

# *ServoCAT*

Special Edition for Obsession and close clones

By StellarCAT  
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*Welcome..... to the world of the CAT....*

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# 1 Introduction

Congratulations! You have just purchased a complete system that will in short order provide you with endless hours of enjoyment at your premium telescope! This manual has been designed with you in mind. It is not the installation manual – for this refer to your CD. This manual will provide you with the setup procedures for your telescope after the drive system is installed.

***ServoCAT***... ***Servo*** (based) ***Computerized Astronomical Telescope system***,  
Your system includes (other than the mechanics):

| <i>Quantity</i> | <i>Item</i>                                                                              |
|-----------------|------------------------------------------------------------------------------------------|
| 1               | <b><i>ServoCAT</i></b> Controller enclosure                                              |
| 1               | Wired StellarCAT Hand Controller (referred to as "HC" - version 'next-gen')              |
| 1               | CD containing <b><i>ServoCAT</i></b> config software, Upgrade, Manuals , and USB drivers |
| 1               | All necessary cabling to connect to your peripherals.                                    |

Once configured (motors mounted, cables installed, power available) the user is but to run the Configuration Utility ***ServoCAT***-Sky to configure the particulars of his system including but not limited to the desired speeds during motion, the mechanical specifications, and the directional control of each axis. This utility is only required to be run once.

**Obsession owners:** Your default values have already been programmed into your system. Unless you want different speeds and/or the tracking is not quite exact you need not run any additional software – just plug it all in and use it! The one exception to this is the backlash compensation setting. The factory default for BL comp is set low intentionally as ultimately it is based on your particular telescope. You may want to increase this value to what is necessary for your scope. Note ALL gear systems have backlash to one degree or another. The ***ServoCAT*** software will automatically compensate for this but needs to know how much to compensate. See section 7 for more information on backlash and refer to the "Backlash Optimization" document on your CD.

System requirements are: Windows XP/Vista.Win7/8. .

**Meade LightBridge 16 Owners:** The default values are already programmed in. If you want to change the settings or do an AutoCAL please contact StellarCAT for the proper template [LB16.dat] [also found on the ***ServoCAT*** CD under TOOLS/Other Configuration Files] **OPEN FROM *ServoCAT*-Sky ONLY!**

## 2 Connection of the ***ServoCAT***

### 2.1 ***ServoCAT*** mounting

The ***ServoCAT*** should be mounted with free air flowing under the unit front and back to allow some minimal amount of cooling to the internal electronics. It should also never be subjected to water of any sort (normal dew is not a problem). Remember that there are status LED's on the front that you may find useful – thus mounting the unit where these can be seen should be considered. Likewise the 2 switches on the front of the unit. Other than these considerations it is fine to mount it inside the rocker. . [An optional Remote Status Unit (RSU) is available to remote the status LED's as well as the switches].

## 2.2 External Connections



### 2.2.1 ServoCAT PnP Power

The *ServoCAT* is powered from a nominal 12V DC power source. The provided RCA cord (large conductor wires) is for this use. It is terminated in a standard 12V automotive plug (male) if you have a non-powered ground board. The unit is fused in both the power plug (10A fast blow) as well as internally. Replace the auto plug fuse with a 10A fast blow fuse – no larger! There is an extra fuse for the internal one taped to the lid of the unit. If you purchased the powered ground board option you will have an RCA/Phono plug on the cable end to mate with the included power rail. The unit is NOT reverse voltage protected (reverse protection reduces the available life of a battery!) - if you do accidentally reverse the voltage the external fuse should blow (the internal fuse might blow).

The current requirements are (from your 12V source):

Tracking: typical 0.25 – 0.4A

Slewing (one axis): 0.5-1.5A

Slewing (both axes full speed): 2-4A [momentary peak during acceleration only]

Average user: 0.4A [400mA] average or 0.4Ah

The unit will operate for 6 – 12+ hours on a single 7AH battery assuming most of the time is spent tracking and not slewing (or doing a GOTO). A larger 12Ah battery is however suggested in order not to have to charge the battery as frequently. Gel cells and Marine Deep Cycle Discharge batteries are much preferred over standard lead acid batteries. The former has a much better life over many recycles. A standard motorcycle battery will do all right but will typically have to be replaced every 12-18 months depending on use. If using the Powered Ground Board plug the provided 12' cable into the foot that has the mating connector and the other end to your battery - center +.

### 2.2.2 Servo Encoder Connections

The supplied servo motor/gearbox systems have small PC boards mounted to them - this allows a motor cable (8 conductor) and its encoder (4 conductor RJH connectors) to be routed back to the unit. These connectors mate up with the appropriate ones on the back of the *ServoCAT* unit – ensure AZ encoder and motor are plugged in to the correct ones (i.e. do not mix the AZ encoder with the ALT motor). The back label indicates each encoder and motor connector.

### 2.2.3 Digital Setting Circle connection

#### **Argo Navis:**

Using the StellarCAT supplied black RJ11 4 conductor plug one end into the DSC port of the *ServoCAT* (front panel). Plug the other end into the SERIAL1 comm port on the top right of the Argo Navis. This should be done with power off to both units! **Refer to section 3 to configure the Argo Navis properly.**

#### 2.2.4 Handpad Connection

The wired handpad plugs into the front panel "Handpad" jack. The other end of the supplied handpad cable plugs into the base of the handpad.

#### 2.2.5 Planetarium and PC-connection (for *ServoCAT* configuration) [OPTIONAL]

If a Planetarium program is to be used and/or if configuring the *ServoCAT* plug the supplied USB cable into the front *ServoCAT* PC Port. The other end plugs into an available USB port on the computer. NOTE: refer to the chapter on installing the USB driver files BEFORE attempting to use the *ServoCAT* - PC connection. **In the planetarium program select "*ServoCAT*" and 9600 baud. For GOTO from the planetarium program see section 8. If *ServoCAT* (or sevocat/argo) is not available you can select "Skycomm" or you may have to use an ASCOM driver for the planetarium program your using.**

#### 2.2.6 Upgrade PC Connection [OPTIONAL]

The *ServoCAT* is designed to allow future feature enhancements and bug fixes to be easily downloaded into its FLASH memory. The connection to the PC for this purpose is via the supplied USB cable. Refer to the chapter on installing the USB drivers before attempting to upgrade. See section 9 for further information on upgrading your *ServoCAT*.

**NOTE on cabling: The cables are NOT standard phone cables. Due to protocols already established the cables supplied with the *ServoCAT* MUST be used.**

## 3 Operation

The following sequence assumes all required connections have been made as listed in 2.2.1-2.2.4 above.

