ServoCAT

Quick Start and Troubleshooting Guide

Welcome..... to the world of the CAT....

1 Addendum - Quick Start

Alright.... it is installed! Now you want to use it right? OK.... follow these instructions and you should be on your way in no time.

First off as is stated in the manual you do not want to exercise the ALT axis without the scope being fully assembled. You can however use the clamp system to hold the mirror box at a bit of an angle without any problems. It is suggested you place the AZ in manual (DISENGAGED) whenever not using it and leave the ALT in ENGAGED. If one of these steps does not work out please refer to the Troubleshooting section.

NOTE: ALL of the following (with the exception of confirming the DSC/encoders are setup right) can be done inside or during the day - none of it needs to be done under night skies. As a matter of fact until all is confirmed to be set right it is suggested you do this during the day so you can see everything and so you do not arrive at a dark site unprepared and find there is a setup issue!

DISENGAGE both axes until you have confirmed you have control of each axis by the HC.

Remember the three finger salute! ANY three (or more) buttons on the HC will make the scope stop (not instantly - it will decelerate in 1/2 second). USE IT WHENEVER YOU ARE NOT SURE THE DIRECTION OR MOTION IS CORRECT! To start again wait 3 seconds and push and hold for 2 seconds any of the motion buttons.

Read Chapter 4 of the ServoCAT Manual - this will familiarize you with the HC (also read the paper supplied with the HC as well note the plastic card for reference).

- Check to be sure the motor power leads (large 8 conductor cable) are plugged into the rear jacks on the back of the ServoCAT - correctly! Also confirm the encoders (small RJH connectors/black) are correct. *If one is swapped the motors will run away when power is applied or the first time you hit the HC.*
- Be sure the E-Stop switch on the ServoCAT is set to OK. Also plug in the Hand Controller (HC).
- Power the ServoCAT on -The green SLEW LED will be on, flash off and back ON.
- Using the HC with the speed set to JOG (push JOG) push the AZ CW button. Does it move CW? If not, if it is moving CCW, then the configuration in the ServoCAT is incorrect. This can be changed by referring to the section in the manual on Configuration. (The Track AND GOTO Direction for the AZ would need to be changed).
- Using the HC push the UP button (top button in the "yellow diamond". Does it move up? If not, if it is moving down, then the configuration in the ServoCAT is incorrect. This can be changed by referring to the section in the manual on Configuration. (The Track and GOTO Direction for the ALT would need to be changed).
- If the above were correct (or corrected by running the ServoCAT-Sky configuration program) then the TRACK direction will be correct.
- SKY COMMANDER users read this section, ARGO NAVIS skip to the next section
  - Refer to Appendix C of the ServoCAT Manual (found on your CD) for connections and setup for the Sky Commander internal to the ServoCAT.
  - With power off on your Sky Commander hold the UP arrow button while turning the Sky Commander power on. Change its baud to 19200, hit E and turn the power off the Sky Commander. [for XP4users see the Appendix in the ServoCAT manual]
  - ENSURE the Sky Commander can do a proper 2 star alignment AND find objects manually. This means after an align you can pull up an object on the screen, show its offset (push the up arrow), and move to it manually and see the offset go to 0,0. If not, if it is off by more than a few tenths than there is something wrong with the alignment, Sky Commander settings, or the encoders/cable. Correct this FIRST before going on!!! The ServoCAT CANNOT operate properly on bad data from the Sky Commander!
  - Do a 2 star alignment with the Sky Commander.

