CGE - Mount Control Kit # 2- Installation Instructions
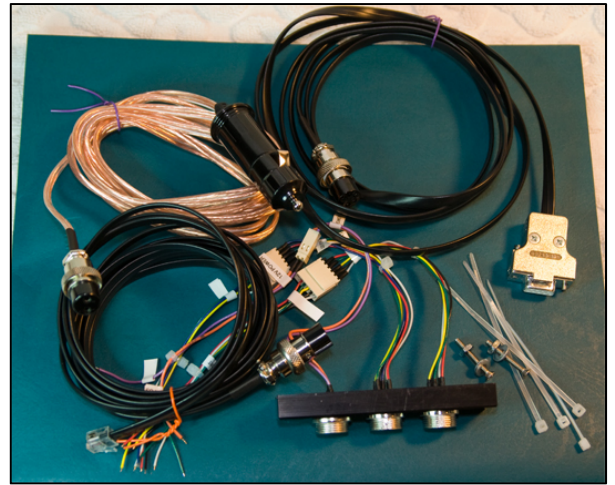
Kit # 2 – PC Port / Guide Port / Power Connectors

Kit 2 Components

Robust Connectors

Kit # 1 Also Available

CGE Mount Control Kit Installation Instructions

Kit # 2 – PC Port / Guide Port / Power Connectors

Introduction

The original **RA/DEC Cable Replacement Kit** continues to solve the most common complaint about the CGE mount. Namely, the external CAT5E cables, and more importantly, the RJ45 (Ethernet) plugs. BUT… the mount is still left with numerous "phone plugs" that are used to communicate with the mount:

- Hand Controller
- GPS Unit
- PC Port
- Auto Guide Port

The factory original plugs (phone plugs) for these devices are just not meant to be subjected to dew, frost, dust, tree sap (airborne), or constant motion and "tugging" on such a weenie connector. Proof of this is comes in the form of the number of incidents of loss of communication with the mount (Error Code 16/17 for example) which usually requires shut down and starting the alignment process from scratch. For astrophotographers, it is not uncommon that the restart process can take an hour or more (align, plate solve, focus). Clear, dark skies are too precious to be wasted on a poor design choice using parts that cost only a few pennies yet cause so many problems.

The solution I offer is to replace the plugs and sockets with robust plugs and connectors that are immune from the effects of Mother Nature. As with the original RA/DEC Kits, the Mount Control Kits use the same "military style" circular connectors with a threaded locking ring. Each kit is tested prior to shipping, either by connecting to my personal CGE mount (where practical) or by way of continuity testing techniques.

There are 2 separate Mount Control Kits:

- **Kit # 1** – Hand Control / AUX2 / AUX1 Ports
- **Kit # 2** – PC Port / Auto Guide Port / Power Connector

*I strongly recommend that you should NOT install either of these kits unless you have already installed the **CGE RA/DEC Cable Replacement Kit first**.* There really isn't any benefit of installing a Mount Control Kit unless the RA/DEC Cable problem is rectified first.

High-Res photos used in this guide can be downloaded from:

http://photos.bendun.net/p146717189

Contents

Disclaimer:

These kits are offered by Gary Bennett, a private individual, not a company. I do this as a semi-not-for-profit service to my fellow CGE owners. As such, I cannot make any guarantees other than the kit will work if installed correctly. I do not attempt to make a profit, but I do not want to lose money either. So, the fee I charge is based on a minimum wage (kit construction only) plus the real cost of parts, sales taxes, shipping, and other shop supplies. The things I do NOT charge for are considerable. For instance: advice, writing manuals, R & D, website, etc., etc. It is my sincere hope that you will not have a need for my services, but if you do, consider that making these kits easy for you to install means more work at my end. This explains why, even at minimum wage, the kits are not inexpensive.

Kit Design Considerations

For this kit to achieve its objective, the plugs for the PC Port, Guide Port, and Power Supply Plug need to be changed. The good news is that this kit includes all new cables that are ready to use with new "military style" plugs already installed. However, unlike the other kits, the circuit board that contains the factory original "phone plugs" also contains logic components (RTC Clock for example) that need to be retained. Aside from the obviously improved performance, ease of installation was the other primary design objective. Installation of this kit does require that wire leads from the new pier mounted connectors be soldered onto the original circuit board. Fortunately, it is a quite easy task.

Kit Components:

- 6-pin circular Guide Port Chassis connector and wiring harness.
- 5-pin circular PC Port Chassis Connector and wiring harness
- 2-pin circular Power Supply Chassis Connector and wiring harness
- CNC Machined, Black Anodized chassis connector mounting plate
- 10' ST-4 Guide Cable (conventional "phone plug at the camera end of the cable).
- 8' PC Port Cable with a DB9 (serial) plug (a "real" Serial Port or USB Serial adapter required)
- 8' Power Supply Cable with Cigarette Lighter Adapter Plug
- Stainless mounting screws
- Cable ties
- 2 brass "stand-off" extensions (not shown in the photo).
- 2 vinyl caps (not shown in the photo) – use these to cover any chassis connectors that are not being used.
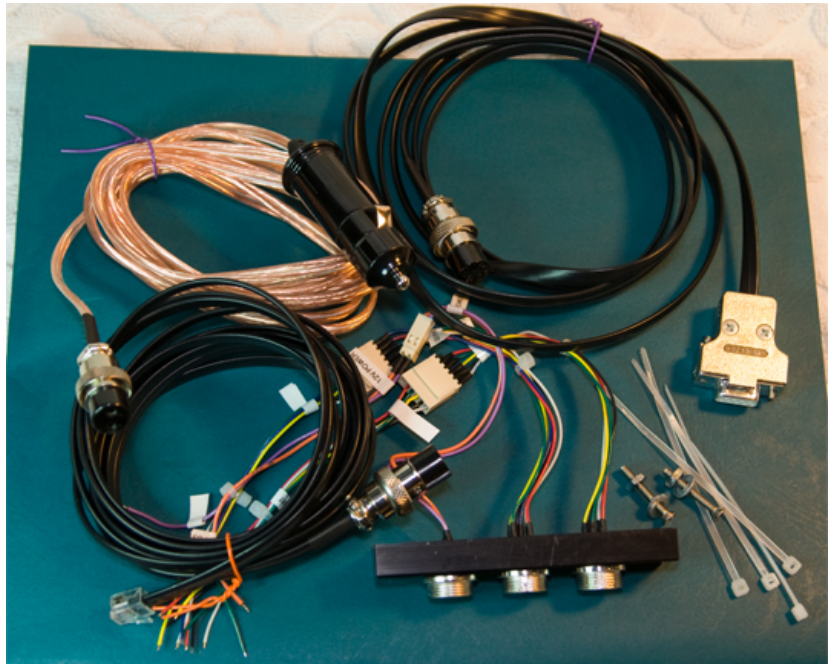
Optional Components:

There is only one option for this kit but it only applies to users of Lodestar Guide Cameras. The basic kit includes a standard ST4 guide cable (as well as a PC Port cable and power cord). If you use, or plan to use a Lodestar Guider, then you will need the optional cable that has the special plug needed for the guide port on the Lodestar camera.

Installation Overview

This installation guide has is **20** pages in total (mostly photos), but only 1 page is needed for the soldering instructions. So, the part that may scare you the most is actually pretty easy.

In a nut-shell (fully detailed instructions will follow), you will:

1. Lift the lid off the electronics pier
2. Temporarily remove the circuit boards (or other Kit mounting plate(s).
3. Label each internal cable BEFORE unplugging the cables from the circuit boards. You will also want to label the "headers" on the circuit boards where those cables were plugged in.