First time pre-startup Argo Navis configuration:

- 3.01) The Argo Navis needs to have version 3.0.0 software or later to operate with the *ServoCAT*. This can be obtained from the WildCard-Innovations website. You can determine the version by turning on the AN, going to STATUS and hitting enter, then turning the dial to see the version. Be sure to use the proper serial cable (Argo Navis to PC) to program the Argo from the PC.
- 3.02) Set the emulation mode of the Argo Navis as follows:
  - a) Go to SETUP, SERIAL, SERIAL1. At this point it will be flashing "baud". Hit ENTER and set this to 19200.
  - b) Hit EXIT once. Turn the dial once and it will be flashing "startup". Hit ENTER and change this to 'servocat'.
  - c) Power the unit down before using it with these new values.
- 3.03) Using the proper supplied cable as mentioned above connect the SERIAL1 port of the Argo Navis to the *ServoCAT*. Approximately 10 seconds after turning power on to both the *ServoCAT* and the Argo Navis the red (~ center on the front panel) DSC LED should start to blink if it is properly communicating with the *ServoCAT* and the Argo will "beep" three times :

**'bee-boop, bee-boop, bee-boop'.**

The blinking (and beeps) is an indication that they 'see' each other and that the Argo is telling the *ServoCAT* that it is not aligned. When the alignment is finished the red light will go to solid on. Refer to Chapter 4: Hand Controller and the use of the GOTO button to improve alignment accuracy.

## Operational Sequence:

- Power up your Argo Navis.
- Set your scope to MANUAL (disengaged) control (not required but some may find aligning the stars easier to do if in manual mode).
- Power up your *ServoCAT*. Confirm the red DSC light on the front of the *ServoCAT* is blinking.
- Do your normal 2 star alignment on the DSC. Note if used with the Argo Navis you can use the *ServoCAT* hand controller "GOTO" button as the equivalent of the Argo Navis' ENTER button during your 2 star alignment - this increases the accuracy of the alignment process as you can visually confirm the star is aligned when the button is pushed. This is an important and powerful feature - use it!
- Engage the motors on your scope using the manual engage/disengage levers.
- Use your scope as you normally would - tracking and full GOTO will be available at this time.

Refer to the Hand Controller [HC] section for operational notes on using the hand controller.



## Operation LED's (front panel mounted LEDs)

### **NOTE FOR ALL LED's : the "LED" switch needs to be on (UP) for the LED's to light**

Center mounted RED marked "DSC" to the right of the DSC jack

This Red LED indicates the status of the connection to the Argo Navis. If there is a connection problem or the Argo Navis serial values have not been set correctly the LED might still be on ... or it could be off. Confirm connections and settings. If track and GOTO information is available from the DSC this LED will be on. Note however that if the baud is set wrong this LED could still be on! If you're not tracking properly check your settings in your DSC.

Right-most GREEN marked "Slew"

This Green LED indicates the motor condition. If lit the motors are on (tracking or slewing). If off the motors are stopped (ESTOP condition). If off the OK switch needs to be up or in the OK position. And one of the handpad motion buttons (yellow) needs to be pressed momentarily to re-enable it. Note if this light is blinking you have the handpad set to "GOTO DISABLE". See section 4 on HC operation. If the green light is off completely check section 7 re AXIS LIMIT.

Right-most YELLOW marked "Sync"

This Yellow LED indicates the state of the Local Sync mode. If lit Local Sync is active. See section 4 for additional HC functionality.

Center YELLOW left of the Handpad Jack

This Yellow LED below the handpad input is used to indicate you have a valid handpad connected. It will be on when the handpad is connected and off when not connected or the channel (if using a Wireless HC) is set different from the units address (see section 4 for details of setting the Wireless HC channels). If you have a HC (Hand Controller) connected and this is not on then check your cable to be sure it is fully plugged in at both ends. If blinking and a Wireless the channel is not properly set. See section 4.

Left-most RED marked "AUX"

This red LED indicates the status of AutoLOCK. See page 12, 13.

Left-most YEL marked "SPm"

This yellow LED indicates SuperProgram mode. See the separate SuperProgram manual for its usage.

## Operation Switches (front panel mounted switches)

### Left-most "LED's OFF" Switch

This switch is used to turn off the front panel LED's when the unit is installed inside the rocker box and the LED's are a problem (in the light path). Generally they will not be a problem. The RSU (Remote Status Unit) will allow the LED's to be remoted to another place outside the box via the supplied cable. Contact StellarCAT for this unit.

**REMEMBER to turn the LED's ON when troubleshooting!**

### AUX Switch

This switch is used to ENABLE AutoLOCK if the object is a sidereal object and it will turn AutoLOCK on if the object is a satellite. See page 12, 13.

### Speed 1/2 Switch

This switch is used to select which configuration speed settings will be used with the HC. Please refer to sections 4 - 7 for details on tailoring the speed values to the users requirements. The factory shipped default values for speed are lower for Speed 2 than for Speed 1. This is intentional. [The user can, if they so decide, change this of course]. The main purpose is to allow a slower GUIDE speed when using higher to high power. When at higher power the field is smaller - thus it is more comfortable to GUIDE at a slower rate so as not to overrun the field. Flipping the Speed switch to the "2" setting will accomplish this. As well it will provide 3 more Spiral Search patterns again tailored for the higher power (tighter and slower spirals).

### "E-Stop/OK" Switch

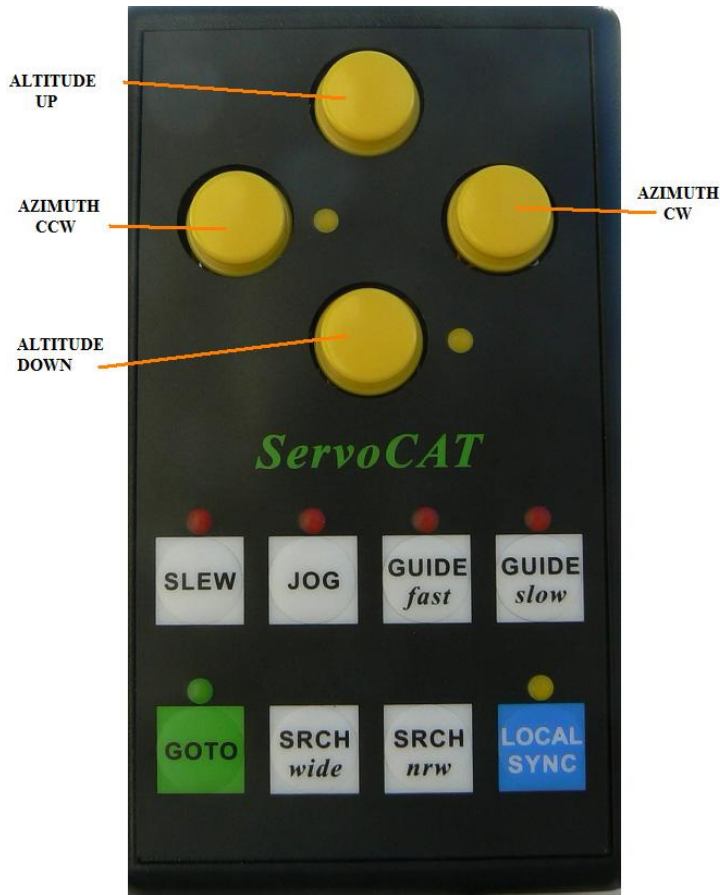
This switch should normally be left in the "OK" position. This allows normal operation of the unit. If at any time the motors need to be "stopped" this switch can be flipped to "STOP" to accomplish it. The motors will halt at a rapid rate (not overly rapid which could cause mechanical issues due to the stress). Also note: if the motors are not running when you think they should be - check this switch to be sure it is set to OK. If in the E-Stop mode and everything appears alright flip the switch back to OK and push one of the YELlow motion buttons to bring the unit back to "Slew Permissive" mode (Slew LED ON again). Also note the 3+ button "B-Stop" will do the same function as the E-Stop switch. See section 4 on the HC for the description of B-Stop.

