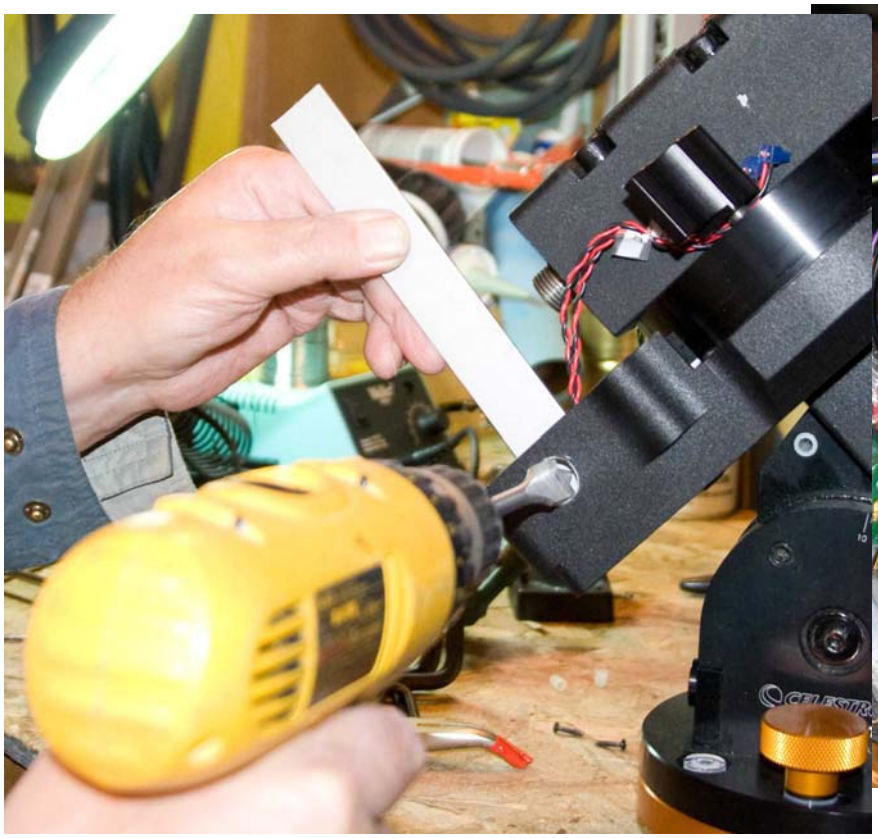
Use the “size as” template at the back of the guide. Tape it to the side of the motor housing. Before taping in place, align the template with the top edge of the housing and the center of the cover plate screw.

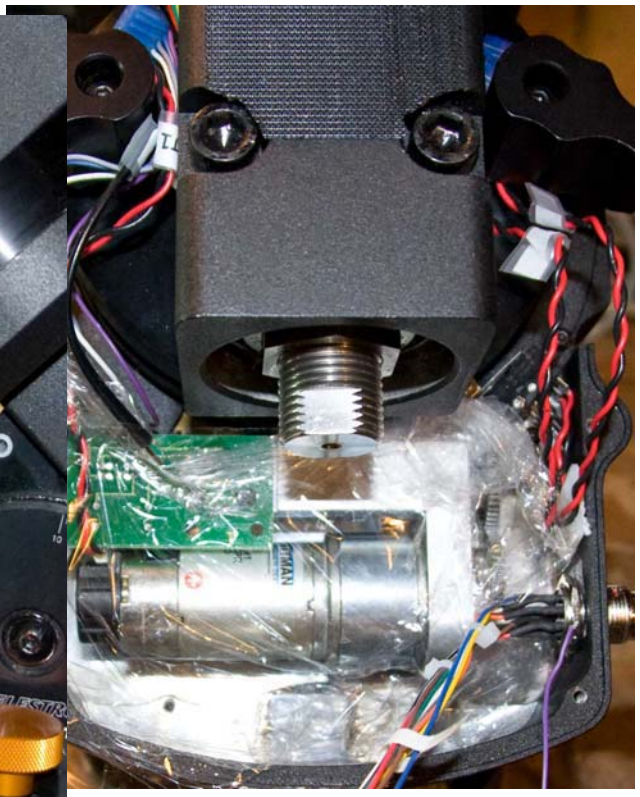
Now you can make your “punch divot” at the center of the chassis connector.

Now you can drill away. Don’t forget to cover the vital parts with plastic wrap before drilling.

