Paramount ME MKS 5000
Upgrade Instructions

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Introduction

The MKS 5000 is Software Bisque's fourth generation dual axis control system. The Paramount ME MKS 5000 *upgrade* allows Paramount ME owners to take advantage of the capabilities of the newest control system:

- USB 2.0 interface, with a USB hub on the Instrument Panel.
- A single electronic board incorporates all I/O ports (and eliminates the Paramount ME Adaptor Panel).
- An integrated through the mount generic "power source" port on the Instrument Panel backed with 18-gauge wire to supply power to your observing equipment at the Instrument Panel, including optional cable sets to power most cameras and accessories.
- Elimination of obsolete Paramount ME through the mount cabling allows additional custom through the mount cabling, and integrated cable connectors on the revised Adaptor Panel hardware.
- An improved temperature compensated internal oscillator with better than 10 parts per million that ensures accurate tracking rates over a wide temperature range.
- MKS 5000 control board expansion slot permits additional features. For example, a Wi-Fi plug in module is available for wireless mount control. Other I/O interfaces are possible, and may be considered in the future.
- The MKS 5000 Adaptor Panel mounting bracket can be used to mount optional cable keystones for additional through the mount cabling (for example, additional USB cables or Ethernet cables).

Minimum System Requirements

The MKS 5000 control system requires the following minimum hardware and software.

- TheSkyX Professional Edition (not included in the MKS 5000 upgrade). Registered TheSky6 Professional Edition licensees are eligible to upgrade to TheSkyX Professional Edition. Visit this web page: http://www.bisque.com/sc/pages/TheSkyXProUpgrade.aspx for details.
- Paramount ME Robotic Telescope Mount. This upgrade is *not* compatible with the Paramount GT-1100 or GT-1100s models.

Packing List
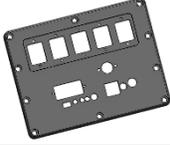
Component	Description
	MKS 5000 "Adaptor Panel" mounting bracket.
	Mounting base with the MKS 5000 printed control board (PCB) attached.

Component	Description
	MKS 5000 Instrument panel with housing (ME II).
	MKS 5000 Through mount cable harness.
	Through mount USB cables (2)
	USB Cable (with mini connector)
	10-32 x ½ in. SHCS (2)
	4-40 x 3/8 in. BHCS (2)
	10-32 x 3/4 in. SHCS (10)
	Paramount ME Flat channel cover.
	4-40 x 1/4 in. SHCS (4) – for Flat channel cover.
	Hand Paddle

MKS 4000 Removal Instructions

IMPORTANT!

Before removing the MKS 4000 control system, connect to the MKS 4000 control system through TheSkyX Professional Edition and save all parameters to a text file.

See Figure 1 for the screen to copy parameters to the Clipboard. The most important items to note are the index angles as highlighted in blue in Figure 2.
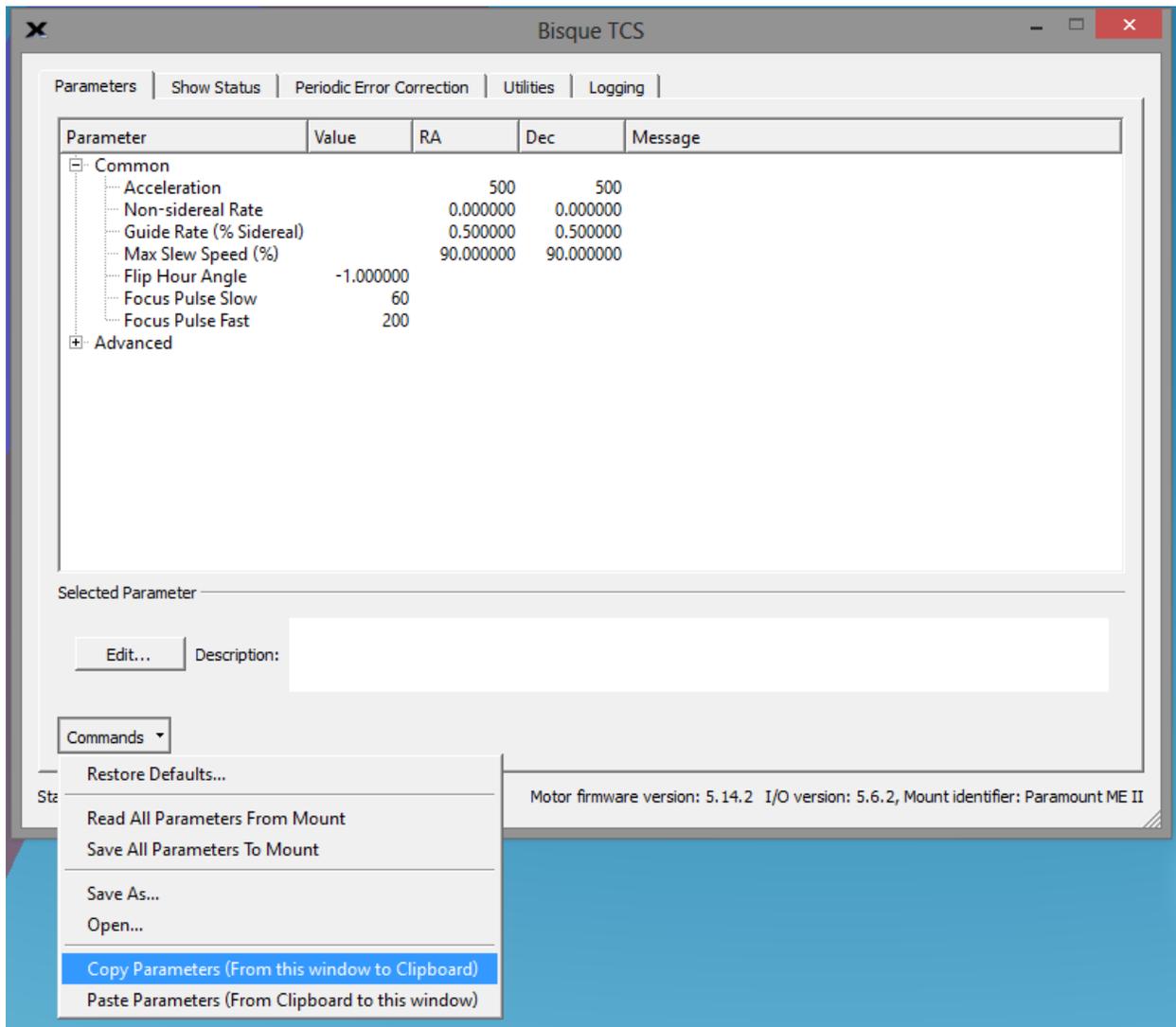