> WARNING: These instructions recommend that you label cables and circuit board "header pins" BEFORE you disconnect the cables. *If you do **NOT** label the cables you are taking a big risk of incorrectly re-connecting the cables onto the circuit boards. There is a "Board and Cable Layout" reference (page 17) at the end of this guide that shows what connects where, BUT… Celestron uses 2 (as far as I know) different circuit board designs for the RTC Board (Power/Guide Port/PC Port).* You need to know which version of this board you have before you will know which reference to use. So word to the wise….your best insurance is to LABEL THE CABLES AND HEADER PINS and then you won't even need to use the reference images. **If you do this wrong, you will FRY your Motor Control Board!!!!! I will say it again…. Ignore the "handy" reference images and LABEL THE DAMN CABLES AND HEADER PINS!!! OK????**
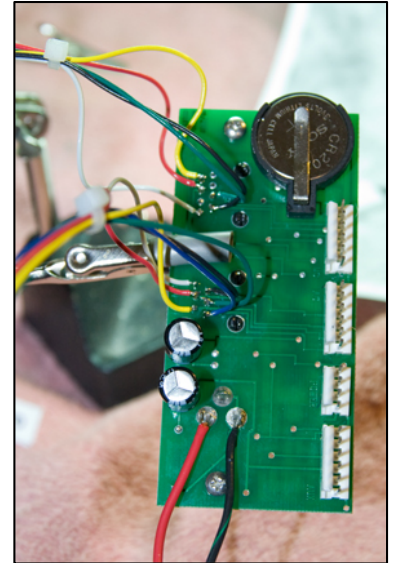
4. FYI, the original circuit board will remain, but it will be mounted to the bottom pier cover
5. Drill 2 X 1/8" holes (see the drilling template at end of this guide) in the bottom pier cover. This is where the circuit board will be mounted using 2 brass "stand-off" extensions included in the kit.
6. Solder (easy) the wire leads onto the circuit board.
7. Remove the original "stand-offs" and replace with the 2 longer "stand-offs" and screws supplied with the kit.
8. Mount the board to the bottom pier lid using the stand-off screws (this is what the 2 drilled holes are used for)
9. Mount the new Pier Chassis Connector Plate using the screws, nuts, washer supplied with the kit.
10. Plug all the cables back in
11. Put the lid back on the electronics pier.
12. That's it!

Stand-Off Extensions

NEW: Kits delivered after Aug 20, 2013 do not use "stand-off extensions".

Approximate installation time: 2 hours (I can do it in 40 mins., but I've done it a few times now. ½ of that is messing with the foam tape on the lid)
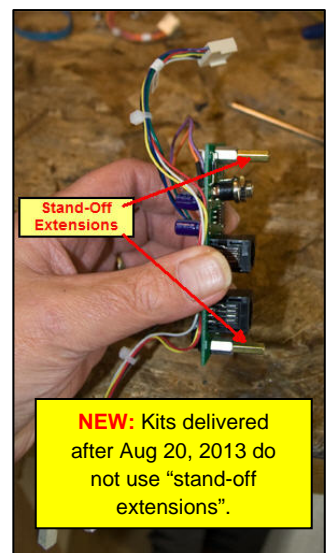
Soldering Task Explained:

I consider this installation to be "easy" for those who have used a soldering iron at least once in their lifetime. The soldering involves:

1. Adding a "dab" of solder to the "pins" on the circuit board
2. The wire leads have been "pre-tinned" (solder applied). The exposed wire is intentionally short. They are long enough for making a good solder connection but not so long that they interfere with other pins.
3. There are 12 wire leads in all:
   - 6 leads for the Guide Port
   - 5 leads for the PC Port
   - 2 leads (+/-) for the power supply
4. Place the wire lead against the pin. A quick touch of the soldering iron is all it will take to make a good solder connection. That extra "dab" of solder will absorb heat almost instantly.
5. Use Hot Melt Glue to insulate the solder connections.
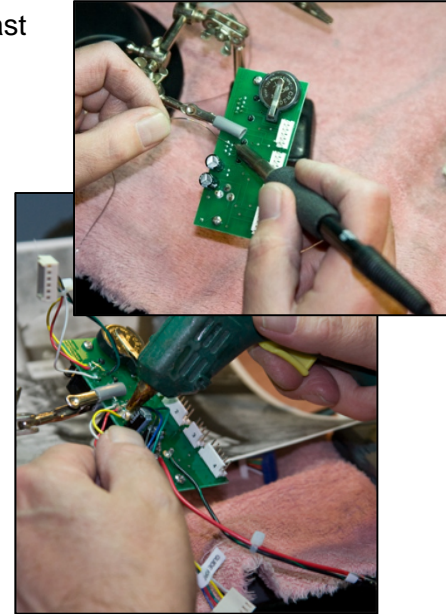
Installation Service Available

If you wish, installation service is available. To use this service you will need to ship your Electronics Pier, Hand Controller, and GPS (if applicable) for modification. You do NOT need to ship the mount.

NOTE: I will NOT install either of the 2 Mount Control Kits unless the RA/DEC Cable Replacement Kit has already been installed. I no longer have the ability to perform tests on an unmodified mount and there really isn't any benefit of installing a Mount Control Kit unless the RA/DEC Cable problem is rectified first.

For USA customers:

- I have a good friend based in the Buffalo, NY area who has agreed to provide installation service.
- Ed Thomas, of Deep Space Products (Arizona), has also agreed to provide kit installation BUT ***only as part of his Hypertune Service***.
- Astrotroniks (New Jersey) now offers kit installation service as part of a Performance Tune service.

For all other countries you have a choice to send to New York/New Jersey, Arizona, or directly to me (Toronto, Canada).

Please contact me for more information:

> Gary Bennett
> gary@bendun.net

Multiple Kit Installation Guidelines
CGE Kit Summary

- CGE RA/DEC Cable Replacement Kit
- CGE - Mount Control Kit # 1 – HC/AUX1/AUX2 Ports
- CGE - Mount Control Kit # 2 – PC Port / Auto Guide Port / Power

If you are installing more than one kit at the same time, it will make your job easier if you install 1 kit at a time and test it before proceeding to installing the next kit. The test does not need to be elaborate. A simple bench test will suffice. You just want to make sure that you hooked everything up correctly and that the mount behaves normally before installing the next kit.

Suggested Order Of Installation:

1. CGE RA/DEC Cable Replacement Kit
2. CGE - Mount Control Kit # 2 – PC Port / Auto Guide Port / Power
3. CGE - Mount Control Kit # 1 – HC/AUX1/AUX2 Ports

Tools & Supplies Required:

1. Soldering iron
2. "Clamp-On-Stand" (3rd hand)
3. Hot Melt Glue Gun and a glue stick (optional)
4. Drill with 1/8" drill bit
5. Double-Sided foam tape (reinstall the pier lid)
6. Philips screwdriver
7. Flat blade (kitchen knife will do)
8. A really good light source. Ideally a light with a magnifying glass.
9. A small amount of solder (for the "dab" of solder on the board pins)
10. This would also be a good time to put a fresh battery for the Real-Time Clock. CR2025 is the "official" battery # but I recommend the CR3032 battery. Same size and voltage, but lasts longer (mAmp/Hours).

Soldering Hints and Tips

A good solder joint requires that the solder, as well as the parts being soldered (the wires) become hot enough to melt solder. The key is to have the soldering iron hot enough that it heats the solder and component very quickly (almost instantly) so that the parts that are being soldered don't have time for the heat to transfer "down-the-line" and cause problems such as melting away the vinyl insulation on the wires, etc.