- o Using the provided (with ServoCAT cables) black 4 conductor cable plug the Sky Commander into the ServoCAT on the front mounted marked DSC connection. The DSC light on the front of the ServoCAT should come on indicating it has a proper signal.
- o Select an object on the Sky Commander that is up and well placed (not near the horizon or zenith). DO NOT DO A GOTO! Set the scope to manual and move the scope to the object. Is it there with the offset indicating 0,0? If not correct the DSC problem.
- o Put the scope in ENGAGED mode and using the GUIDE mode of the HC center the object (zero out the offsets).
- o Slew ONLY the AZ either CW or CCW away from the object so the display reads between 10 and 20 degrees of offset. ONLY the AZ should have changed (the ALT may have changed by a few tenths).
- o Remember the three finger salute! ANY three (or more) buttons on the HC will make the scope stop. USE IT WHENEVER YOU ARE NOT SURE THE DIRECTION OR MOTION IS CORRECT! To start again after having stopped wait 3 seconds and push any of the yellow motion buttons for a second.
- o Hit the GOTO (green) button and release it (note: it only needs a 1/4 second push and then release... if the GOTO light and the SLEW light on the ServoCAT start to blink you actually pushed it way too long and have disabled the GOTO - push it again for more than a second and release to re-enable if this is the case. GOTO only needs a short push!)
- o If after pushing the GOTO button it goes the wrong direction use the three button stop on the HC. *Remember the GOTO button only needs a 1/4 second push then release!*
- o If the scope moves towards the object and it is close then you are fine. If away then either the DSC is not set right (i.e. it is not able to find objects manually) or the GOTO direction in the Configuration is set incorrectly for the AZ axis. Refer to the manual to correct this.
- o Move (manual or slew) back to the object. Center it again.
- o Now using ONLY the ALT UP button (or down) move away from the object by about 10 or 20 degrees.
- o If after pushing the GOTO button it goes the wrong direction use the three button stop on the HC.
- o If the scope moves towards and it is close then you are fine. If away then either the DSC is not set right (i.e. it is not able to find objects manually) or the GOTO direction in the Configuration is set incorrectly for the ALT axis. Refer to the manual to correct this.
- o This completes the initial setup and confirmation of the ServoCAT. To refine GOTO accuracy (and Track length) refer to the main manual.

- • ARGO NAVIS users read this section, SKY COMMANDER users read the previous section
  - o The Argo Navis requires version 2.0 or later software to operate with the ServoCAT. [Mode Status - turn the dial to see the rev level of the Argo Navis firmware]
  - o Set the Argo Navis to "servocat" as follows:
    - ▪ Go to SETUP/SERIAL/SERIAL1/baud and set it to 19200
  - o Go to SETUP/SERIAL/SERIAL1/startup and set it to "servocat"
  - o ENSURE the Argo Navis can do a proper 2 star alignment AND find objects manually. This means after an align you can pull up an object on the screen, show its (GUIDE mode), and move to it manually and see the offset go to 0,0. If not, if it is off by more than a few tenths than there is something wrong with the alignment, Argo Navis settings, or the encoders/cable. Correct this FIRST before going on!!! The ServoCAT CANNOT operate on bad data from the Argo Navis! [Refer to our help guide "Some DSC Setup Notes" for assistance in this area.]
  - o Do a 2 star alignment with the Argo Navis.
  - o Using the correct cable to the Argo Navis (our supplied black, 9' 4 conductor) plug the Argo Navis SERIAL1 into the ServoCAT on the front panel marked DSC. The DSC light should come on indicating it has a proper signal. It will flash if connected and not aligned. **[Remember to ALWAYS power up the ServoCAT BEFORE finishing the alignment - as confirmed by the "beep" from the Argo and the blinking red DSC light on the ServoCAT]**

- Select an object on the Argo Navis that is up and well placed (not near the horizon or zenith). DO NOT DO A GOTO! Set the scope to manual and move the scope to the object (you can also slew to it - but do not do a GOTO yet). Is it there with the offset indicating less than 0.5 degrees in each axis (think of the arrow in the Argo display as a decimal point)? If not either the alignment wasn't accurate enough or this is a DSC problem - correct this before moving on!.
- Put the scope in ENGAGED mode (both axes) if disengaged.
- Slew ONLY the AZ either CW or CCW away from the object so the display reads between 10 and 20 degrees of offset. ONLY the AZ should have changed (the ALT may have changed by a few tenths).
- Remember the three finger salute! ANY three (or more) buttons on the HC will make the scope stop. USE IT WHENEVER YOU ARE NOT SURE THE DIRECTION OR MOTION IS CORRECT! To start again wait 3 seconds and push any of the motion buttons for a second and then release. If after pushing the GOTO button it goes the wrong direction use the three button stop on the HC to stop it.
- Hit the GOTO (green) button and release it (note: it only needs a 1/4 second push and then release... if the GOTO light and the SLEW light on the ServoCAT start to blink you actually pushed it way too long and have disabled the GOTO - push it again for more than a second and release to re-enable if this is the case. GOTO only needs a short push!
- If the scope moves towards the objects position and it is close then you are fine. If away then either the DSC is not set right (i.e. it is not able to find objects manually) or the GOTO direction in the Configuration is set incorrectly for the AZ axis. Refer to the manual to correct this.
- Move (manual or slew) back to the object.
- Now using ONLY the ALT UP button (or down) move away from the object by about 10 or 20 degrees. Push and release the GOTO again.
- If it moves towards the object and it is close then you are fine. If away then either the DSC is not set right (i.e. it is not able to find objects manually) or the GOTO direction in the Configuration is set incorrectly for the ALT axis. Refer to the manual to correct this.
- This completes the initial setup and confirmation of the ServoCAT. To refine GOTO accuracy (and Track length) refer to the main manual.
- *PLEASE REFER TO OUR SUPPLIED, both on the CD and printed for those not wanting to read instructions on the CD, "ServoCAT Setup and Usage sheet" as well as "Some DSC Setup Notes". The former has the disengage positions for each axis shown - pay particular attention to the ALT position for disengage. The latter has a complete step by step setup of the Argo Navis along with verification testing and use.*
- **HAVE FUN! Don't get frustrated - write to us if you have questions!**