Figure 1: Copy Parameters to Text File

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Untitled - Notepa

File  Edit  Format  View  Help

Bisque TCS Parameter                    RA Value        Dec Value
--------------------------------  -------------- ----------------
MKS_INDEX_ANGLE                   ,        3447 ,             983
MKS_UNIT_ID_                      ,           5 ,               5
MKS_ACCELERATION                  ,         500 ,             500
MKS_HOME_VEL_HI                   ,  1200000000 ,      1200000000
MKS_HOME_VEL_MED                  ,   120000000 ,       120000000
MKS_HOME_VEL_LOW                  ,     5900000 ,         5900000
MKS_HOME_REQD                     ,           1 ,               1
MKS_HOME_JOYSTICK                 ,           1 ,               1
MKS_HOME_INDEX_OFFSET             ,           0 ,               0
MKS_CREEP_RATE                    ,           0 ,               0
MKS_GUIDE_RATE                    ,     -1211266 ,          998874
MKS_EMF_CONSTANT                  ,          53 ,              53
MKS_MAX_SPEED                     ,  1620000000 ,      1620000000
MKS_BASE_RATE                     ,    -77521077 ,               0
MKS_MIN_POS_LIMIT                 ,     -9072000 ,       -12825000
MKS_MAX_POS_LIMIT                 ,     2160000 ,         3325000
MKS_PEC_RATIO                     ,           9 ,               9
MKS_HOME_DIR                      ,           1 ,               1
MKS_HOME_SENSE                    ,           1 ,               1
MKS_HOME_MODE                     ,           2 ,               2
MKS_HOME_IN_OUT_IN                ,           1 ,               1
MKS_PEC_CUTOFF_SPEED              ,           0 ,               0
MKS_MAX_VOLTAGE                   ,          30 ,              30
MKS_MAX_GAIN                      ,         120 ,             120
MKS_MAX_POS_ERROR                 ,        2000 ,            2000
MKS_JOY_CENTER                    ,        2184 ,            2184
```

Figure 2: Save the existing motor Index Angles.

MKS 4000 Main Control Board Removal

The RA side panel houses the MKS 4000 main control board. Use the Paramount ME User Guide (http://www.bisque.com/sc/media/p/28169.aspx) "Removing the RA and Dec Side Panels" section (page 55) to remove only the RA side panel. The main control board can then be removed from the side panel by unplugging all cables and then removing 9, 4-40 screws with a 1/16 hex wrench.