Before drilling, cover the vital components (motor and gears) inside the housing with plastic wrap. This will keep bits of metal from flying into the gears, motors, etc.

Place a flat metal object (a jar lid or metal ruler will do) as a precaution in case the drill lurches forward when you break through with the drill bit. This will prevent the drill bit from touching parts that should not be touched.





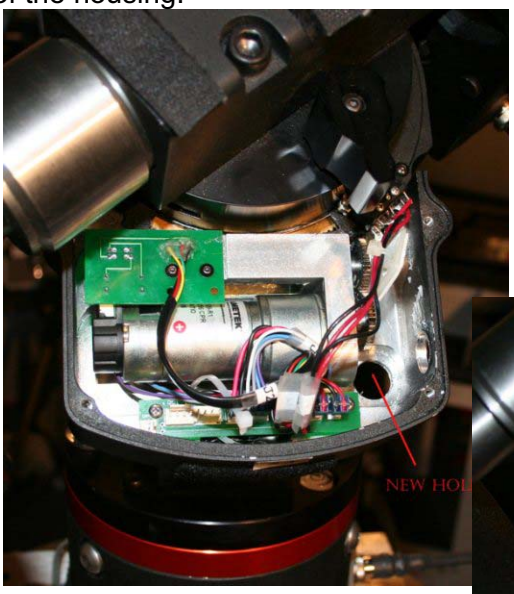
I started with a small hole using a 1/8” bit followed by a larger hole using a ¼”. Then you can use the 5/8” bit. A gentle “rocking action” while drilling speeds up the process. Just go easy and it makes a nice neat hole.

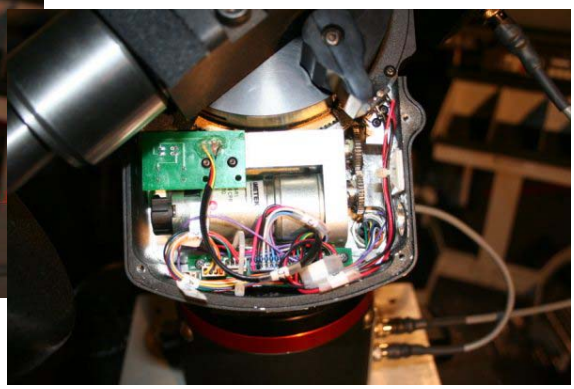
You may find that the drill bit “stalls” when it is about to break through. If this happens, put the drill into reverse and briefly run it “backwards”, then change directions again. You may need to do this several times. Just go easy, don’t try and force it, and you will make out fine.

When finished, vacuum up the metal bits. Then take a small art brush and brush where ever you can reach. Then use the vacuum again to suck up any traces of metal dust.

Alternate locations for Chassis Connectors

Here are a few photos that show how 1 buyer installed the RA chassis connector on the bottom of the motor housing instead of the side. He uses a rather impressive number of counter weights that did not like the location in the side of the housing.



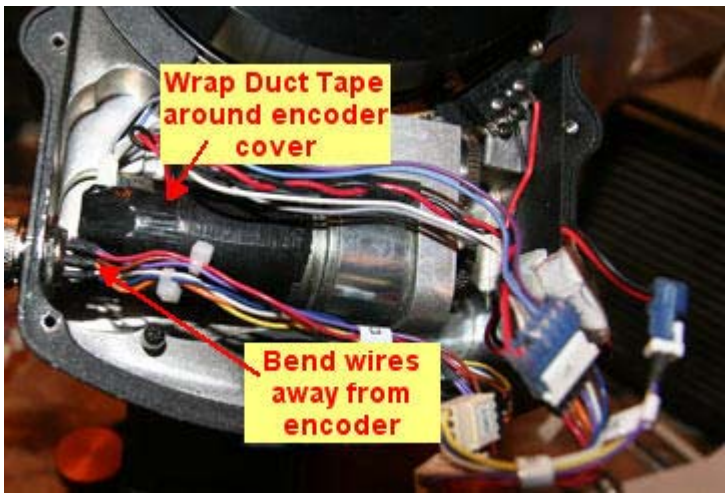


TIP: Known Issue

The wires for the DEC Motor chassis connector, when mounted on the West (encoder) side, come very close to touching the plastic encoder wheel cover. The cover is not secured very well and easily pops-off. If this happens it may cause the motor to "stall" if the cover is off and touching the encoder wheel. That wheel is connected directly to the motor shaft and is spinning at thousands of RPM and as such has very little torque. Thus, a stalled motor. It won't damage anything, but the motor will stall.