Operational Note(s): The Servomotor gearbox system has been designed to provide LOTS of torque - enough to drive 30-40" monster scopes with reserve. Learn to use the 3+ button "B-Stop" function, you might need it during your initial outings. If for example you select an object and there is a ladder in the way - you might want to stop the movement quickly. Use the B-Stop function to stop it before it reaches these limits (ANY 3 or more buttons on the handpad will stop it). We do have over-travel limit switch capability for those that want to wire it up to their system. Contact the factory for this capability. In addition software current limits labeled "Axis Limits" can be set to turn the axis off when it hits an obstruction. See section 7.2 for detail on this.

## 4 Hand Controller (wired and wireless) Usage

This section describes in detail the operation of the HC.

### 4.1 RXDesign HP8 Handpad - Version 'next-gen' : January 2010



NOTE: The LED's on the HC are intentionally dim - they're designed to be used at night and not to detrimentally effect your night vision! It's normal on power up for ALL LED's to turn on briefly followed by the GUIDE fast speed being selected with its LED indicator.

#### *Directional Buttons (also referred to as "motion buttons"):*

The 4 yellow buttons, in a diamond shape, represent for an ALT/AZ (dob) mount UP/DWN, CW/CCW. For an EQ mount: N/S, E/W. Note if one pushes both buttons for an axis together, say UP and DWN for one second and then releases them the yellow light next to that axis function (i.e. in this case the one next to the DWN button) will be on and the directions will be reversed, UP will cause it to go DWN and vice versa.

Reverse this process to get them back to normal again. *Note further this is NOT a work-around for motors that are not going the right direction when the programming is incorrectly done or the ALT cable is wrapped incorrectly.*

#### *Speed Selection Buttons:*

The speed of the motors will be determined by the speed selection on the hand controller as indicated by their individual LED and on the position of the Speed 1/2 switch on the front of the ServoCAT. The speeds available are: SLEW, used for positioning the scope over large distances. "JOG" used for positioning the scope over smaller distances yet while still not looking into an eyepiece - for example to best place the scope using a



Telrad or low power finder scope. "GUIDE fast" is used when looking into the eyepiece at an object and the field is large - i.e. a higher speed is needed to get across the field comfortably. "GUIDE slow" similar to GUIDE fast except used when the field is more narrow. Another way to think of "fast" and "slow" would be "wide" and "narrow" as in the eyepiece field. Note there are two "sets" of these four speeds - the second set being selected by flipping the SPEED 1/2 switch on the front of the *ServoCAT*. Further note the SLEW, JOG and, GUIDE speeds are all programmable by the user to custom tailor the operation to their particular scope, typical choice of eyepieces, and comfort. See sections 5-7 for details on doing this.

### Guide speeds:

With SPEED 1/2 set to 1: **GUIDEslow** = **GUIDE1**      **GUIDEfast** = 2X **GUIDE1**

With SPEED 1/2 set to 2: **GUIDEfast** = **GUIDE2**      **GUIDEslow** = 1/2 x **GUIDE2**

### **GUIDE1, GUIDE2 : the parameters in the dat file set using *ServoCAT-Sky***

#### *Additional HC functionality:*

**BSTOP:** By pressing more than 2 buttons (any) both motors will decelerate rapidly to a STOP. They will remain there for 3 seconds after which a 2 second push of a motion button (yellow) will restore motion. If in BSTOP the green Slew light will go out.

**GOTO:** When depressed the *ServoCAT* will move to the currently selected Argo Navis object at a speed equal to the SLEW speed if the SPEED SELECT switch is set to (SLEW) or (GUIDE). If the speed select switch is set to the JOG position the GOTO speed will be 2/3 of the programmed SLEW rate. A GOTO move can consist of either 2 or 3 moves to the object, getting a new position after the 1st (and 2nd) move to finalize the position. When finished the Argo Navis will beep:

**'bee-boop'**

to indicate a completed GOTO. If the object you have selected is either below or above the Argo Navis programmed (SETUP GOTO) HORIZON or ZENITH limits the GOTO will not work and you will instead hear :

**'bee-booooooop bee-booooooop bee-booooooop'**

Note if you are sure this object is inside the limits then either the DATE/TIME, and/or LOCATION (SETUP) has not been set properly in the Argo Navis.

**The GOTO requires only a short push and release. The GOTO doesn't happen until the button is RELEASED. If you hold it too long and the green SLEW light is blinking (the HC green GOTO light) then you've disabled it!**

**GOTO BUTTON DISABLE:** GOTO PUSHED and held for ~ 1 second. Both the green HC light and the green *ServoCAT* "slew" LED blink. This disables the GOTO button. Push again for ~1 seconds to re-enable it. This is used when you want to hand the Hand Controller to a person and you don't want to risk an accidental GOTO.

#### **GOTO BUTTON AS "ENTER" when doing alignment on Argo Navis**

While using version 2.0.0 of the Argo Navis and higher the *ServoCAT* handpad GOTO button will be seen by the AN as an "ENTER" function during the alignment. This allows one to center the alignment star and hit "ENTER" from the handpad while actually looking at the star - thus increasing the accuracy of the alignment. ***This is a highly recommended function - learn to use it!***

## **FUNCTIONS:**

### **LOCAL SYNC:** Also known as "LOCAL AREA SYNCHRONIZE" TOGGLE ACTION

This function will allow an offset to be added to the currently reported DSC position allowing much greater accuracy in a 'local' area of 5-10° radius from where it was turned on. For example – do a GOTO to an object. Sometimes, due to DSC errors caused by mount inaccuracies, 2 star alignment inaccuracies and similar errors the object might not be in the eyepiece view. If not you can do a Spiral Search (see below) and stop and center the object when visible. Now do a Local Sync (yellow "Sync" LED comes on).

Note local sync acts slightly differently depending on the state of AutoLOCK.

#### **-Local Sync without AutoLOCK.**

If the AUX switch is down AutoLOCK will be disabled. Turning Local Sync will turn on the SYNC led both on the front panel as well as on the HC. The system will remember as noted the offset from where the DSC says the object is to where you have centered the object. From here on until you cancel the Local Sync any object that you select in the DSC Database will include this offset. This function is a toggle function indicated by the YELlow LED. So you must remember to turn it off if you leave the local area where this offset is defined (5 - 10° radius). When not in AutoLOCK this function is manual - you must remember to turn it on and off as needed.

#### **-Local Syn with AutoLOCK.**

If the AUX switch is UP, which enables AutoLOCK and Local Sync is turned on (HC button) then both Local Sync and AutoLOCK will be on. The yellow SYNC light and the red AUX light will each be on indicating their respective functions. If you do a GOTO while in this mode that is more than ~9° radius from where you currently are the saved offset will be cleared to 0 value. There will be a single tone from the Argo Navis indicating this reset has taken place :

**'beep'**

AutoLOCK and LS will remain on and the offset zeroed. Re-center as needed.