MKS 4000 Adaptor Panel Board Removal

Free the Adaptor Panel by removing 14, 10-32 screws (Figure 3) and removing it from the back of the mount using a 5/32 in. hex wrench.

Figure 3: Paramount ME Adaptor Panel

At this point, the motors, the sensor cable, and the two cables that run up to the instrument panel should remain.

MKS 4000 Instrument Panel Board Removal

Remove the five (some Paramount ME Instrument Panel housings may have six), 4-40 screws to free the Instrument Panel using a 1/16 in. hex wrench, and unplug the two cables from the Instrument Panel board.

The two cables that were unplugged from the Instrument Panel follow the same through the mount "path" as the MKS 5000 cabling. If the MKS 4000 cabling path is unfamiliar, then do not remove the smaller 8 pin cable just yet so that this cable can be used to route the new cables. Please refer to the *Paramount ME User Guide* (http://www.bisque.com/sc/media/p/28169.aspx) for step-by-step

instructions how to access and install through the mount cabling. If you are already familiar with the path that cables must follow through the mount then both of these cables can be removed from the mount.

MKS 5000 Upgrade Installation Instructions

The MKS 5000 upgrade includes a mounting base that holds the MKS 5000 board, and a replacement Adaptor Panel mounting plate. These two components must be assembled using two 10-32 screws as shown in Figure 4 before installing this unit into the mount.
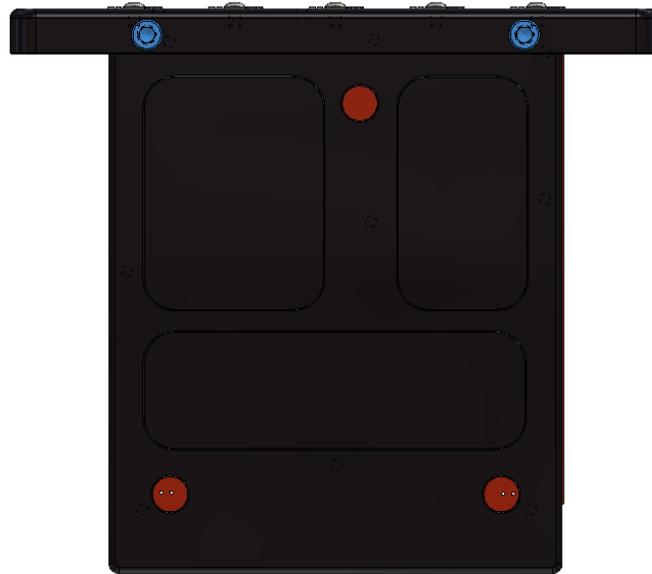

Figure 4: MKS 5000 Upgrade Base Screws

Once assembled, inserted the unit into the right ascension housing and mount it using the same screws that held the original Adaptor Panel in place. Note that the upgraded panel uses only ten of the original fourteen 8-32 screws (Figure 5).
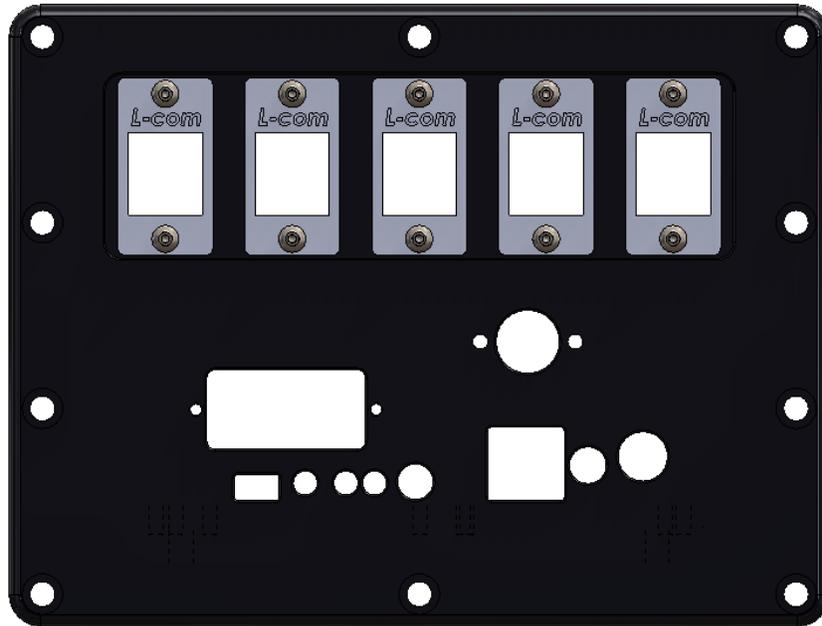
Figure 5: MKS 5000 Upgrade Front Panel.

The MKS 5000 control board cables are identical as the ones used in the Paramount ME II and Paramount MX mounts and are plugged in as shown in Figure 6.
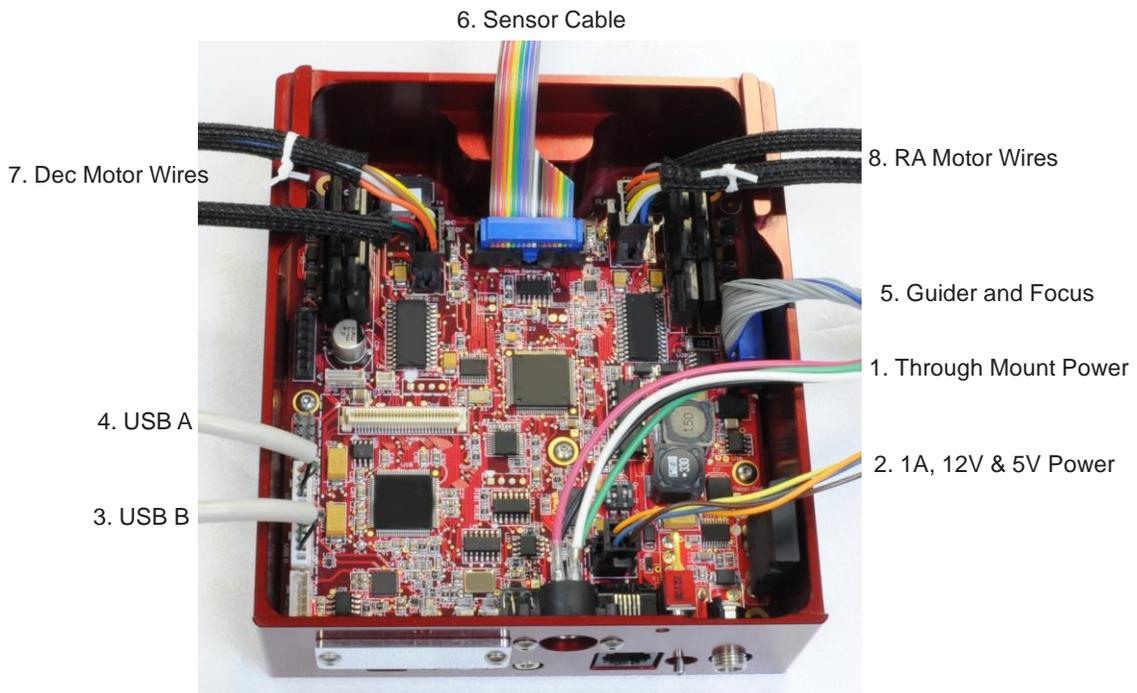

Figure 6: Cables plugged into the MKS 5000 PCB.

Through Mount Cable Wiring