To avoid this I recommend 2 preventative measures:

1) Gently bend the wires so that they are away from the plastic cover.
2) Wrap a piece of duct tape around the plastic cover as seen in this photo:

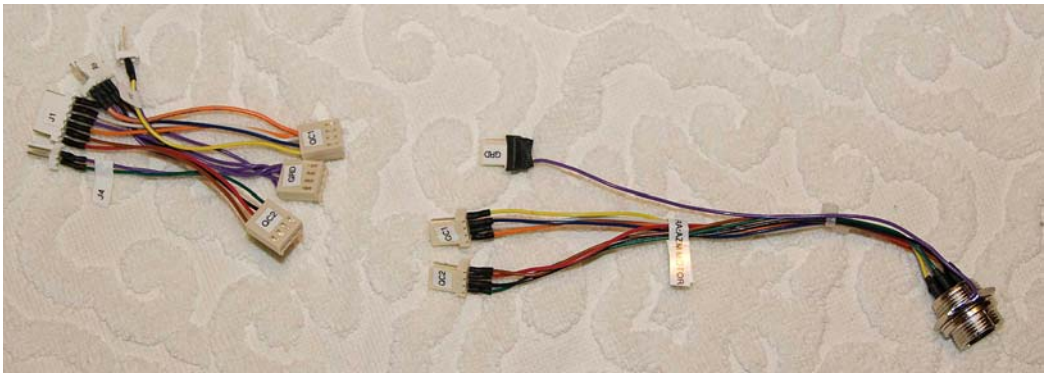


Plug up the old RJ45 hole

Before mounting the Chassis Connectors, plug the holes left by the old RJ45 connectors. I used a square cable tie mounting pad and silicone it in place.

It takes approx. 1 hour for the silicone to “set”. If you want to proceed without waiting just cover the area with a piece of electrical tape to keep it from getting knocked out of place.