**Application:** You want to find a Palomar Globular in Sag. This area of the sky is VERY busy AND Palomars are not known for being overly bright... do you know that it's in the field when you do a GOTO? Here's what you do to be SURE you have the field... find a bright object that is nearby, a star, galaxy, whatever... dial it up on the Argo Navis and do a GOTO to it... now find and center that object. Turn LOCAL SYNC on (yellow light comes on). The system will remember the difference from where the DSC thinks the object is and where it actually is - and until you turn the LSYNC off again it will use this offset on other objects. Now select the Palomar you wanted to find - do a GOTO and it will not only be in the field but it will be near its center!

**SPIRAL SEARCH:**

SRCH WIDE and SRCH NRW [Spiral Search **Wide** field, **Narrow** field]

When trying to locate an object that is not in the field of view do a Spiral Search – this will spiral out at a constant linear velocity and a constant track width (a spiral – not a box, so it is easy to follow with the eye). There are 6 spiral search patterns. A pattern consists of both a spiral angle and speed. The widest search pattern is with Speed 1/2 (front of the *ServoCAT*) set to 1, GUIDE set to FAST and by selecting the SRCH WIDE button.

**NOTE: Spiral Search only works with the speed set to either **GUIDEfast** or **GUIDEslow**.**

In addition Spiral Search is not intended to be used at higher powers. It is a field search tool for medium to wide fields.

The chart below shows the sequence of patterns available. Push any of the 4 yellow "motion" buttons to stop.

-**Search wide:** Wide fast speed spiral search - intended for wide fields  
-**Search nrw:** Narrower slower spiral search - intended for medium width fields  
Note: The Spiral Search is effected by the Speed 1/2 switch on the front of the *ServoCAT*. There are 6 Spiral Search patterns, 3 in each Speed 1/2 position. The numbers below are relative indicators of speed/path width

| Speed 1/2=1 | GUIDE FAST | GUIDE SLOW |
|-------------|------------|------------|
| SRCH WIDE   | 50         | 39         |
| SRCH NRW    | 39         | 30         |
| Speed 1/2=2 | GUIDE FAST | GUIDE SLOW |
| SRCH WIDE   | 33         | 24         |
| SRCH NRW    | 24         | 15         |

Also the Spiral Search is very handy to just “tool” around a busy area of many objects or large structures. To “stop” when an object is found simply push any of the 4 motion buttons (yellow). If not stopped the spiral goes until it has completed 3¼ rotations (almost 1200 degrees) and covers an area up to 12 degr<sup>2</sup>. It does compensate for backlash in the system however the more uncompensated backlash there is the more difficult the task of doing a true spiral is.

In addition when using the Speed 1/2 switch set to Speed 2 you will have 3 more spiral search speed/widths to select from - these are for higher magnification and thus smaller fields. **Push any of the 4 yellow "motion" buttons to stop. Note the first 2/3 of a rotation will not allow a stop nor an update to a planetarium program as there's a great deal of calculations going on during this initial time.**

## **Hand Controller use relative to LMIS and AutoLOCK**

### *Last Move is Sidereal (referred to as LMIS)*

ALL systems - all amateur and even professional systems - will have some amount of backlash. Even high end systems (think: expensive) have some small amount of lash. LMIS, Last Move is Sidereal is a built in feature, activated when not in **AutoLOCK**, that will remove the backlash allowing tracking to start immediately with no delays.

***For LMIS to work at its best one has to have taken the time to ensure the programmed Backlash Compensation value, shown in the "ServoCAT-Sky" dat template, has been properly set on your scope.***

Refer to the document on the *ServoCAT* CD entitled "Backlash Optimization" for instructions on how to best do this.

Note backlash has two negative effects:

- 1) it causes a momentary loss of tracking if the last move were in the opposite direction of tracking where the lash has to be removed from the system before the 'gears' engage and tracking resumes.
- 2) it is seen, while looking through an eyepiece, as a delay when doing a **GUIDE** and reversing directions using the hand controller. Backlash compensation, a feature that has been in the *ServoCAT* since day one (2002), is there to reduce these effects by automatically compensating for the lash. However one has to take the time to program it to best suit their needs.

Another way to eliminate backlash, on GOTO's, is to always ensure that the last move to the end point (the object or point in space if from a planetarium program) is in the sidereal direction and is at least equal to the amount of lash in the system thus removing all lash from the system. This is what LMIS does. ***Last Move is Sidereal is automatic when not in AutoLOCK.*** Since **AutoLOCK** will automatically resolve backlash as well LMIS is not used when in **AutoLOCK**. If one does a **GOTO** to an object and the **AutoLOCK** is currently off the GOTO will resolve directions at the end of the move. This will slightly increase the time at the end of a GOTO as it does this. With the Argo Navis its done.

**'beep'**

The **GUIDE** values should read less than one encoder count (typically 0.04 degrees). Tracking should start immediately from that point. If not - if it is larger than this then you've not properly set the internal *ServoCAT* motor backlash compensation value.

## **AutoLOCK**

**AutoLOCK** allows one to 'lock' on to a point in space and track that point with zero long term error limited mostly by the DSC encoders resolution. It will do this even with ratios that are not precisely set. (Note however it is not a substitute for properly programming the system!)

In order to use **AutoLOCK** on a non-satellite object the AUX switch has to be UP. When used for a non-satellite object this 'enables' the function - it doesn't in itself turn it on. One of two ways **to turn AutoLOCK OFF is to flip the AUX switch down**. If it was on the red AUX light will go out (as will the Local Sync light).

The most common way to use the system with **AutoLOCK** will be to, as usual, find your object in the Argo Navis CATALOG. Once entered hit GOTO. Since **AutoLOCK** hasn't been turned on yet the scope will automatically resolve any backlash by doing a LMIS (see description above). Tracking will start immediately.

**To turn AutoLOCK ON push the SYNC Local Sync button**. The Local Sync light on both the front of the *ServoCAT* and on the HC (on Gen3 units) will come on indicating Local Sync is on and the AUX red light will also come on indicating it's in **AutoLOCK**. The system will 'hold' to this point all night long. If the object is not in the eyepiece field (a pointing issue most commonly *not* related to the *ServoCAT*) you can use the HC **GUIDE** buttons as usual to find the object and center it. When using **GUIDE** to move around the field the yellow Local Sync and the red **AutoLOCK** lights will temporarily turn off. Approximately one second from the last **GUIDE** button push the 2 indicator lights will come back on. At this instant in time the current offset values as shown on the Argo are "remembered" as the new reference offset. The tracking will be relative to this new point. The object displayed on the Argo Navis at the time of the last GOTO is called the 'reference object'. The offset distance is the distance from where the scope is currently to the calculated position of the reference object. Note both **AutoLOCK** and Local Sync are on at this time. Note further when doing a GOTO from one object to another with **AutoLOCK** the backlash is not compensated for immediately by the built in backlash compensation system. It is instead compensated for by **AutoLOCK**.