- If your soldering iron has adjustable temperature, set the temp to 700°F (370°C).
- Practice your technique using one of those outdated computer components that you don't need, but can't bear to throw away.
- Is it hot yet? Touch a piece of solder (or junk component) to the tip of the iron to see if it is hot enough to melt the solder.
- Unless you happen to have 3 hands, you will need to clamp at least one of the wires to something. A "Clamp-On Stand (3rd hand) is the best way and they can be found just about anywhere for approx. $5.00.
  o Wrap the clamp jaws with some electrical tape. Otherwise the sharp jaws might (probably will) scratch the traces on the circuit board.
  o Any other tools that you plan to use to grip wire should also be padded with electrical tape. Needle-nose pliers included!
- The wire ends have been "pre-tinned" (solder applied).

Some of these tips (with photos) will be repeated in the detailed installation instructions that follow.

TIP: Plug Orientation

When it's time to re-connect cables to the circuit boards and kit wiring harnesses, take note of the orientation of the plug. Reversing the plug orientation is the most common mistake made during kit installation. As far as I know, nothing bad has ever happened, but it will leave you scratching your head wondering why things aren't working.
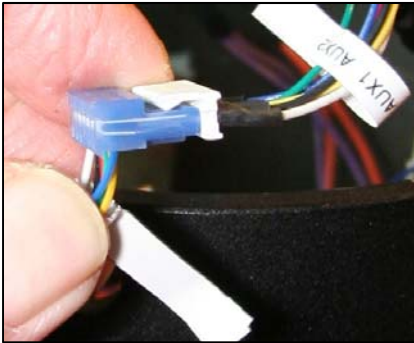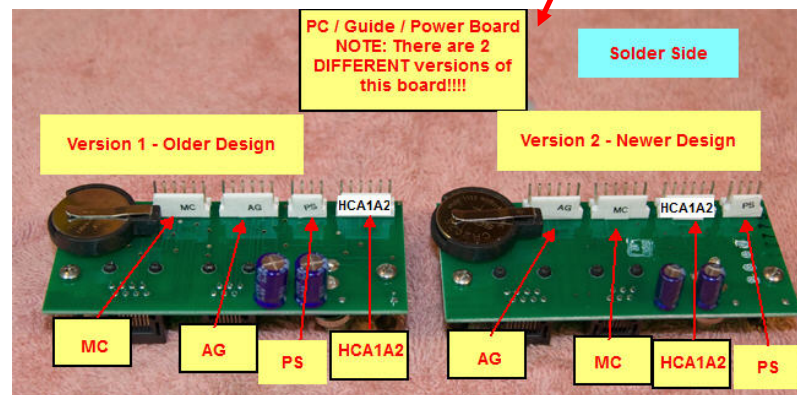

Wiring Harness Plug Orientation
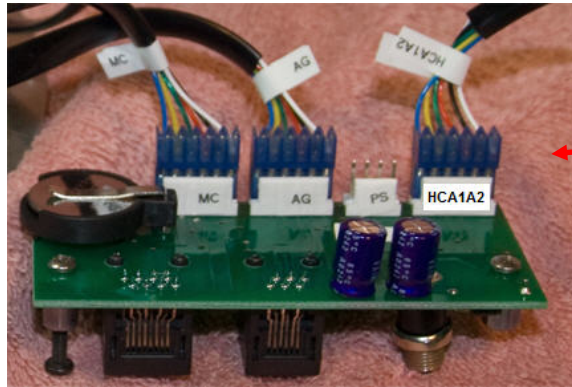
Circuit Board Plug Orientation

NOTE: There are 2 different versions of this board. See Page 17 for more information.

PC / Guide / Power Board
NOTE: There are 2 DIFFERENT versions of this board!!!!

Solder Side

Version 1 - Older Design

Version 2 - Newer Design

MC   AG   PS   HCA1A2

AG   MC   HCA1A2   PS

Detailed Installation Instructions

Step 1: Remove the lid from the electronics pier

The lid uses a very high-tech method to secure it to the pier: doubled sided foam tape!

You will be removing the circuit board (where those nasty "phone plug" 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 at Home Depot when you buy a can of paint) and pulled up on the aluminum disk.

Peel off the old foam tape. I do NOT recommend using "Goo Gone" as it is an oil product that may prevent the new foam tape from adhering later on. Best removal method? Scrape, sand, and clean when done. Don't worry about removing every trace; the new foam tape will still stick.

Step 2 – Remove the Circuit Boards

This next step may seem a bit "scary" to some of you (perhaps all) but it is really pretty easy. As long as you label everything it is very cut & dry.

> **TIP:** *It is much easier, faster, and safer (I've done a few) to remove ALL of the circuit boards (including Kit Pier Mounting Plates). As long as you carefully label all cables and the "headers" they plug into, it makes the job <u>really</u> easy. I have included "<u>labels</u>" and <u>diagrams</u> at the end of this guide that you can use to label everything (cut out and tape on). If you own a label maker it is even easier (1/4" label tapes works best). This easy step will save you time and potential grief. You also need to drill 2 small holes and you won't want and of the metal bits to land on top of a circuit board.*

> **NOTE: For Those Installing More Than 1 Kit.**
> Since installing this kit (Kit # 2) recommends removing everything from inside of the electronics pier, it is only logical that you would install Kit # 2 BEFORE installing any of the other kits.

The "<u>labels</u>" at the end of the guide as well as <u>diagrams</u> provide a layout of each circuit board and the cables that plug into them. Print 2 copies of the <u>label page</u> (1 copy you will use for cutting the labels) and use it as your guide when disconnecting cables and dismounting boards. You will use this as a guide again when you are ready to reassemble everything.

To label the circuit boards you will need to remove the screws and lift the board out. But **don't disconnect cables until you have labeled the cable and the "header that it is connected to**.

> **NOTE:** *You do NOT need to dismount the Main Motor Control Board. You can leave it attached to the top pier lid. Don't unplug any cables that connect onto the Main Board. Instead, disconnect the other end of those cables AFTER you label them.*

The only thing that should remain inside the pier is the ON/OFF Power Switch and its cable.

The next steps assume that you have completed the above recommendations.

Step 3 – Solder Wire Leads to the Circuit Board

This is the easy part!

Disconnect the "quick connect" plugs. Now you are ready to solder. Start by adding a "dab" of solder to the pins on the board that the wire leads will be soldered to.

> **NOTE:** *The PC Port has 8 pins on the board but only 5 of them are used.*

Make sure that whatever you are using to grip the board won't scratch the traces on the board. Wrap alligator clip jaws with electrical tape.

The wire leads have been "pre-tinned" (solder applied). The exposed wire is intentionally very short. It is just the right length to make a good solder connection without interfering with other pins/leads. Place the wire lead against the pin. With the "dab" of solder you added, your soldering iron should almost instantly melt the solder and fuse the wire to the pin. Hold the wire steady for long enough to allow the solder to solidify.

After all the leads have been soldered, have a good look to make sure you didn't accidently touch a wire with the iron and burn through any of the vinyl insulation. Also have a look at your soldered connections and just make sure no solder "bleeds" onto an adjacent pin.

The only thing left to do now is to insulate your solder connection with some hot-melt glue.