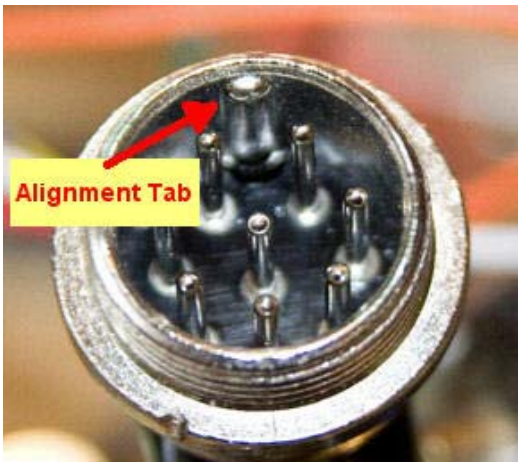
Mount the Motor Chassis Connectors

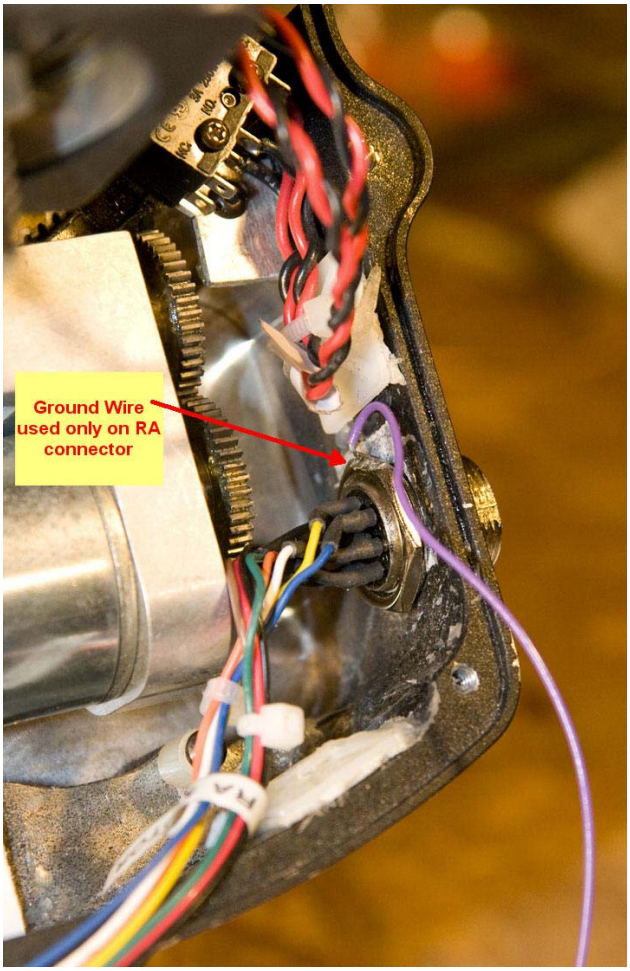


Temporarily disconnect the QC1/QC2/GRD plugs then slide the wires through the hole and then slide the lock washer (the thin metal ring) and the retaining nut over the wires. The RA motor harness has a ground wire soldered onto the retaining nut so take care not to damage the wire when turning the nut. NOTE: The DEC motor harness does NOT have a separate ground connector (QC1/QC2 only).

> ***NOTE:*** If the chassis connector does not protrude enough to allow the retaining nut to thread on, remove the washer (it really is not needed) and try again.

Orient the connector so that the plug alignment tab (look for a metal "bump" inside the chassis connector) is perpendicular to the top surface of the motor housing. This will make it much easier to plug in the cable each time if you know where the alignment tabs is.



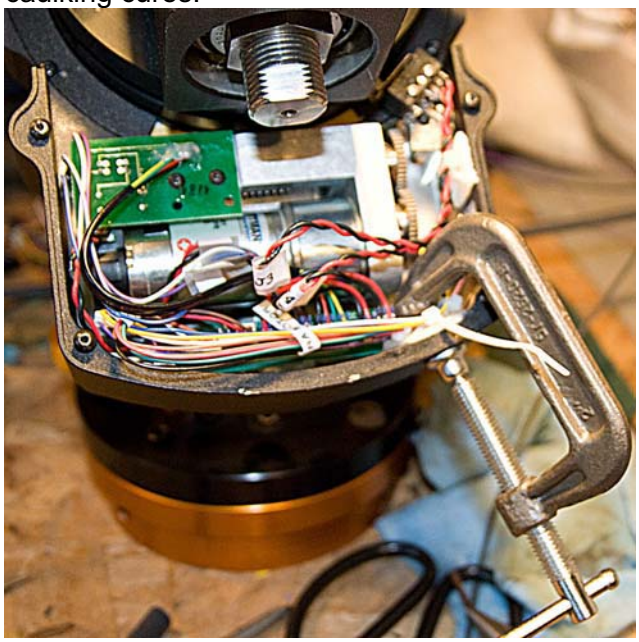


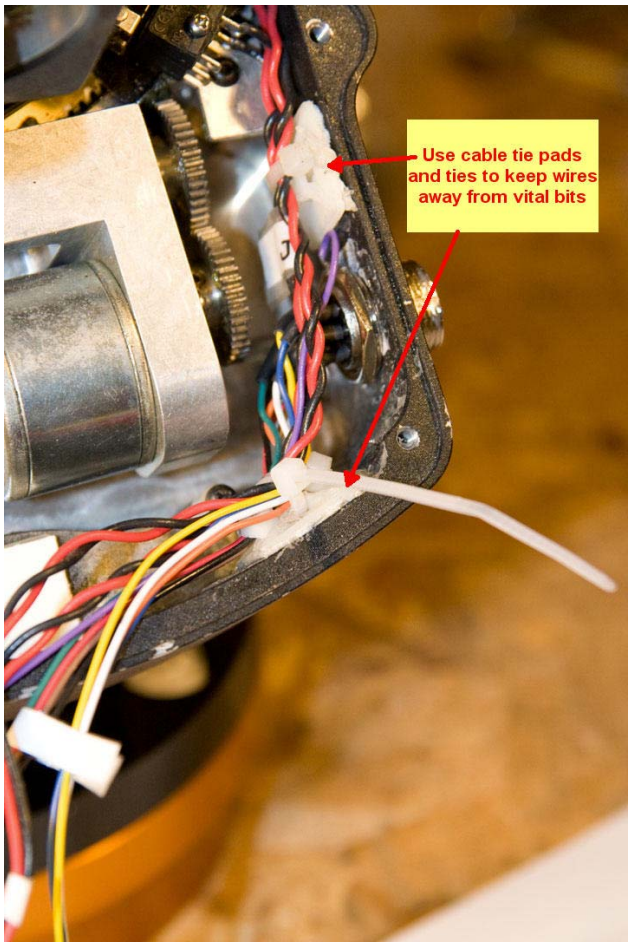
Now thread the retaining nut onto the back of the chassis connector. You should be able to turn the nut with your fingers at first but at some point you will need to use a wrench. A 19mm wrench was a perfect fit but a ¾" wrench will also work. You may also have success with needle nose pliers.