**When doing a GOTO or GUIDEing around the field with AutoLOCK on:**

**When the GOTO has finished or you have finished GUIDEing, depending on the overall level of backlash in your telescope it might take a few seconds to remove that lash. It will appear to be drifting from the center until the backlash has been removed - rest assured however it will get to the point where it was set!**

If you want to **get back to the original position of the object** as calculated by the Argo Navis simply **turn the Local Sync function off** (push **SYNC**) and hit **GOTO**. This will turn **AutoLOCK** and Local Sync off. The GOTO with LMIS will go to the objects position as calculated by the Argo Navis and finish using LMIS. Turn Local Sync back on as desired (which will in turn turn **AutoLOCK** back on).

If a new **GOTO** is initiated **AutoLOCK** and Local Sync will remain on and the **new object on the Argo display becomes the reference object and the already set offset will apply to the new object**. Be aware: Local Sync is a LOCAL function! Due to field rotation (as well as mount errors) it will only be accurate in a relatively small field of 5 - 10° radius.

**With AutoLOCK on: when doing a GOTO that is larger than 9° radius from the current point the Local Sync offset value will automatically be reset to 0.**

Further note that if one moved in small increments - **GOTO** hoping from object to object less than the 9° radius the offset will NOT be shut off! So it is possible (although highly unlikely) to move great distances across the sky and still have a(n incorrect) Local Sync OFFSET value!  
**AutoLOCK AND Local Sync can be turned off simply by turning off the Local Sync (push the SYNC button, the LS light will go off as will the AutoLOCK light).**

## **AutoLOCK on SATELLITES**

**WE STRONGLY CAUTION AGAINST TRYING TO TRACK A non-GEO SYNCHRONOUS SATELLITE WITH A SCOPE THAT HAS A LADDER OR ANY FREEDOM OF MOVEMENT ISSUES!**

Due to their faster (to much faster) track rates **AutoLOCK** is automatically on when the object is a satellite AND the AUX switch is UP. While in a 'lock' radius of  $\pm 5^\circ$  from the calculated position of the satellite the track rates in the ALT will be those for the satellite and the "AUX" light will be on indicating it is in **AutoLOCK**. When in this zone the **GUIDE** speeds will be proportional to the satellites track rate in order to best find the object. If you leave this area the AUX light will go off indicating you've 'left' the zone, lock is off and tracking is back to sidereal. The Argo Navis will emit a double 'beep' :

**'beep beep'**

when you have left the defined lock radius allowing you to know it's out of range. Push the **GOTO** button to bring it back within the lock range.

If you do a GOTO to a satellite that is below the horizon the AZ will properly finish the GOTO. The ALT will not move until it is above the programmed HORIZON LIMIT (SETUP GOTO) at which point you'll hear the beep indicating it has risen. A GOTO at this point will lock it on to the satellite. **NOTE and CAUTION: The AZ will continue to track at the satellite rate AT ALL TIMES! If you DON'T want this hit EXIT on the Argo Navis to change the object away from "SATELLITE"!**

**NOTE: If AutoLOCK is ON and either the SLEW or the JOG speed on the HC are used the system will force AutoLOCK OFF. It is assumed by hitting either of these one is moving to another part of the sky and any offsets currently in place will not be of use.**

Since **AutoLOCK** is a tracking function it is assumed that if the user moves using **SLEW** or **JOG** (a much greater distance in a short period of time) that **AutoLOCK** is no longer needed. Thus **AutoLOCK is turned off if either SLEWing or JOGging**. Note its not the act of hitting the SLEW or the JOG speed button but rather doing this AND then doing an actual move using one of the yellow motion buttons. If one hits the SLEW or the JOG and realizes they don't want to do this resulting in a lose of LOCK - and haven't hit any of the yellow motion buttons, just change the speed by hitting one of the **GUIDE** buttons.

**Spiral Search is not enabled when in AutoLOCK.** To use Spiral Search to find an object turn off Local Sync (and thus **AutoLOCK**) - do the Spiral Search - then re-enable **AutoLOCK/Local Sync** by turning Local Sync back on.

end of Chapter 4: Hand Controller

Obsession Retro Users (and some scope manufacturers that do the setup for their customers) : The following information is not needed to get started and may not be needed at all depending on your level of comfort and need in using the *ServoCAT*. IF you have a home built telescope or the builder did not configure the ServoCAT for you - you will *have to* do the configuration!

## 5 Defaults

The default parameters for your *ServoCAT* settings are as follows (contained within the "Obs\_retro.dat" file under the \Tools directory of your CD):

### 15" Obsession

|                 | AZ           | ALT          |              |
|-----------------|--------------|--------------|--------------|
| <i>Name</i>     | <i>Value</i> | <i>Value</i> | <i>Units</i> |
| Encoder         | 2000         | 2000         | Cnts         |
| Gear Ratio      | 6929         | 7722         | -            |
| Slew 1          | 6.0          | 5.0          | degrees/sec  |
| Jog 1           | 140          | 140          | arcmins/sec  |
| Guide 1         | 280          | 280          | arcsecs/sec  |
| Slew 2          | 4.5          | 4.0          | degrees/sec  |
| Jog 2           | 120          | 120          | arcmins/sec  |
| Guide 2         | 160          | 160          | arcsecs/sec  |
| Accel           | 3            | 3            | secs         |
| Backlash        | 2            | 2            | arcmins      |
| Axis Limit      | 0            | 50           | -            |
| EasyTrack LAT   | 35.00        | 2            | EzTrk Sign   |
| Track Direction | -1           | -1           | -            |
| GOTO Direction  | -1           | +1           | -            |

### 18" Obsession

|                 | AZ           | ALT          |              |
|-----------------|--------------|--------------|--------------|
| <i>Name</i>     | <i>Value</i> | <i>Value</i> | <i>Units</i> |
| Encoder         | 2000         | 2000         | Cnts         |
| Gear Ratio      | 7914         | 7254         | -            |
| Slew 1          | 6.0          | 5.0          | degrees/sec  |
| Jog 1           | 140          | 140          | arcmins/sec  |
| Guide 1         | 250          | 250          | arcsecs/sec  |
| Slew 2          | 4.5          | 4.0          | degrees/sec  |
| Jog 2           | 120          | 120          | arcmins/sec  |
| Guide 2         | 160          | 160          | arcsecs/sec  |
| Accel           | 3            | 3            | secs         |
| Backlash        | 2            | 2            | arcmins      |
| Axis Limit      | 0            | 50           | -            |
| EasyTrack LAT   | 35.00        | 2            | EZTrk Sign   |
| Track Direction | -1           | -1           | -            |
| GOTO Direction  | -1           | +1           | -            |

### 20" Obsession

|                 | AZ           | ALT          |              |
|-----------------|--------------|--------------|--------------|
| <i>Name</i>     | <i>Value</i> | <i>Value</i> | <i>Units</i> |
| Encoder         | 2000         | 2000         | Cnts         |
| Gear Ratio      | 8264         | 7882         | -            |
| Slew 1          | 5.5          | 5.0          | degrees/sec  |
| Jog 1           | 140          | 140          | arcmins/sec  |
| Guide 1         | 280          | 280          | arcsecs/sec  |
| Slew 2          | 4.0          | 4.0          | degrees/sec  |
| Jog 2           | 120          | 120          | arcmins/sec  |
| Guide 2         | 160          | 160          | arcsecs/sec  |
| Accel           | 3            | 3            | Secs         |
| Backlash        | 2            | 2            | Arcmins      |
| Axis Limit      | 0            | 50           | -            |
| EasyTrack LAT   | 35.00        | 2            | EZTrk Sign   |
| Track Direction | -1           | -1           | -            |
| GOTO Direction  | -1           | +1           | -            |