2 Track Improvements

NOTE: the MOST EFFECTIVE means of improving Track capability is simple to do an AutoCAL! This requires an AutoCAL cable. Refer to the SuperProgram manual AutoCAL9ibrate) section for more information on this process.

Most systems when shipped have the ability to track an object in a medium power eyepiece for 15 - 60 minutes.... if you want better it can easily be accomplished simply by tweaking the ratios stored in the ServoCAT. This can be accomplished during the day - and is actually suggested to be done during the day so you can see well and so it is out of the way before you head off.

Remember the three finger salute! ANY three (or more) buttons on the HC will make the scope stop (not instantly - it will decelerate at twice the speed set in your configuration file). USE IT WHENEVER YOU ARE NOT SURE THE DIRECTION OR MOTION IS CORRECT! To start again wait 3 seconds and push any of the motion buttons.

- Do a 2 star alignment with your DSC. If using the Argo Navis go to SETUP/GUIDE and set the digits to 2. This will provide a higher readout resolution. This alignment can be done during the day by using Polaris (most astronomers know where Polaris is even during the day - within 10 degrees or so is fine) and one other star that you know the rough position of (for example we know that at one time during the year Rigel is at about 160 deg AZ and 20 degr ALT).
- Pull up an object to the South (you need not see it - just find one in the data base that would be to the south - in our example we chose M42) and center it (use a GOTO if you want to).
- Using the CCW button and having the speed set to GUIDE move PAST the object by a couple tenths of a degree. This is done to eliminate any backlash in the system in order to ascertain the precise ratio needed.
- Use the CW button ONLY and with the speed set to GUIDE zero out the AZ offset. If you overshoot it by a small amount then repeat the step previous to this one and this step. (Offset displayed by UP arrow on Sky Commander, GUIDE mode on Argo Navis).
- When zeroed note the time and the offset value.
- Let the scope track the object for a minimum of 15 minutes - 30 or 60 is preferred.
- After the time frame you have selected note the numerical offset value on a piece of paper.
- Using the GUIDE speed and the AZ buttons ONLY see which direction you have to move the scope to bring it back to the object. If you had to use the CW button then the scope was tracking to slow and the gear ratio set by the ServoCAT-Sky Configuration program is too low - it needs to be increased in value. If you had to use the CCW button then the scope is going too fast - you need to reduce the ratio. If the offset was very small you can either leave the ratio or do the test with a longer time period (try 60 minutes).
- The formula to calculate the amount of change is as follows:

Base gear ratio (already in the Obsession data files on your CD)

Change =   error in decimal degrees / amount the sky moved in the period

Final Corrected Gear Ratio = Base Gear ratio +/- Change

One example - You did the test for a total of 30 minutes. It was off by 0.09 degrees and it was too slow
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The sky (earth) is moving at 15 degrees/60 minutes so in 30 minutes it would have moved 7.5 degrees.