You will also need to grip the outside of the connector. To keep from marring the metal threads, put some electrical tape on the jaws of which ever tool you choose. I used channel locks.

It is a fairly tight squeeze for getting a wrench onto the nut but with patience, persistence, and creative use of your tools, you will succeed. The wire soldered to the nut (RA Motor only) starts to get wrapped around so you will need to help it "unwind" a few times.

Later on you will use the cable ties and adhesive pads to keep wires away from the RA gears. NOTE: The cable tie pads are self adhesive but they don't stick very well on dirty or curved surfaced. For extra insurance, apply clear silicone caulking around the edges and allow it to cure for a few hours. Use a small clamp to hold it in place while the caulking cures.





Now you can go ahead and reconnect the QC1, QC2, and GRD (RA motor only) connectors.

Next, connect the motor and switch sensor cables to the ends of the wiring harness. The wiring harness is labeled the same way as shown below:

For the ***RA Motor*** there are 4 cables:

- **J1** 6-pin
- **J2**4-pin
- **J3** 4-pin
- **J4** 4-Pin

For the ***DEC Motor*** there are only 2 cables:

- **J1** 6-pin
- **J3** 2-pin

Take note of the plug orientation:

Mount the Pier Chassis Connectors

The chassis connectors were already mounted to the aluminum chassis connector mounting plate so all that remains is to insert the wiring harness into the pier hole and use the supplied screws to mount the plate to the pier.

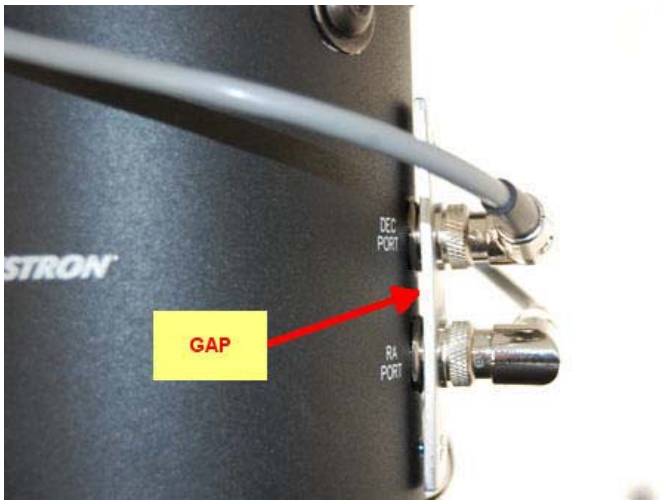
The back of the plate is labeled with RA and DEC and the wiring harness is also labeled. Just orient the plate so the DEC is at the top.

The screws will go into the same holes that were used to mount the factory original RJ45 connector board.

The supplied screws are #6-32 and my pier was already tapped with #6-32 threads. I have worked on 2 other mounts that had larger diameter holes. If your pier has the larger dia. hole then you will also use the washer and nut that was also supplied with the kit.

When mounted, the plate will have a gap around the sides and you will use clear silicone caulking to fill the gap. It looks rather hansom when finished.

The “plumber’s secret” to making a nice neat seal is to use your finger and wet it with…….saliva! Plain water just does not work as well. Use a dry rag to clean up excess caulking at the outside edges.



Note: Why the gap? I chose to allow a gap rather than drill more holes in the pier and then be left with original RJ45 connectors to fill in. The existing holes are too large for the chassis connector to mount “as is” and a bit too small to accommodate the retaining nut. Thus the gap!

Some customers have “bored” out a larger hole (7/8”) so that the retaining nut sits inside the hole and the mounting plate is flush with the pier surface. You will need a large sized drill press, 7/8” spiral bit, and a good way to clamp onto the pier.

Connecting the Electronics Pier Wiring Harnesses

The cables that you disconnected from the circuit board earlier can now be connected to the pier chassis connector wiring harnesses.