NOTE: *for BELT gearboxes reverse Track and GOTO direction flags; multiply ratios by 0.92308*  
Also in the Obs\_retro\_25\_30.dat file you have these defaults:

## 25" Obsession

|                 | AZ    | ALT   |             |
|-----------------|-------|-------|-------------|
| Name            | Value | Value | Units       |
| Encoder         | 2000  | 2000  | Cnts        |
| Gear Ratio      | 7800  | 9750  | -           |
| Slew 1          | 5.3   | 4.5   | degrees/sec |
| Jog 1           | 140   | 140   | arcmins/sec |
| Guide 1         | 250   | 250   | arcsecs/sec |
| Slew 2          | 4.0   | 3.8   | degrees/sec |
| Jog 2           | 120   | 120   | arcmins/sec |
| Guide 2         | 150   | 150   | arcsecs/sec |
| Accel           | 3     | 3     | secs        |
| Backlash        | 1     | 1     | arcmins     |
| Axis Limit      | 0     | 50    | -           |
| EasyTrack LAT   | 00.00 | 0     | EZTrk Sgn   |
| Track Direction | -1    | -1    | -           |
| GOTO Direction  | -1    | +1    | -           |

## 30" Obsession

|                 | AZ    | ALT   |             |
|-----------------|-------|-------|-------------|
| Name            | Value | Value | Units       |
| Encoder         | 2000  | 2000  | Cnts        |
| Gear Ratio      | 8389  | 10487 | -           |
| Slew 1          | 5.0   | 4.5   | degrees/sec |
| Jog 1           | 140   | 140   | arcmins/sec |
| Guide 1         | 230   | 230   | arcsecs/sec |
| Slew 2          | 4.0   | 3.5   | degrees/sec |
| Jog 2           | 140   | 140   | arcmins/sec |
| Guide 2         | 160   | 160   | arcsecs/sec |
| Accel           | 3     | 3     | Secs        |
| Backlash        | 1     | 1     | arcmins     |
| Axis Limit      | 0     | 80    | -           |
| EasyTrack LAT   | 00.00 | 0     | EZTrk Sign  |
| Track Direction | -1    | -1    | -           |
| GOTO Direction  | -1    | +1    | -           |

**NOTE: for BELT gearboxes reverse Track and GOTO direction flags; multiply ratios by 0.92308**

The following description of software installation covers the *ServoCAT-Sky* configuration program. For most Obsession Retro users it is not necessary to install or use it. However if you decide to change any of your parameters you will need to install and run the program.

## 6 Software Installation

### 6.1 System Requirements

The installation software will automatically place the program under the following folders:

Program Files (x86)/ServoCAT-Sky

The system requirements during installation are approximately 2Meg of hard disk space, 32M system memory and running Windows XP/7/8. Other configurations may work but have not been tested. Once installed the hard disk space is approximately 200K.

**[REFER TO APPENDIX B if you have not already installed the USB driver]**

### 6.2 Software Installation – *ServoCAT-Sky* Configuration Program

The only software required by the *ServoCAT-Sky* system is the *ServoCAT-Sky* Configuration Utility. This is contained on the provided CD under the folder  
“Tools”

To install this utility insert the CDROM and double click on the *ServoCAT-Sky\_SetupJul1.exe* program contained under the Tools directory.

The actual installed routine, *ServoCAT.exe*, can then be run from this folder. In order to place this routine onto the Windows desktop right click on the *ServoCAT.exe* listing under Windows Explorer. This provides the option: “Send to”... click “ShortCut on Desktop”.



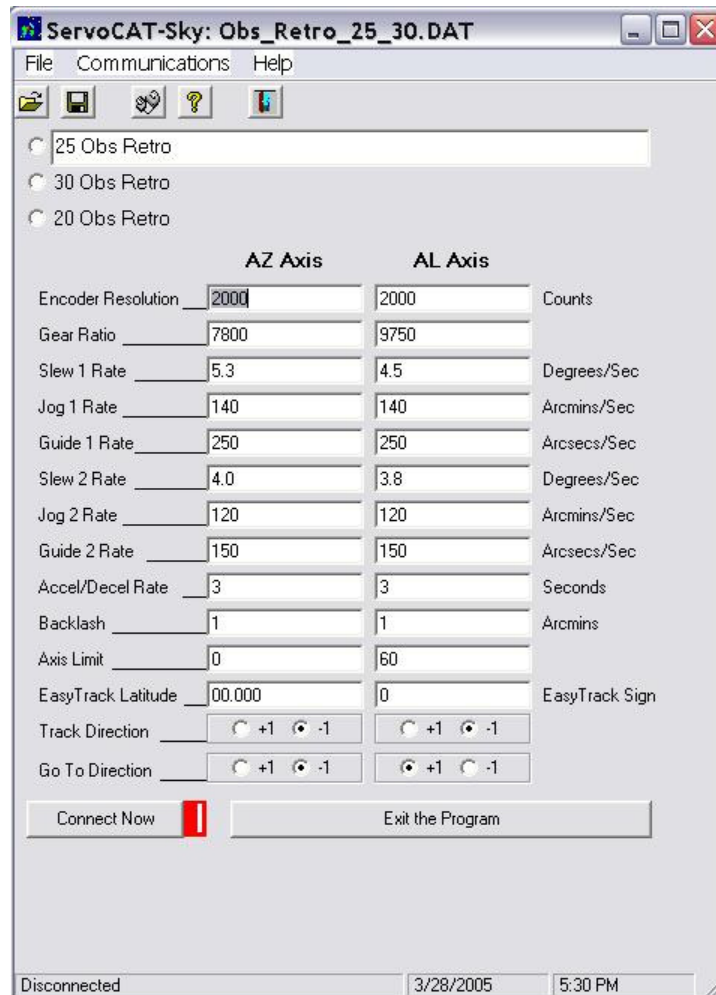
The details of this software's use are listed later in section 7 Software Configuration. It is suggested you open one of the default files found on your CD (under \Tools). There are defaults for 15, 18, 20" scopes in the Obs\_Retro\_belt.dat file, 25, 30" found in Obs\_Retro\_25\_belt.dat, and Junior settings for an 11, 12, and 15. Obsession UC's can be found under both the Junior and the UC files. There are other scope configurations as well. *Use one of these as a starting point – selecting the one that closest fits your scope size.* Or contact StellarCAT for more options related to the starting dat file to use. Also some scope manufacturers while installing the ServoCAT are supplying the details of their setup for you. Contact them for more details.