The MKS5000 upgrade uses the existing Paramount ME motors and homing sensor cable. All other cables should be replaced. When wiring the Paramount ME, follow the same path as the previous wires that were installed (as described in the section "MKS 4000 Adaptor Panel Board Removal" on page 7) or refer to the Paramount ME User Guide "Add Additional Cable" section on page 58 as a reference. Figure 7 shows an example of an MKS 5000 upgrade installed with the new cabling along with extra L-Com keystone Adaptor cables which are discussed in the following section. The cables can be either zip tied to the compression rods and/or each other to prevent them from binding, as well as keeping them from snagging while the mount is in operation. If the Paramount ME was part of the first few production runs, the Pittman motors will have all of the wires coming out of the base of the motor zip tied together. If this is true, carefully clip and remove that zip tie and separate the two sets of wires.
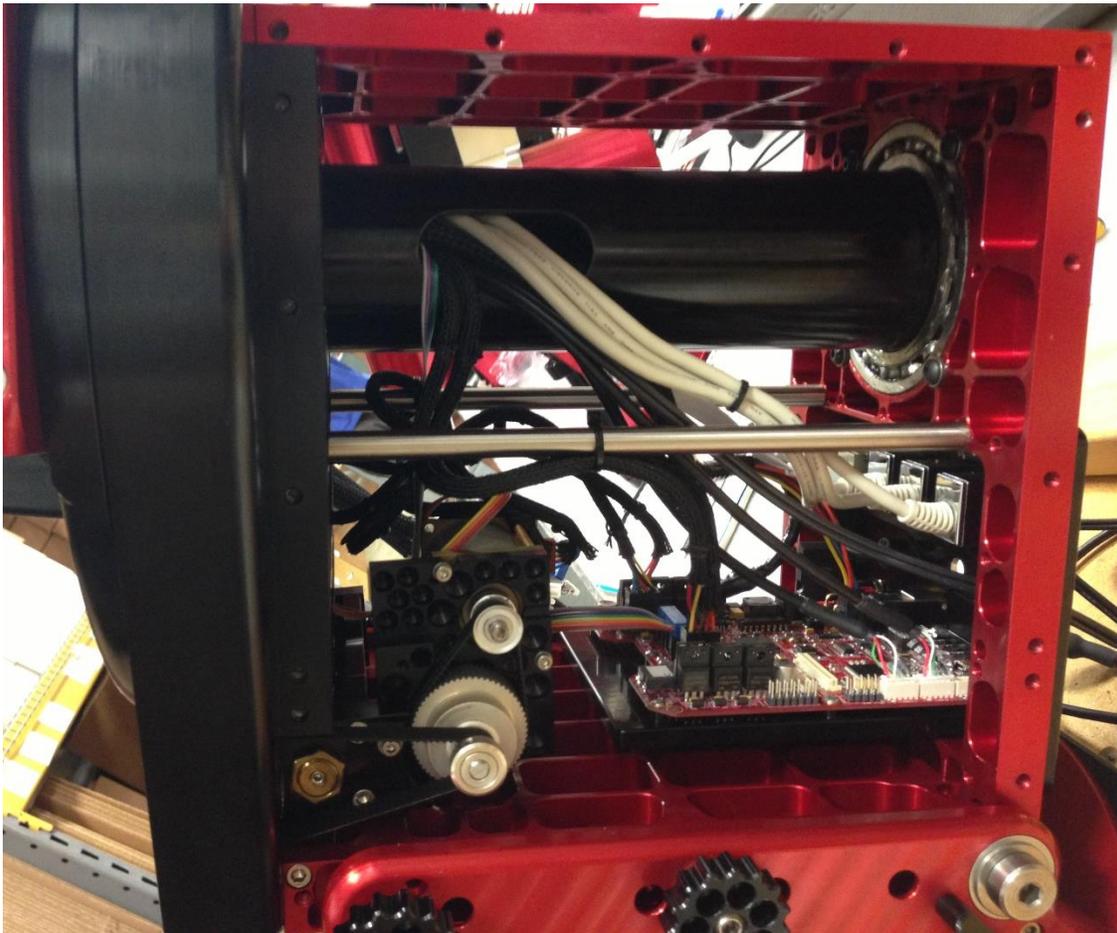

Figure 7: Paramount ME with MKS 5000 upgrade wiring (both side panels are removed for illustration).

L-COM Keystone Panel Adaptors

The five L-com "keystones" on the front panel are designed to make through mount cabling easier to install, more accessible and simpler to disconnect from the mount. The L-com webpage (http://www.l-com.com/Adaptors) has cables, connectors and Adaptors that can be used to personalize the mount for different accessories.

Connecting to TheSkyX

The MKS 5000 behaves much like the MKS 4000 when connecting to TheSkyX Professional Edition. If you are unfamiliar with using TheSkyX Professional Edition in conjunction with the MKS 5000 control system, please visit the URL below and download the *Paramount ME II and MX User Guide* for more information:

http://www.bisque.com/sc/media/p/75568.aspx

The documentation below is specific to the Paramount ME MKS 5000 upgrade and describes necessary setup and configuration instructions. The MKS 5000 board is programmed with the correct defaults and the most recent firmware. It is also programmed to work with the Paramount ME motors (in terms of the using the Paramount ME motor specific EMF constants; however, you must still program the board to use the specific motor index angles for your mount, as described below).