The Error therefore is :   0.09 / 7.5 = 0.012

Your scope is a 20" and the programmed ratio for the AZ is 8258. The amount to change the ratio is

$$8258 \ x \ 0.012 \ = \ 99$$

Since the object was falling behind the ratio needs to be increased in the configuration program so set the new value to

$$8258 \ + \ 99 \ = \ 8357.$$

- Pull up an object to the East (you need not see it - just find one in the data base that would be to the east) and center it (use a GOTO if you want to). Use the Guide speed on the HC to get the offset (UP arrow on Sky Commander, GUIDE mode on Argo Navis) down very close to zero. Note the time and the offset value.
- Using the DWN button with the speed set to GUIDE move PAST the object by a couple tenths of a degree. This is done to eliminate any backlash in the system in order to ascertain the precise ratio needed.
- Use the UP button ONLY with the speed set to GUIDE zero out the ALT offset. If you overshoot it by a small amount then repeat the step previous to this one and this step. (Offset displayed by UP arrow on Sky Commander, GUIDE mode on Argo Navis).
- When zeroed note the time and the offset value.
- Let the scope track the object for a minimum of 15 minutes - 30 or 60 is preferred.
- After the time frame you have selected note the numerical offset value on a piece of paper.
- Using the GUIDE speed and the ALT buttons ONLY see which direction you have to move the scope to bring it back to the object. If you had to use the UP button then the scope was tracking to slow and the gear ratio set by the ServoCAT-Sky Configuration program is too low - it needs to be increased in value. If you had to use the DOWN button then the scope is going too fast - you need to reduce the ratio. If the offset was very small you can either leave the ratio or do the test with a longer time period (try 60 minutes).
- The formula to calculate the amount of change is as follows:

Base gear ratio (already in the Obsession data files on your CD)

Change =   error in decimal degrees / amount the sky moved in the period

Final Corrected Gear Ratio = Base Gear ratio +/- Change

One example - You did the test for a total of 30 minutes. It was off by 0.3 degrees and it was too fast (used the DOWN button to recenter it)
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The sky (earth) is moving at 15 degrees/60 minutes so in 30 minutes it would have moved 7.5 degrees.

The Error therefore is :   0.3 / 7.5 = 0.0400

Your scope is a 20" and the programmed ratio for the AZ is 8298. The amount to change the ratio is

8298 x 0.0400 = 332

Since the object was going too fast the ratio needs to be decreased by this amount in the configuration program so set the new value to

8298 + 332 = 7966.

- Be aware that alignment and mechanical details will cause this to vary slightly. Setting this once should be more than adequate

NOTE ON BACKLASH: There is backlash in your system. We have designed it to reduce the amount but without going to exotic (read "expensive") gearing we cannot eliminate it. The software will compensate for this by speeding the motor up a predetermined amount each time you change directions. This amount is listed in your configuration file for each axis. If you do decide to play with it be careful to increase it slowly - it is not good to have too much backlash comp. Try increasing by 1 or 2 arcmins at a time.

You can also take backlash into account when positioning an object by centering the object using the same direction button that the sky is moving. For example - if an object is anywhere from directly east to directly west but going south in the process (lower hemisphere) then the AZ will always be tracking going CW... if it is the "upper" hemisphere the AZ will always be tracking going CCW. Likewise if an object is east of the meridian it will be rising (UP on ALT), if western it will be setting (DWN). So if you are looking at an object that is southeast position that object in the center of the eyepiece by using the CW and UP buttons as your last button depression. This will eliminate any backlash. The alternatives are to program the backlash variable or to not worry about it - it is typically only a few arcminutes - once it gets to that point (by drifting) it will track from there on.
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3 Troubleshooting

DSC Problems:

First and foremost the DSC (Argo Navis or Sky Commander) MUST, we repeat MUST be setup properly to operate the ServoCAT. Also the ServoCAT requires the DSC to be connected and properly operating to get EITHER TRACKing or GOTO.

DSC (Argo Navis or Sky Commander) OPERATION:

If your unit has been programmed with what you feel is the right gear ratio and encoder counts and it does not track properly you will need to do the following:
- ✓ Ensure DSC (Argo Navis or Sky Commander) has been set up properly – it has REV and NORM settings for both axes and these need to be correct. This can be set up during the day.
  CAUTION CAUTION CAUTION if doing this during the day KEEP THE MIRROR COVERED and away from the SUN!