**AN IMPORTANT NOTE on the ".dat" files. All scope parameters are stored in a .dat file. Note the .dat files are not to be opened by double clicking on them! They are to be opened from within the ServoCAT-Sky program via the "floppy" symbol or via FILE | OPEN.**

## 7 Setup - Software Configuration

### 7.1 Entering Values

After installation of the software (Section 6.2) run the application "ServoCAT-Sky". This will show the screen below.



First and foremost: If you already have your own dat file do a FILE | OPEN, find it and open it (note: the program will automatically open the last file viewed). If you have not created one then open one of the default templates on the CD (under TOOLS) - one that has scopes in your scope range. Once open click on one of the three round 'radio' buttons at the top. The one closest to your scope size. Edit the text in its white box to reflect your scope: "John's 30" Skymixer" or some such - something that makes sense for your scope. (optionally you can edit the text in the other two white lines to say "DON'T USE" or somesuch if you think you might forget to select yours). Now click on FILE | SAVE AS and type in a name for the file. Save the file in the ServoCAT-Sky folder. **Further every time you open this program you MUST click on your radio button at the top as there's no guarantees you will get the right data without having done this.**

You will need to enter the information displayed to complete the configuration of your system. The "encoder" listed here is NOT your DSC encoder but rather the encoder on the back of the servo motor. Since we are supplying the motors this value will be 2000.

**GEN2 with version 7+ EXCEPTION and BUG REPORT:**

With the release of version 7.0X firmware IF installed in Generation 2 ServoCAT's (black box with no front panel USB Port connection) one must enter 1000 for both the AZ and the ALT encoder values in the ServoCAT-Sky dat file! Gen3 remains set to 2000. This is not a bug and is due to hardware differences between Gen2 and Gen3.

**BUG REPORT when using ServoCAT Sky with a Gen2 and version 7+:**

We've just found when changing the encoder value to 1000 (as needed when using version 7+ in Gen2 ServoCAT) that the ratio will get altered. Until this is fixed please write down your ALT and AZ ratios BEFORE changing the encoder value. Then after having changed it go back and re-enter the 2 ratio values (**even if they appear unchanged!**).

The gear ratio is the total gear ratio from motor shaft to actual scope axis. The StellarCAT Deluxe gear box system is geared a total of 363.26 if BELT and 393.53 if SPUR gear, the Junior Gearbox is 121.1. Multiply this by your final gear ratio:

**ALT Gear ratio = gearbox ratio \* ( Altitude bearing diameter ) / ( the roller diameter)**

The Altitude rollers that are commonly used are as follows:

All Juniors: 0.798" (20.27mm) [special Juniors and 15/18 UC's: 1.048"]

~15" Standard **ServoCAT** 1.048" (26.62mm)

~18" Standard **ServoCAT** 1.298" (32.97 mm)

~20" Standard **ServoCAT** 1.298" (32.97 mm)

~22" Standard **ServoCAT** 1.298" (32.97 mm)

~25" Standard **ServoCAT** 1.298" (32.97 mm)

~30" Standard **ServoCAT** either 1.548" (39.32mm) or custom 1.798" (46.05mm)

[Note: diameter shown includes the diameter of the ALT drive cable]

**AZ Gear ratio = gearbox ratio \* ( ground board diameter ) / ( the roller diameter )**

*The Azimuth rollers that are commonly used are as follows:*

All Juniors: 0.75" (19mm)

~15" Standard *ServoCAT* 1" (25.4mm)

~18" Standard *ServoCAT* 1.125" (28.6 mm)

~20" Standard *ServoCAT* 1.125" (28.6mm)

~22" Standard *ServoCAT* 1.125" (28.6mm) or (optional) 1.5" (38mm)

~25" Standard *ServoCAT* 1.5" (38mm)

~30" Standard *ServoCAT* either 1.5" or custom usually 1.75" (44.5mm)

The maximum shaft resolution cannot exceed 65,000,000 counts / 360°. This is equal to the number of counts multiplied by the gear ratio. The software will automatically catch this if it happens and require a change in one or both of the parameters.

**[highest ratio that can be entered is 16250]**

The Track Direction sets which way the scope moves with the handpad (and thus the track direction). A simple test is to move the scope using the HC CW on the AZ. This should cause it to go from north to east (CW)... if not change the TRACK direction flag to the opposite sense (+1 > -1 or -1 > +1). For the Altitude UP should be UP. See the CAVEAT below!

The GOTO Direction sets which way the scope goes after pressing a GOTO (and a proper alignment has been made).

**CAVEAT: If you change the Track Direction flag you MUST automatically change the GOTO direction flag as well. They are as a 'set'.**

**NOTE: for BOTH Track and GOTO direction you MUST have a working DSC system with its encoder signs set correctly! This will NOT and should not be used to correct for an incorrect DSC installation.**

Notice the SLEW speed is in degrees/sec, the JOG speed is in arcmins/sec, and the GUIDE Speed is in arcsecs/sec. All values are integer with the single exception of the SLEW speed which allows increments of 0.1 to be entered. The "1" vs. "2" are the values you get with the front panel mounted switch.

The acceleration value is the time from 0 speed to full SLEW speed at the programmed rate. The acceleration rate will remain the same for the other speeds – thus if the JOG speed is ½ the SLEW speed it will take ½ the time to get there. Start with higher values (slower accel) until you are sure the mechanics are up to the job. Typical values will be in the 2 – 4 second range. Larger scopes, 28 and higher, should consider a setting of 4 or 5.

The "backlash" parameter is nominally set to 1 but can be adjusted upwards IF there is backlash in the system. This will show itself as delays when changing directions – only noticeable during GUIDEing. It also shows as "drifting" after a goto until the backlash has been taken up.

NOTE: This is a function of the mechanics of the system. All (reasonably priced) systems will have some amount of backlash. However it is better to have this number a little low (or 0) than to have too much backlash compensation in place. If your mount is REALLY nice and the backlash is less than one arcmin contact the factory to find out how to program in arcsecs instead of arcmins. See the document "Backlash Optimization" found on the CD under MANUALS/Other Instructions. Typical values for Junior systems might be in the 4 - 6 range, for standard systems in the 2 - 4 range.

Finally note that all parameters have individual max and min values that cannot be exceeded (the program will not accept out of range values).

### 7.2 **Software Current Limit for ALT over-travel prevention - "Axis Limit"**

The software has the capability to add soft current limit points on both the AZ and the ALT axis. More than likely it is not needed on the AZ axis so it is recommended this be left as standard (0). By changing the ALT limit one can prevent damage if the ALT hits a chair or a ladder. These limits are set by changing the value under "Axis Limit" Altitude on your configuration sheet. Currently these are set ~ 50 - this provides some safety but may not be enough for your particular scope (or maybe too much!). The lower the value the more current limiting you have and the easier it is to stop the unit. If you go too low it may not move at all or stall with wind and eyepiece changes. Simply raise it if this is the case. Starting values of ~20-25 for Jr installs and 30 - 55 for larger scopes are about right. Test the "down" movement of the ALT by holding your hand under the tube as it is going down at the SLEW speed - it should stop in about 1/2 - 3/4 second. If it does not then lower the above value. If it stops too easily raise it. Notice the green SLEW light goes off under this condition. To restart simply hit any motion button (preferably not the DOWN!).