NOTE: There are 2 different versions of this board (see page 17 for details) BUT, the solder connections are the same. The only difference is "Header Pins" (where the cables plug onto the board).
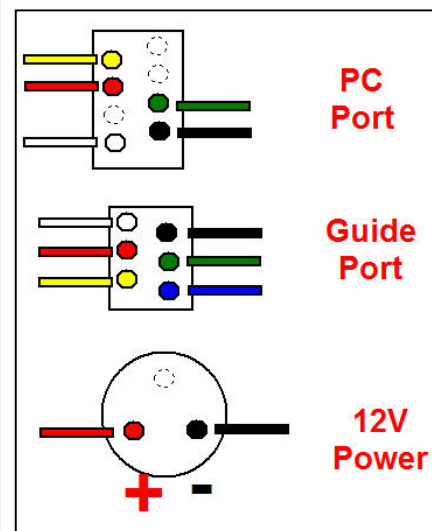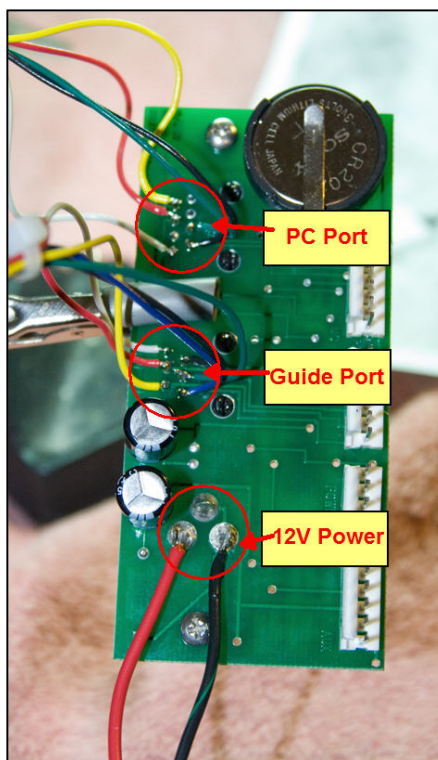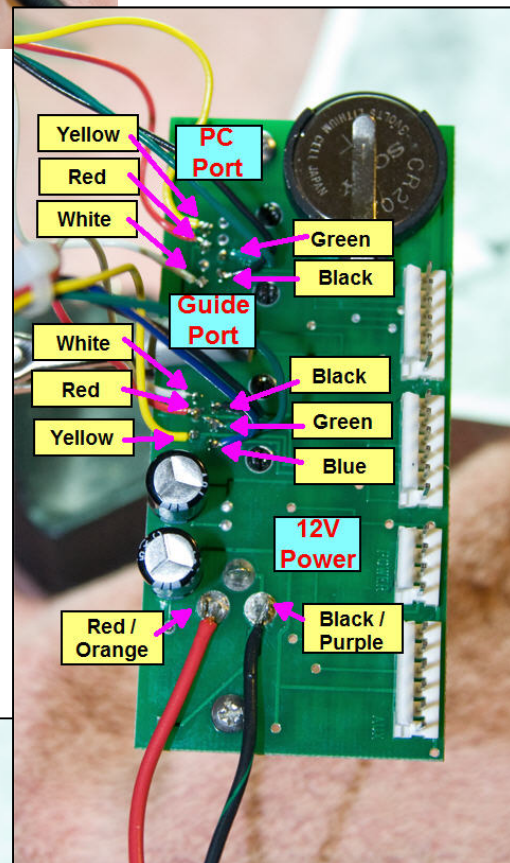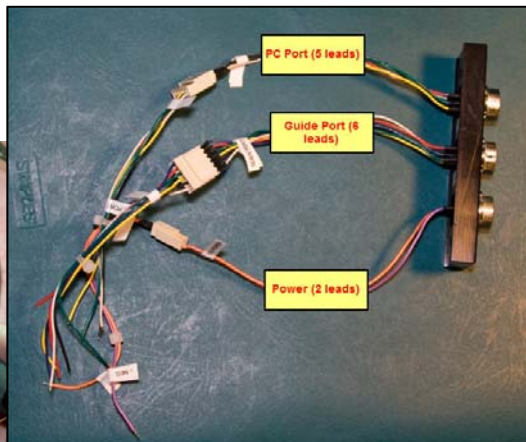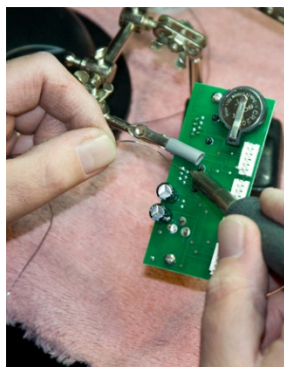
Step 4 – Locate and Drill 2 Board Mounting Holes

You will be drilling 2 small 1/8" holes in the bottom pier cover that will be used to mount the original PC/Guide/Power circuit board. I have made the assumption that the 3 brackets (the ones with foam tape) that fasten the bottom lid to the pier are NOT in the same location on every electronic pier.

Use the Drilling Template at the end of this guide as an aid to determining the best location for mounting the circuit board. *NOTE: Make sure your printer is NOT set to "shrink to fit" when printing this page*. Cut out the circular disc on the template and place it inside the pier. The 2 drill locations on the template are space 3 1/8" apart and were intentionally placed "off center". The idea here is to turn the disk so that you find a location that provides the greatest distance from the lid brackets as well as the components that you will be remounting to the side of the pier later on. It does not have to be exact, just "eyeball it". Temporarily place the board on top of the template (line up the screw holes on the board with the drill location marks) to double check that you found a good spot.

You will not be able to drill the holes from the inside (an electric drill won't fit) so you will have to transfer the template to the bottom of the cover plate BUT the template will now need to be UPSIDE DOWN. If you printed the template using common printer paper you will still be able to see the drill marks through the back of the paper.

Now take a sharp nail or knife and "scratch" a mark where you will be drilling the 2 holes. Those holes should measure 3 1/8" apart. Now drill the holes using a 1/8" drill bit.

"De-Burr" the hole by taking a larger drill bit and "press-and-spin" the bit by hand to eliminate burrs. Carefully vacuum up any bits of "shrapnel".

Step 5 – Mount the Board to the Bottom Pier Lid

You will be using the original "stand-offs" and the kit supplies 2 stand-off extensions that will thread into the original stand-offs. Now go ahead and mount the board to the bottom pier cover. Use the original board mounting screws for this.

> NOTE: For kits delivered after Aug 20, 2013. The "stand-off extensions" are no longer used. Instead, the kit now supplies a full-sized "stand-off" that replaces the ones used by Celestron. Just remove the original stand-offs and replace with the longer ones supplied in the kit. New screws are also supplied.

Stand-Off Extensions

NEW: Kits delivered after Aug 20, 2013 do not use "stand-off extensions". Read this:
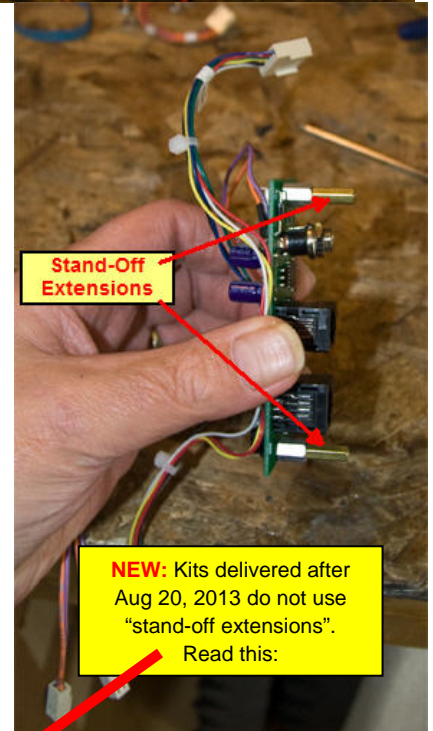
Step 6 – Attach the Pier Mounting Plates and/or Original Boards

It is now time to put it all back together.