Pier connectors:

1. DEC/ALT Sense
2. RA/AZM Sense
3. DEC/ALT Motor
4. RA/AZM Motor

Take note of the plug orientation:

Bench Testing

Before replacing the motor housing covers and the pier lid, it would be a good idea to test the mount.

You can do this on your work bench by simply plugging in your new external cables, hand controller, and power cord.

Inserting the 8-Pin Cable Connectors

These cables are the reason you installed the Cable Replacement Kit. The cable can plug in only one way. There is an alignment tab on the inside of the chassis connector. The external plug (female) has a slot and it needs to align with the tab on the chassis (male) connector.

For best performance, make sure that you push the plug all the way in. Then thread on the locking ring. Take care not the strip the threads. If you find that it is not threading on properly just reverse direction and start the thread at a different place. After time, the sharp edges on the threads will smooth out and you will find it much easier to thread on the locking ring.

A firmly connected cable is your insurance that you will have years of trouble free star gazing. The metal casing and the locking ring are your “ground” wire so it is important that it be fully threaded onto the chassis connector.

Power It Up

First test the motor slewing functions using the direction controls. If everything seems in order you can go ahead and try a “dummy alignment” which will begin with “Set Switch Position”.

Chose a Two Star Alignment and let it do its thing.

If things don’t seem to be working properly, refer to the Trouble Shooting section of this guide.

Once you are satisfied, you can now reinstall the motor housing covers and the pier lid.

Reinstall the Motor Housing Cover and the Pier Lid

Reinstall the Motor Housing Covers

This is easy. Just replace the cover and 4 screws.

Reinstall the Pier Lid

The lid is “fastened” with 2-sided foam tape. I found it easiest to remove the 3 aluminum right angle brackets from the underside of the lid and use a new piece of foam tape to affix the angle brackets (adhere to the sides of the pier interior) and then place the lid on top of the brackets.

Use the reference line you made earlier to determine the proper depth for the bracket placements. The brackets will need to be placed lower than this mark as you need to compensate for the thickness of the bracket, foam tape, and the lid itself. Find something such as a piece of cardboard that is approximately as thick as needed and use it to align with your reference mark and the bracket underneath.

I left the foam tape wax backing on the top of the bracket so that it would not stick to the cardboard.

Once the brackets are adhered to the side you can now remove the wax backing and place the lid on top of the brackets. Remember to align the lid with the reference marks you made earlier. Check to see if there are any cables that will get caught on the brackets as you lower the lid in place.

Congratulations, You’re Done!

Clear Skies!

Trouble Shooting Guide

There are only a few things that could have caused any problems you may be experiencing.

- Make sure that the connector plugs are pushed all the way onto the wiring harnesses.
- Some of the wires that you did not unplug may have been pulled out of their circuit boards. Push them in to make sure they are well seated.
- Recheck where things are plugged in. I goofed on this a bunch of times. The wiring harnesses and are labeled so double check.
- The “Quick Connect” plugs have metal inserts. Sometimes they get “pushed out” by the “header pins”. If this happens, just push on the wires to urge the metal inserts back into place.
- The most common mistakes are:
    - QC1 & QC2 connectors reversed
    - J3 & J4 motor housing cables are reversed
    - The connectors are misaligned. If you see a “header pin” with nothing covering it then you need to remove the connector and move it over a notch (I’ve done this a bunch of times).
    - External cables are reversed. Ie: The DEC cable is plugged into the RA Pier connector. I have done this blooper countless times.
- If the DEC motor runs and does not stop (find switch position), check to see if your DEC clutch knobs are tightened down. This can also happen if you have reversed the DEC/RA cable.
- It is normal that the RA slews all the way to one side and then slowly moves to switch position. You can speed this up by loosening the clutches, moving RA closer to switch position.
- If you use a GPS unit and have tested the mount with out connecting the GPS unit (or are indoors) you may need to use the Utilities Menu to turn “GPS ON”.

Cable Harness Labels

Make sure you label the cables before unplugging them from the factory original circuit boards.

Print this page, cut out the labels, and tape them to the cables.

Motor Housing Labels

RA/AZM
J1 J2 J3 J4

DEC/ALT
J1 J3

Pier Labels

ALT (DEC) Sense

ALT (DEC) Motor

AZM (RA) Sense

AZM (RA) Motor

Make sure that your printer is NOT set to "Scale To Fit Page".

Double check the measurement after printing.