Before powering up the MKS 5000-enabled Paramount for the first time, *you must download and install the most updated version of TheSkyX Professional Edition*:

http://www.bisque.com/sc/media/24/default.aspx.

And download and run the latest MKS 5000 USB Driver Installer:

http://www.bisque.com/sc/media/p/54758.aspx.

Once the latest version of TheSkyX Professional Edition and the MKS 5000 USB driver have been installed, it's time to turn on the mount.

> When the mount is first turned on, it most likely will emit successive beep because the index angles have not been programmed.

From TheSkyX, establish communications with the MKS 5000 the same way as the MKS 4000.

From TheSkyX Professional Edition, verify the Paramount ME is still selected as your mount (see Figure 8) along with the correct COM port selected for the USB used to talk to the MKS 5000.

After connecting to the Paramount, answer *No* if prompted to home the mount. From here, open the Bisque TCS window by clicking the *Bisque TCS* command from the *Tools* pop-up menu on the *Telescope* window. From the Utilities tab, click *Reboot For Indexing* (See Figure 9), this will stop the successive beeps.
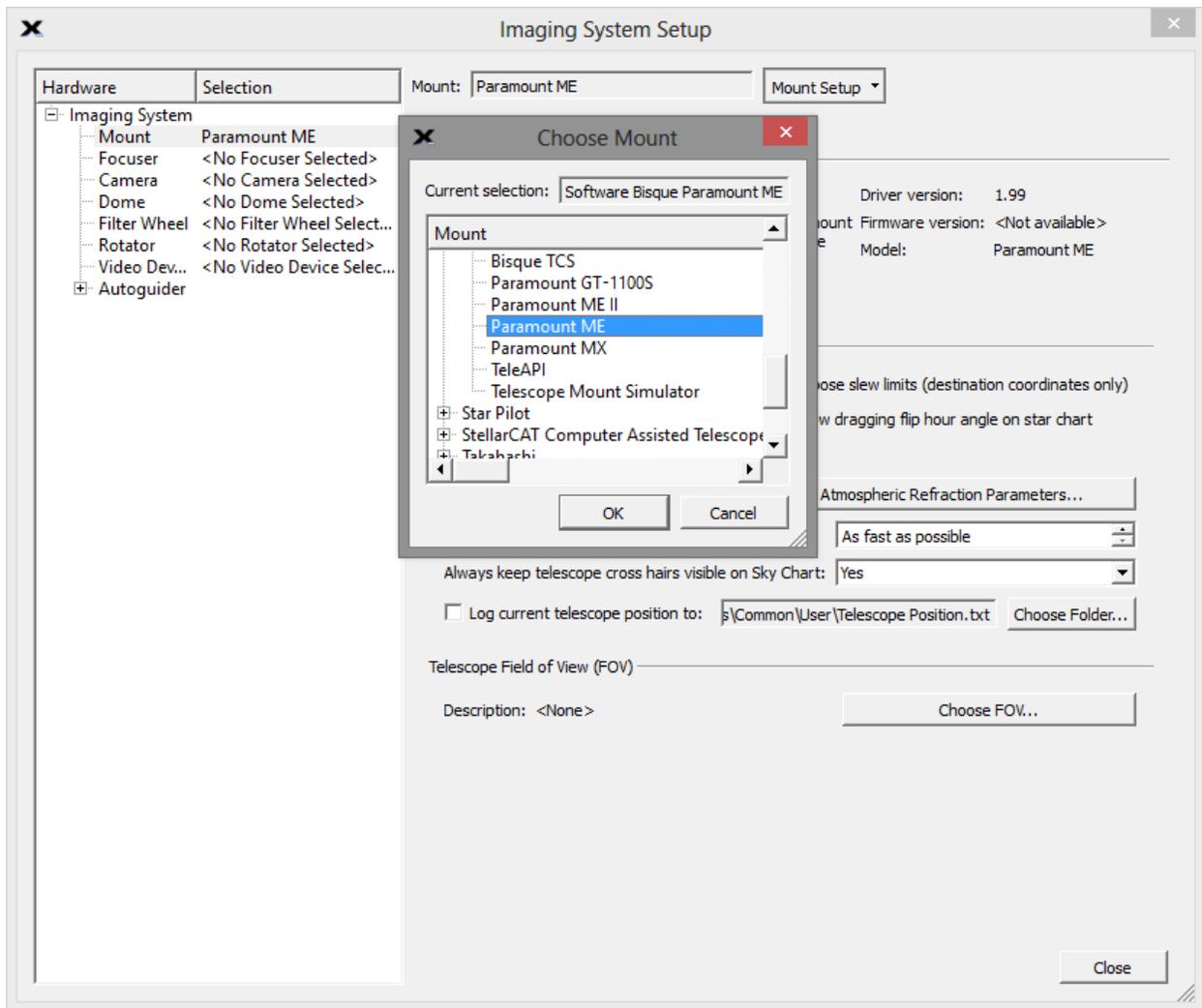
Figure 8: Verify the correct mount is selected on the Choose Mount window.
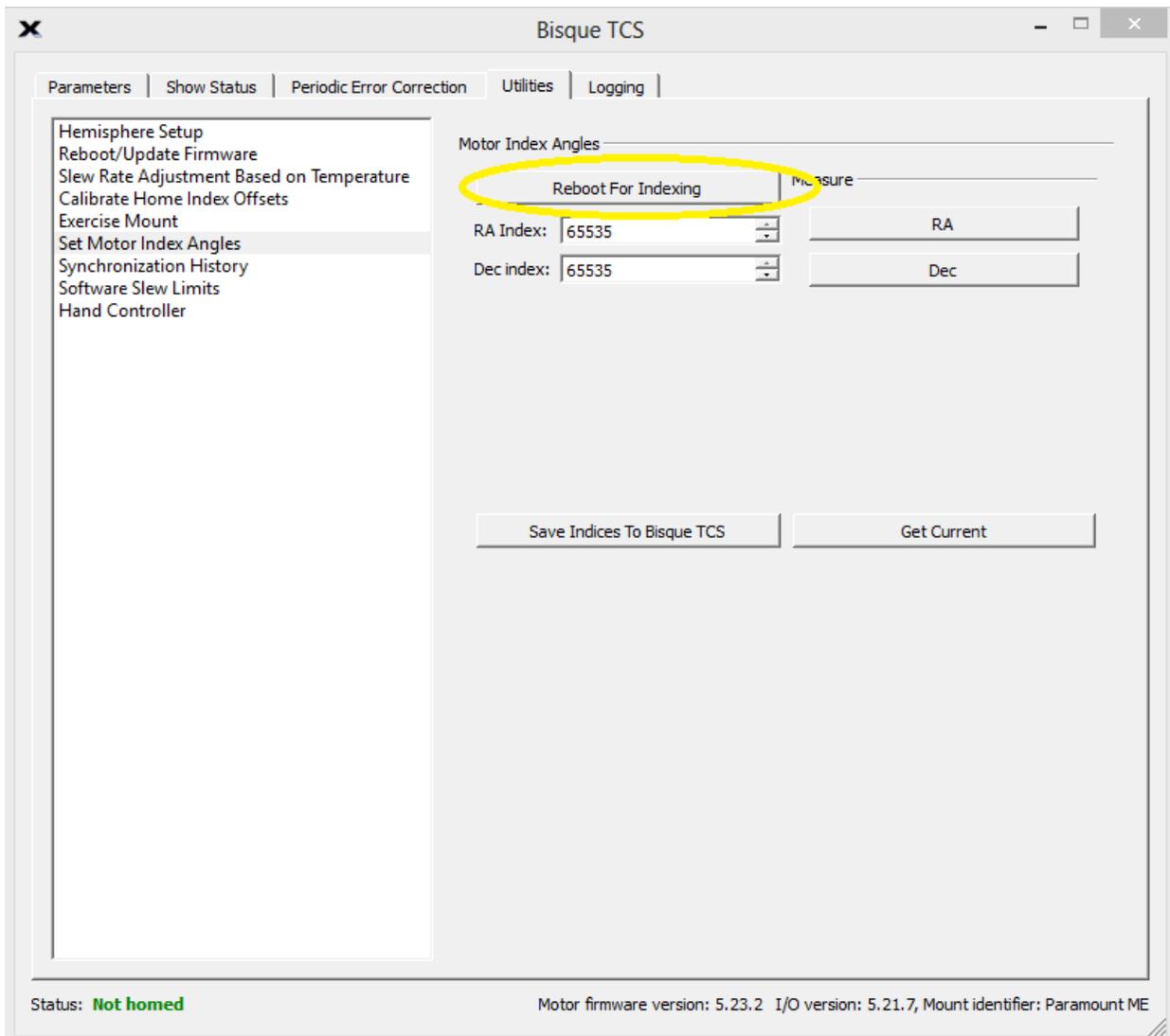
Figure 9: The Reboot for Indexing button on the Bisque TCS Utilities tab.

Highlight the **Set Motor Index Angles** text on the **Utilities** tab to reveal the options for programming the control board's motor index angles. For the Paramount ME MKS 5000 control system, the value of RA index angle needs must be derived from the existing value before it can saved to the control system. The declination index angle remains the same. These values should be programmed in to your mks5000 board correctly if you provided that information upon ordering the MKS5000 upgrade.

To compute the right ascension index angle for the MKS 5000, *first if the original index angle is less than or equal to 666 then add 333. Otherwise subtract 666 from the original RA index angle value* (See Table 1) to obtain the correct MKS 5000 RA index angle.