Use the screws, nuts, washer that came with the kit to install the pier chassis connector mounting plate. The "quick connect plugs" were pre-labeled so now you just need to connect them to the wiring harnesses you just soldered onto the circuit board.
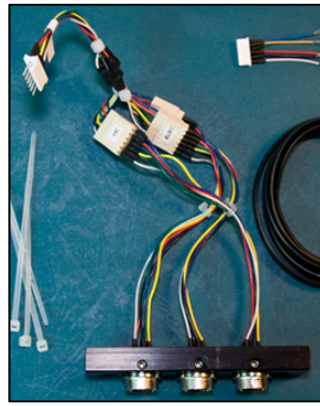

Once they are plugged in, "stuff them" out of the way so that you can go ahead and remount the remaining components that were temporally removed earlier.

Take note of the plug orientation shown in these photographs.

When it's time to re-connect cables to the circuit boards and kit wiring harnesses, take note of the orientation of the plug. Reversing the plug orientation is the most common mistake made during kit installation. As far as I know, nothing bad has ever happened, but it will leave you scratching your head wondering why things aren't working.
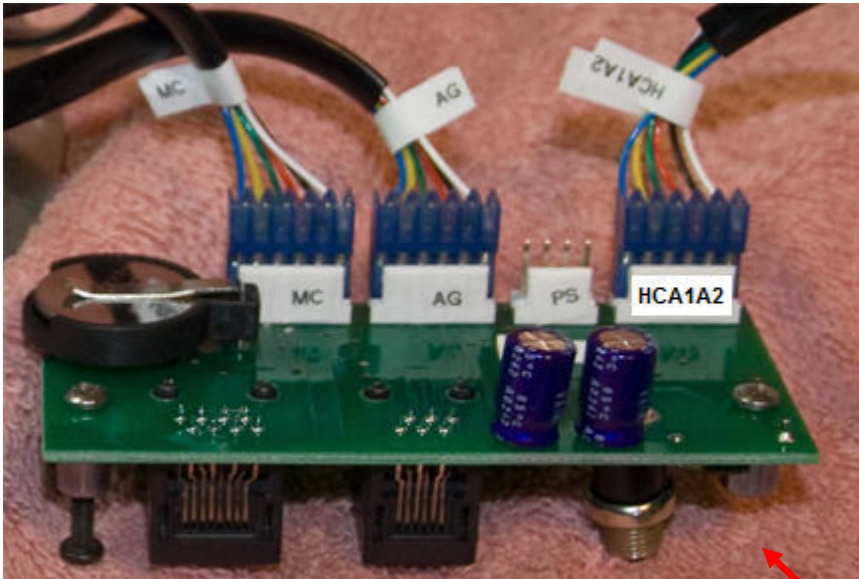
Circuit Board - Plug Orientation
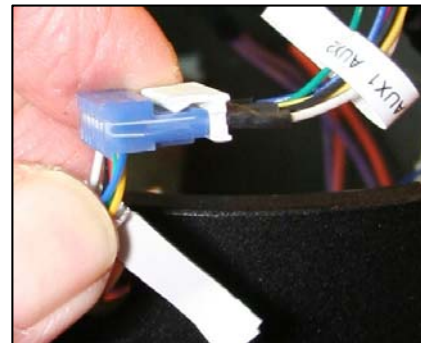
Kit Wiring Harnesses - Plug Orientation

NOTE: There are 2 different versions of this board. See Page 17 for more information.

Step 7 – Reinstall the Pier Lid

> **NOTE:** *This step will use the 2-sided foam tape. Adhesive (of any kind) will NOT adhere to a cold surface so make sure the electronics pier is at room temperature. Also, use clean rag with a dab of alcohol to clean the surface and let dry before attempting to apply the foam tape.*

The easiest way of reinstalling the electronics pier lid is to do it in 2 steps:

Step A: Affix the aluminum brackets to the inside of the pier:

- Cut a piece of foam tape and attach to 1 side of the aluminum bracket
- Use a measuring tape to set the depth of the top of the bracket:
  - The reference marks you made before removing the lid is your guide.
  - Measure the depth of the reference mark
  - Add ¼" to accommodate the thickness of the aluminum lid + thickness of the foam tape
  - Now stick the bracket to the pier and press against the side to fully adhere.
- Now affix a piece of foam tape to the top of each bracket.
- You are now ready to place the lid.

Step B: Check that all cable plugs are fully seated.

In particular, the cables plugging into the main motor control board (the big one attached to the underside of the lid). Some of these cables likely got tugged on so just make sure the plugs are pushed all the way in.

Step C: Place the lid back onto the electronics pier

- Use the reference marks you made earlier to orient to the original position.
- Have a peek under the lid to make sure the edges of the motor control board (under the lid) will not touch brackets/screws/etc.
- Make sure that cables are clear of the aluminum brackets.
- Gently press the lid down. Set something (a measuring tape for example) on top of the lid for a while to make sure the lid is fully adhered to the brackets. That's it!

Congratulations – You're Done!

Labels

CABLE Labels (1 label for each end of the cable)

DEC(ALT) MOTOR   DEC(ALT) MOTOR

DEC(ALT) SENSE   DEC(ALT) SENSE

RA(AZM) MOTOR   RA(AZM) MOTOR

RA(AZM) SENSE   RA(AZM) SENSE

AG   AG

MC   MC

HC-AUX1-AUX2   HC-AUX1-AUX2

Main Board Circuit Board "Header" Labels

(DEC Motor/Sense) (RA Motor/Sense)