✓ Ensure DSC encoder counts are set correctly (typically either +8192 or -8192)
✓ Do your 2 star alignment using Polaris and one other known star position (approximate is all that is needed – the star need not be seen). Now point the scope south and look at the DSC readout for RA. Move the scope towards the west – the RA value should go down (newer hour). If not reverse the setting for this axis: on the SC change to REV if NORM and vice-versa; if the Argo Navis change from + to - or vice versa). Point the scope south and at ~10 degr above the horizon. Note the readout DEC value. Move the scope upward. The DEC value should be negative but should be going positive (smaller values). If not change the settings.
This all assumes Northern hemisphere. NOTE: ONCE SET – DO NOT CHANGE! The CAT has its own settings to compensate from this point but it has to know the DSC is correct!
✓ Run the system. Remember power to the CAT can be shut off at any time – no reinitialization OR re-alignment is required once done the first time (as long as the DSC stays powered and connected to its encoders).
REFER to the ServoCAT-Sky manual Appendix C – Additional Notes on TRACK adjustment for improving tracking.

SERVOCAT OPERATION:

The majority of these items refer to the use of the Plug-n-Play enclosure system.

TERMS: ServoCAT referred to as CAT
        Plug-n-Play enclosure referred to as PnP
        RXDesign HC controller referred to as HP8
        Sky Commander referred to as SC
        Argo Navis referred to as AN

No lights on ServoCAT	-Confirm power plug plugged in to a 12V source. -Confirm source is not current limiting -Check fuse in 12V auto plug (replace with 1.25" 5-10A fast blow)
Leftmost RED LED (SC) not on, Green (Slew) LED is on	-DSC not plugged in and/or turned on -DSC baud not set to 19.2K and/or skycomm emulation (if AN) -Wrong cable used for DSC in use (different from SC to AN) -If unit serial number ends in -03 then the internal jumper for DSC could be wrong (see Argo Navis addendum)
GREEN (Slew) LED not on	-E-Stop / OK button set to E-Stop; push motion button on HC
YELLOW (Sync) LED not on	-Only activated by a FUNCT/SYNC command from the HP8. Toggles off by pushing this combination again. Requires DSC to be plugged in and operating.
Motor turns slow	-Download your systems parameters using ServoCAT Config (sect 2 & 5)
Motor turns wrong direction	-Download your systems parameters using ServoCAT Config (sect 2 & 5). Track Direction to correct this.
Motor does GOTO in wrong direction	-Download your systems parameters using ServoCAT Config (sect 2 & 5). GOTO Direction to correct this. Each axis has its own parameter.
HP8 LED not on when speed switch set to JOG (middle) or Slew (top)	-Ensure HC cable plugged in all the way at both ends. -Check cable for breaks -Confirm CAT powered up with its LED's on
After doing 3 button B-Stop the CAT does not respond right away to button depressions	-There is a 3 second delay after a B-Stop to allow release of the buttons. Check the ESTOP switch.
Sometimes button depressions go unnoticed – especially the GOTO	The sampling of the DSC is top priority – it is sometimes slower in responding and thus some button depressions may be missed. Push again and for a little longer.
Travel Limit switches are desired	-Contact RXDesign on how to implement ALT axis down and p overtravel limits.
Configuration program does not download	Upgrade to version 1.3 or Follow the sequence: a) Power off CAT, plug in 4 pin (!) cable from PC Port (inside unit) to the PC. Note Comm port (com1, 2, 3, or 4) b) Leave power OFF CAT and start ServoCAT config program c) Change values as needed and SAVE the values!

	d) Go to Communications menu item and set comm port e) Push the "CONNECT" button next to the red indicator on the screen – it should change to read "DISCONNECT" meaning it is connected and you hit it to disconnect (disconnect if you have to change your comm port at this time). The light next to it should now be Green and at the bottom of the screen it should say "CONNECTED". f) Power up the CAT. g) There should be a flash of text at the bottom of the screen, the green light should change to yellow momentarily and then to RED and the text by the button should now say "CONNECT" again. If nothing else shows and this sequence happened then your parameters will be in the unit, power down and up.
Configuration program does not download (after above)	-Before doing step 'e' above try powering up the CAT and IMMEDIATELY hitting the DISCONNECT button. Step 'g' should follow from here.
Upgrade does not work	-All files under the upgrade directory need to be in the directory from which you run this utility. If it does not see them it will abort. Go to Setup pulldown and set directory