Enter the derived **RA Index Angle** and original **Dec Index Angle** in their respective text boxes. Remember the original index angles are located on the individual motors or can be read from the parameters saved in your text file from the "MKS 4000 Removal Instructions" above. Click **Save Indices to Bisque TCS** and then home the mount.

Table 1: Calculating New RA Index Angle

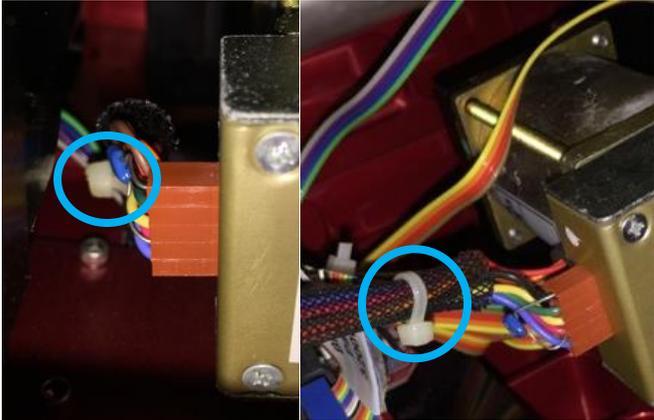| Original (mks4000) RA Index Angle	256		Original (mks4000) RA Index Angle	785
Add 333	+333		Subtract 666	-666
Correct RA Index Angle	589		**Correct RA Index Angle**	119

Please do not attempt to update the MKS 5000 firmware unless specifically instructed to do so by Software Bisque.

In the future, if there is ever a need to reset the control system parameters to defaults values from TheSkyX, choose the Paramount ME as the mount. The most recent firmware versions are 5.25.12 for motor and 5.21.7 for I/O.

After following all of these steps, your Paramount ME should now be able to home and is ready for use.

TROUBLESHOOTING

The table below describes some common issues that can occur when replacing the MKS 5000 PCB.

Problem Description	Solution
I do not know the motor index angles for my mount. How can I find them?	Index angles are in one of three places. 1. On a sticker located on each motor 2. On a sticker located on the mks4000 board 3. In saved parameters from the mount on your computer.
After powering the mount, the MKS 5000 beeps continuously.	The motor index angles that are stored in the MKS 5000 are incorrect for one or both of the servo motors, so the motors cannot be properly initialized. See Table 1: Calculating New RA Index Angle on the previous page for details on how to calculate and save the motor index angle values to the MKS 5000 control system. Check to make sure there are no zip ties (usually white or black) tied around the cables of your motors. If there are, carefully remove them without cutting any of the motor wires. (See images below). This is especially important if upgrading from an mks3000 to an mks5000 If, after programming the MKS 500 with the correct motor index angles, the behavior persists then the motors need a "kickstart" of sorts. 1. Write down your original mks4000 index angles. 2. Place both axes of your Paramount in **balance.** 3. Measure each of the index angles (See Figure 9 and the box "How do I determine the mount's motor index angles?" of this Troubleshooting chart). 4. Cycle the power, and try homing. 5. If the mount is still continuously beeping, turn off the mount, wait a couple of minutes and go back to the window in Figure 9 and replace those values with the original ones you wrote down in step 1. Then cycle the power again.