DM   DS   RM   RS   AG   MC

PC Port / Guide Port / Power Circuit Board "Header" Labels

(Power Switch / HC-AUX1-AUX2 / Main Board 1 / Main Board 2)
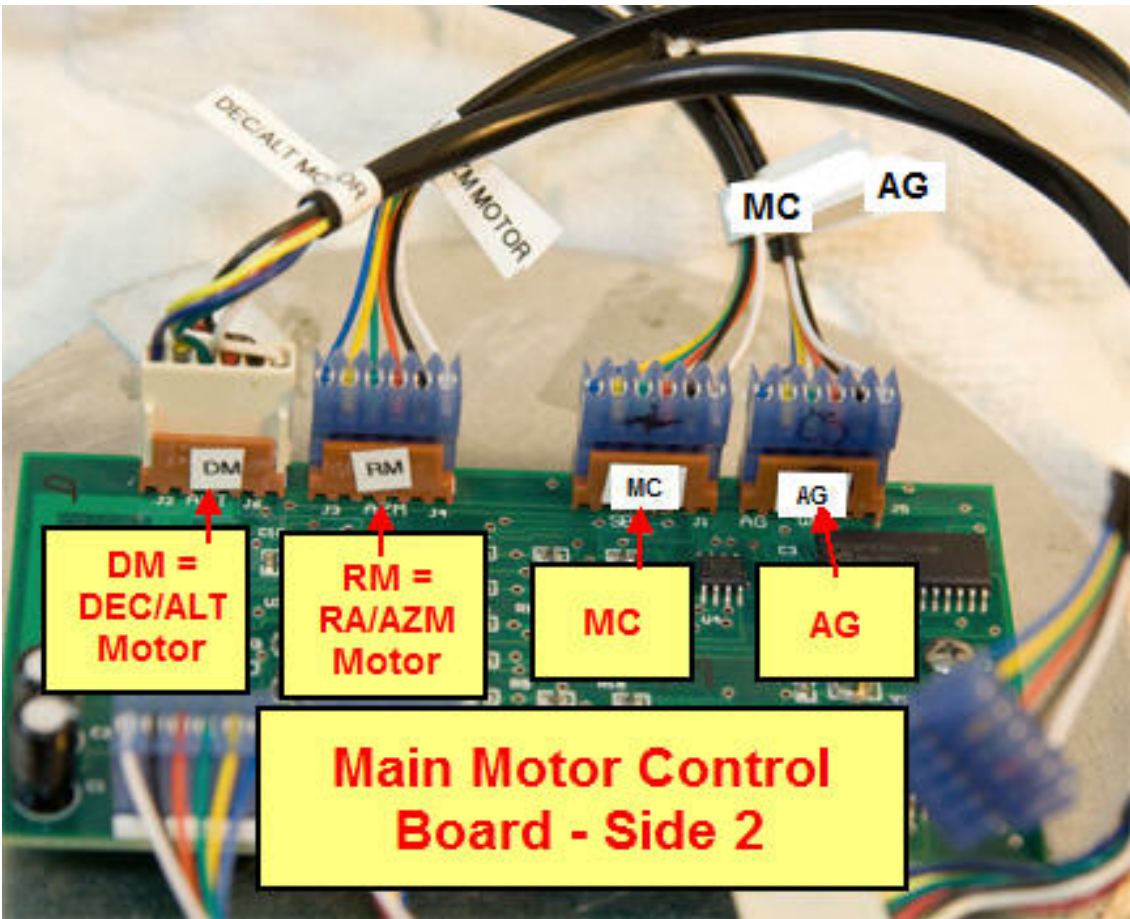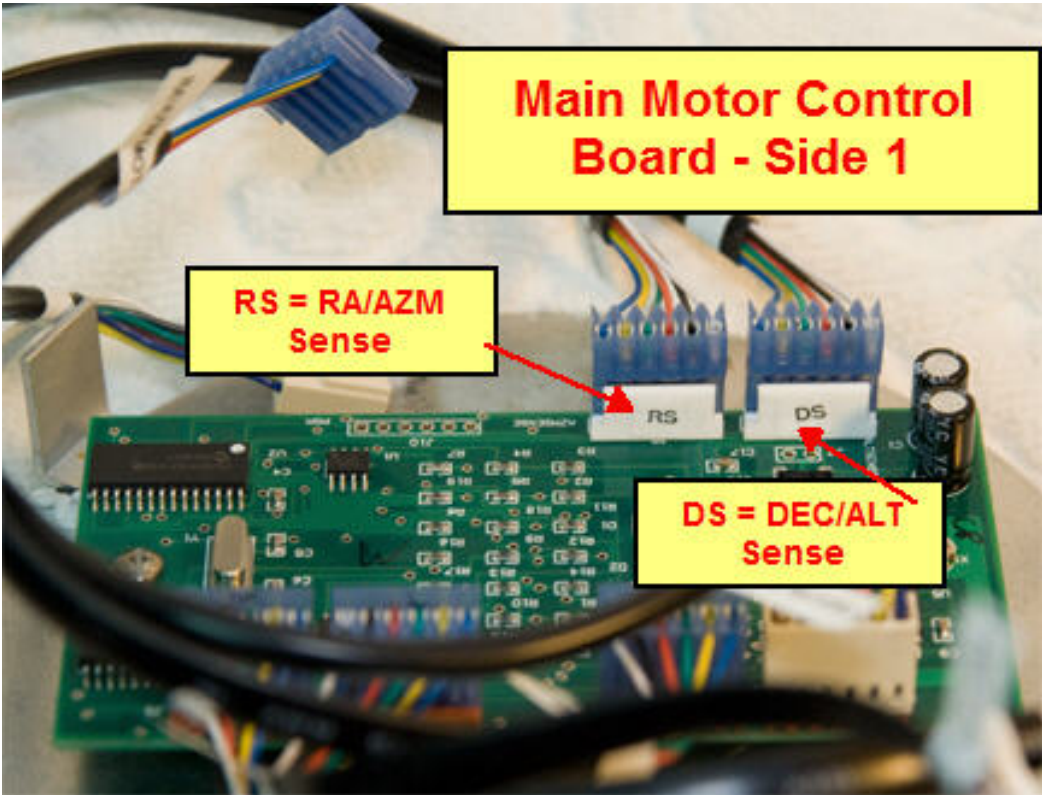
PS   HCA1A2   AG   MC

HC / AUX1 /AUX2 Circuit Board "Header" Labels

Single 6-Pin "Header"

HCA1A2

Diagrams

Main Motor Control Board – Label Guide

Main Motor Control Board - Side 1

RS = RA/AZM Sense

DS = DEC/ALT Sense

MC

AG

DM = DEC/ALT Motor

RM = RA/AZM Motor

MC

AG

Main Motor Control Board - Side 2

HC / AUX1 / AUX2 Circuit Board

HC /AUX1 / AUX2 Board

Label
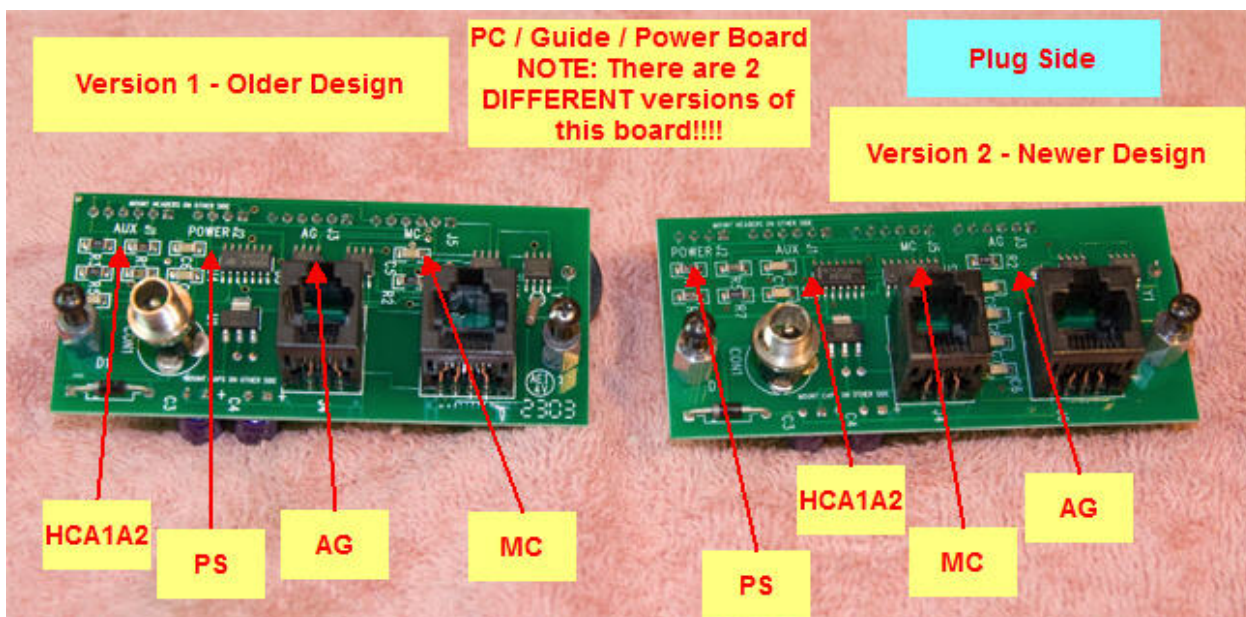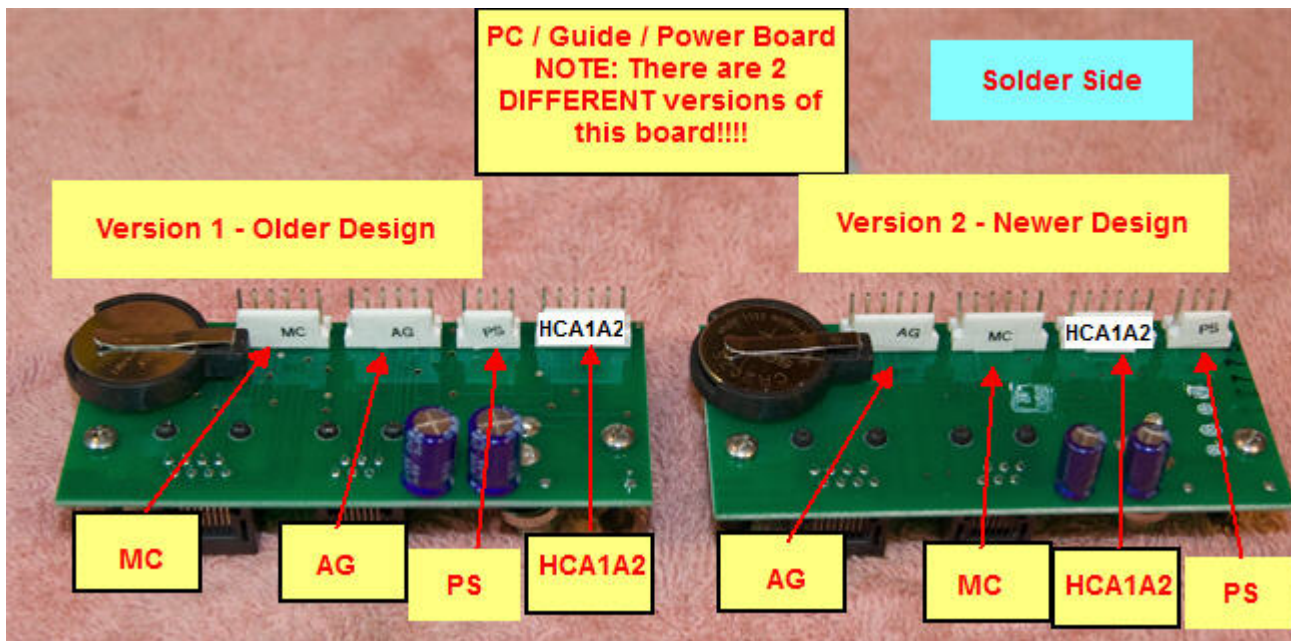HCA1A2
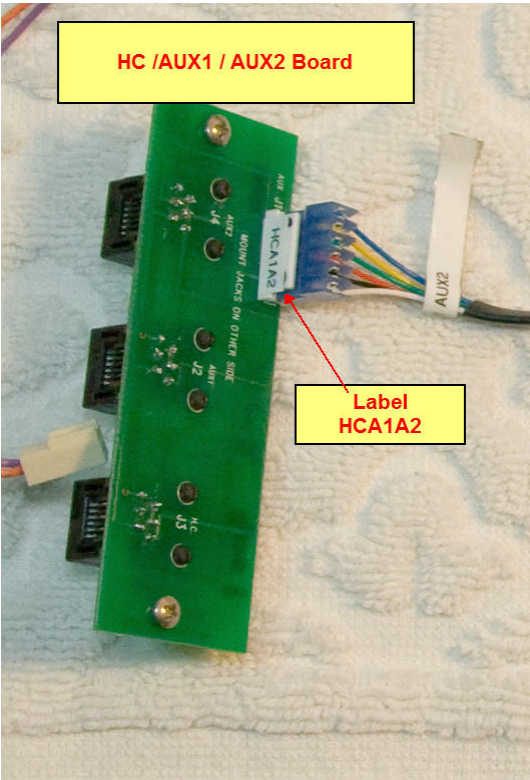
IMPORTANT: PLEASE READ THIS

There are 2 different versions (that I know of) of this circuit board. The pin-outs where you will solder the wiring harness leads are identical BUT…**THIS IS THE IMPORTANT PART**…. The cable connections (circuit board header pins) are in a different arrangement. The following 2 photos illustrate this. As long as you label the circuit board headers and the cables the same way you won't need to worry about this BUT… if you are going to rely on the reference photos at the end of this guide that show how the circuit boards connect to each other then you must be careful and know exactly which board version you have. **In particular… the "MC" and "AG" connections**. If you accidentally reverse these (I did it once) **YOU WILL FRY YOUR MAIN MC CONTROL BOARD**!!!!!!!!!! This is the only "fatal" mistake that I know of when installing any of my 3 kits. You can make mistakes with just about anything else, but reversing MC and AG is going to be a fatal mistake! Your BEST INSURANCE….don't be lazy, label the headers and cables and breathe easy! Then you can ignore looking at these reference images in the first place!!!!

PC / Guide / Power Board
NOTE: There are 2 DIFFERENT versions of this board!!!!

Solder Side

Version 1 - Older Design

Version 2 - Newer Design

MC   AG   PS   HCA1A2

AG   MC   HCA1A2   PS

PC / Guide / Power Board
NOTE: There are 2 DIFFERENT versions of this board!!!!