	6. This sometimes can take a couple of tries along with checking all of the other troubleshoot steps in this document
How do I determine the mount's motor index angles?	The procedure below describes how to measure the right ascension and declination motor index angles. These values should be saved to the MKS 5000 as described in "**Error! Reference source not found.**" on page 1. Launch TheSkyX Pro. 2. Choose the **Connect** command from the **Telescope** menu. 3. Choose the **Bisque TCS** command from the **Tools** pop-up menu. 4. On the **Utilities** tab, choose highlight **Set Motor Index Angles** on the left side of the window. 5. Click the **Get Current** button to retrieve the motor index angle values that are permanently stored in the MKS 5000. 6. Click the **RA** button to measure the right ascension axis motor index angle, and compare it with the **RA Index** value. 7. Click the **Dec** button to measure the declination axis motor index angle, and compare it with the **Dec Index** value.
After issuing the **Find Home** command, the telescope status text shows *Not Homed* or homing the mount by double-tapping the button on the joystick fails.	**Solution 1: Calibrate the joystick** 1. Connect to the mount. 2. Choose the **Bisque TCS** command from the **Tools** pop-up menu on the **Telescope** window. 3. Highlight **Hand Controller** in the list on the left side of the **Utilities** tab on the **Bisque TCS** window. 4. Click the **Calibrate Joystick** button. 5. **Important!** Choose the **Save All Parameters** to the **Mount** command from the **Commands** pop-up menu on the **Parameters** tab of the **Bisque TCS** window. Explanation: The MKS 5000 control system has an internal sensor that detects input from the joystick on the hand paddle. Joystick calibration **should be** performed at the factory, and normally need not be calibrated again. However, if the joystick sensor was not calibrated at the factory, issuing the **Find Home** command may fail unexpectedly and the telescope status text on the **Telescope** window will show *Not Homed*. Note that the hand paddle *does not* need to be plugged in to the Electronics Box for successful joystick calibration. **Solution 2: Ensure both ends of the homing sensor cable are plugged in.** One end of the homing sensor cable plugs into the MKS 5000 PCB (Figure 9), then this cable splits into to two separate cables for right ascension

|	
	and declination homing sensor. Use this document for reference on where to locate those: http://www.bisque.com/sc/media/p/30773.aspx Double-check that all three ends of the homing sensor cable are in place and that there is no grease in between either of the sensors themselves.

After replacing the MKS 5000 board, stars are always trailed in right ascension as if the wrong sidereal tracking rate is being used.	If your mount is exhibiting this behavior, the first step is to connect to the mount and verify that the Mount Identifier is correct for your model mount.
	
	1. Choose the **Connect** command from the **Telescope** menu.
	2. On the **Telescope** window, choose the **Bisque TCS** command from the **Tools** pop-up menu.
	3. Verify the Mount Identifier in the lower right of the Bisque TCS window (Figure 10) is set for a Paramount ME.
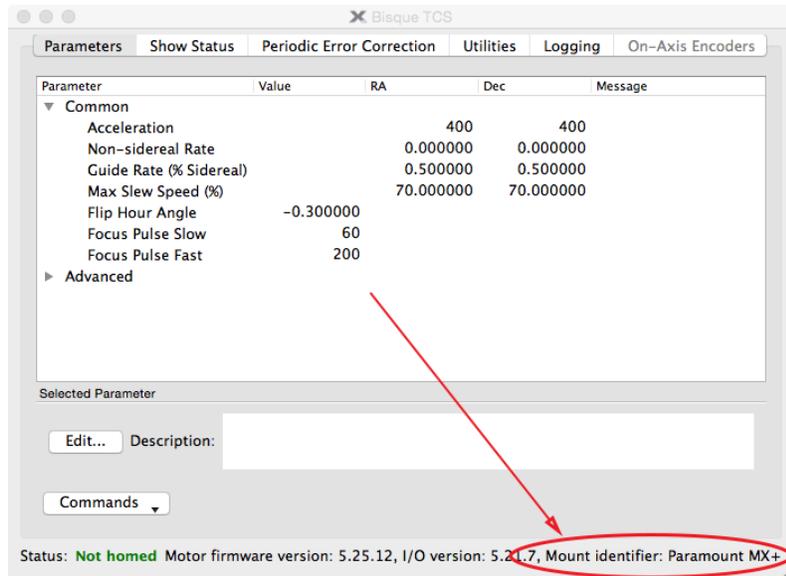	
	Figure 10: Mount Identifier on the Bisque TCS window.
	
	If not, configure the MKS 5000 for your mount, as described below:
	
	1. Make sure to install the latest daily build of TheSkyX:
	   • Mac: http://www.bisque.com/sc/media/p/47013.aspx
	   • Windows: http://www.bisque.com/sc/media/p/45603.aspx
	2. Launch TheSkyX Pro.
	3. Choose the **Connect** command from the **Telescope** menu.
	4. Choose the **Bisque TCS** command from the **Tools** pop-up menu.
	5. On the **Parameters** tab, choose the **Restore Defaults** command from the **Commands** pop-up menu.
	6. **CRITICAL**: When prompted, choose the correct model of your mount (Figure 11).

7. **CRITICAL**: Choose the *Save All Parameters To Mount* command to permanently save these settings to the MKS 5000.
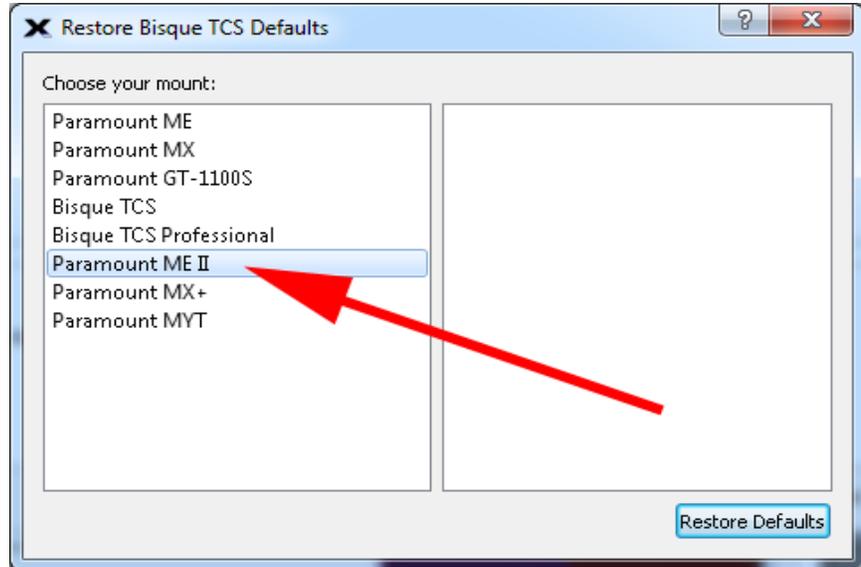8. Disconnect, turn off the mount reconnect, and verify that the *Bisque TCS* window shows correct *Mount Identifier*.

Figure 11: Choosing your Paramount model.

The Paramount will now track at the sidereal rate.