Plug Side

Version 1 - Older Design

Version 2 - Newer Design

HCA1A2   PS   AG   MC
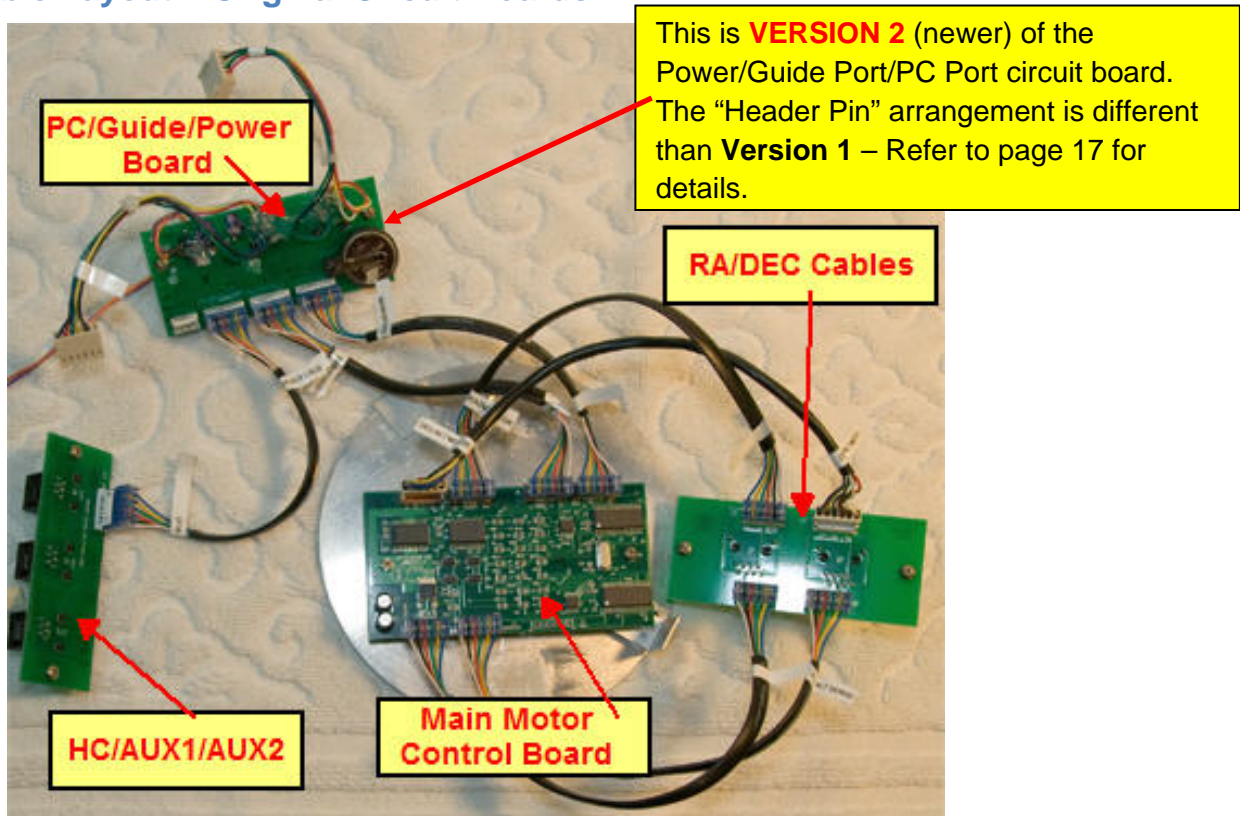
PS   HCA1A2   MC   AG
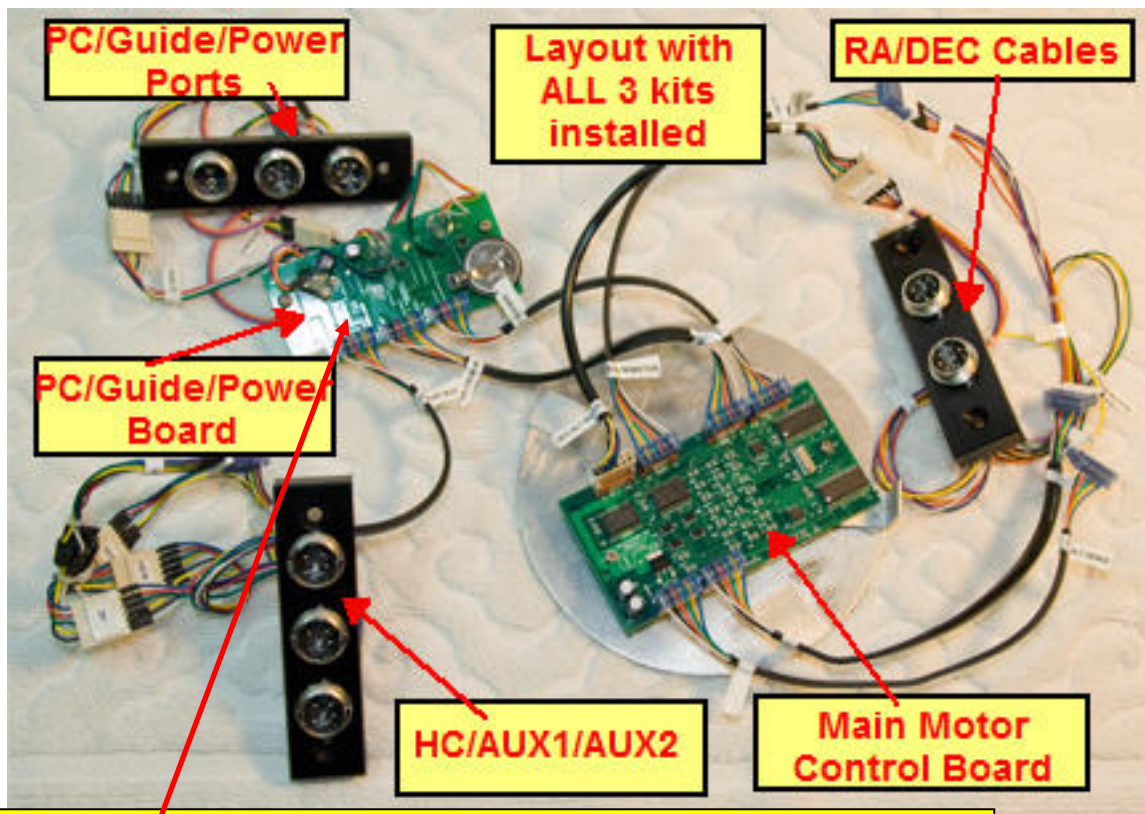
RA/DEC CAT5E(RJ45) Cable Circuit Board

NOTE: If you have already installed the RA/DEC Cable Replacement Kit, the kit "wiring harnesses" eliminate this circuit board and the cables should have been already labeled prior to installing that kit.
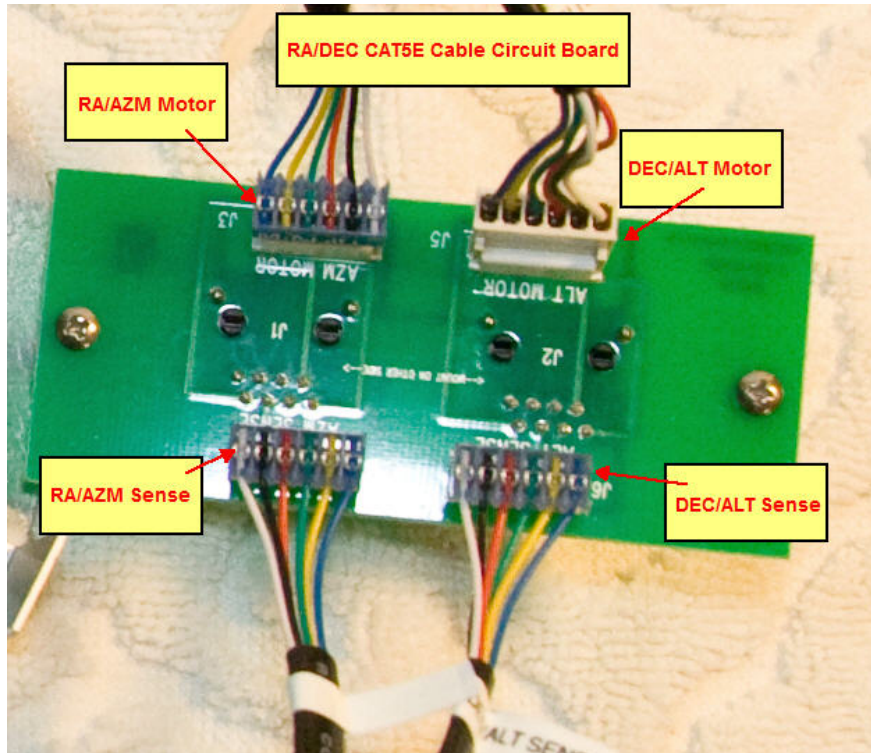
Board & Cable Layout – Original Circuit Boards

PC/Guide/Power Board

This is **VERSION 2** (newer) of the Power/Guide Port/PC Port circuit board. The "Header Pin" arrangement is different than **Version 1** – Refer to page 17 for details.

RA/DEC Cables

HC/AUX1/AUX2

Main Motor Control Board

Board & Cable Layout – All 3 Kit Conversions

PC/Guide/Power Ports

Layout with ALL 3 kits installed

RA/DEC Cables

PC/Guide/Power Board

HC/AUX1/AUX2

Main Motor Control Board

This is **VERSION 2** (newer) of the Power/Guide Port/PC Port circuit board. The "Header Pin" arrangement is different than **Version 1** – Refer to page 17 for details.

Drilling Template

1

Drill
Location

center

3 1/8"
3.125"

2

Drill
Location

disc diameter = 5 3/8"