**GREEN SLEW LIGHT OFF**

**If the green SLEW light goes off when the ALTaxis is moving this could be a sign that you've hit the programmed AXIS LIMIT value! Check to see if programmed too low causing nuisance tripping. Push one of the yellow motion buttons several times to restore the green SLEW light.**

### 7.3 **Speed Setting and Speed "sets".**

The user is provided with 4 speeds for each axis. Note in addition to the 4 speeds the user also has 2 "sets" of speeds to choose from. This provides a convenient way, when out in the field, to switch speeds if the conditions are such that slower speeds are desired. For example under heavier wind conditions one might choose to slow down the top end slew speed. Also the user might choose to have the GUIDE 1 speed at a value convenient for normal magnifications and the GUIDE 2 speed set for guiding the smaller fields associated with those rarer times at higher magnifications.

the following is how the hand controller GUIDE speeds relate to the programmed values:

#### **Guide speeds:**

With SPEED 1/2 set to 1: **GUIDE<sub>slow</sub>** = **GUIDE1**      **GUIDE<sub>fast</sub>** = 2X **GUIDE1**

With SPEED 1/2 set to 2: **GUIDE<sub>fast</sub>** = **GUIDE2**      **GUIDE<sub>slow</sub>** = 1/2 x **GUIDE2**

**GUIDE1, GUIDE2 : the parameters in the dat file set using ServoCAT-Sky**

### 7.4 **EasyTrack settings.**

For more about EasyTrack refer to section 10 of this manual.

### 7.5 **Saving entered values to a file**

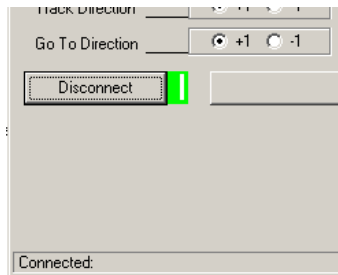
After entering all the values for each axis remember to save the parameters by clicking FILE | SAVE. You should have already named it (see the start of section 7 if not). The file is a standard ASCII text file that can be manipulated with NotePad if one chooses to do so – however this is NOT suggested as an error in entering could result in erratic behavior at the scope. If this is done and not tried BEFORE you leave the computer at home you may get in the field and have an unusable system. It is recommended that the provided editing system (*ServoCAT-Sky* config

program) be used. If the file (*ServoCAT.dat*) is corrupted delete it and open one of our default files - edit as needed for your parameters.

[NOTE: The following section requires that the USB system has been set up on the PC you're about to us. This means the USB drivers installed and the installed comm port number identified. See Appendix B for more details.]

### 7.6 **Uploading the parameters to the *ServoCAT* system**

Ensure that the PC connection cable (provided USB) has been connected to the front "PC Port" of the *ServoCAT* unit and to the PC USB port (always use the same USB port on a particular computer) **and that the power on the *ServoCAT* system is off**. In the configuration software select the serial port to which the cable is connected. The port setup is automatic – there are no selections there. Click on the bottom left button labeled “CONNECT NOW”. This will change to a DISCONNECT value on the button and display “Connected to scope” at the bottom of the screen. NOTE: this does not mean there is a connection - only that its ready to go to make a connection. The program is now monitoring for *ServoCAT* input. Note when ready the button shows a GREEN color next to it.



**NOW turn on the power to the *ServoCAT***. After a couple seconds you will see the green colored indicator on the PC window shown above change to yellow indicating transmission – quickly changing to red when completed. **If successful you will see a message panel stating so.** If you have not done so already SAVE your file as indicated in 7.5 above! Close the *ServoCAT*-Sky program, turn power off to the *ServoCAT*-Sky system and remove the configuration cable. You are now ready for field operation with the stored values.

If there was a problem you will receive a dialog box indicating an unsuccessful download. If this is the case ensure the cable is plugged into the PC port on the *ServoCAT* and into the PC and the correct PC port is selected from the Communications menu. In most all cases problems are related to the USB driver installation and have nothing to do with this program or the *ServoCAT* itself.

### 7.7 **Modifying stored values and improving their accuracy**

Most users will not have an exact value for their gear ratio. A close value will do for most use - allowing tracking for typically 10-30 minutes. GOTO accuracy is even higher as it is done three times – thus resolving any micro-slippage or gross ratio errors in the first attempt. This is done automatically and transparently to the user. Refer to Appendix C for a simple test to improve track accuracy. It works quite well! If it is desired to improve the tracking accuracy as much as possible it is recommended you do a SuperProgram:AutoCAL. This procedure is discussed in the SuperProgram manual on your CD (Manuals\Other Instructions). Note however most do not need to do an AutoCAL and few do!

### 7.8 **Reading already stored values from the *ServoCAT***

Starting with version 7.0 one can now read the data parameters back from the *ServoCAT*. To do so you need to use the SCU (*ServoCAT* Utility) provided by Peter Eschman for this purpose. It can be found here along with instructions on how to use it: <http://www.unm.edu/~eschman/>

[there is also a means to do it using serial commands. contact us for a list of these if you need this functionality]

## 8 Planetarium Program

The ServoCAT PC Interface allows the normal planetarium support provided by the Argo Navis to be used with no additional serial port requirements. It should work with any program that supports the Planetarium option of ServoCAT/Argo Navis or has ASCOM capability.

In order to use the planetarium feature simply plug in the provided data cable (USB cable), the port is the PC Port on the front of the unit. Next setup the planetarium program for its serial port and set it to 9600, No parity, 8 data bits, and 1 stop bit. (note: some programs already default to these values and thus do not require their being edited). Ensure the Argo has been aligned and was connected to the ServoCAT before the alignment was finished! (Motors do not have to be engaged). Start the link from the Planetarium program. Set the update rate to no faster than twice per second. Adjust this to where it appears to work fine (we suggest the display update rate is set to ~ 500mS). Note that the position will not move at this rate as the positions resolution reported is not fine enough to see a change in this short time period. Depending on the position in the sky it will update once to twice per second typically. Also note if your program shows a telescope position indicator - a ring or cross hair... it will bounce back and forth a small amount. This is normal and is caused by the finite resolution of the Argo Navis encoders. The higher the resolution encoders you have - the less movement you will see as this happens.

For full GOTO operation using your PC Planetarium program you will need to use the system with a version 2+ Argo Navis. Connect the system as described above. Set the Argo Navis to "MODE CATALOG | CATALOG: FROM PLANETARIUM". Now select the object or the point in the sky you want on your planetarium program and do a goto per its requirements. That is it! The scope will move to the point/object selected and the Argo will "beep" when it arrives at this point. Note offsets as seen on the screen are a function of the "quality" of the alignment and mount on the scope - a DSC issue and have nothing to do with the *ServoCAT* itself.

## 9 Upgrading Sky Interface Firmware

Obviously as time goes by there are improvements made to most "progressive - customer driven" products. The *ServoCAT* system is indeed one of these. We will strive to resolve problems quickly when they arise and to make improvements that benefit the larger group of users. Towards that end a convenient method of upgrading the software has been provided. **[REFER TO APPENDIX B if you have not installed the USB driver]**

### **NOTE: CONFIGURATION vs. UPGRADING**

Configuration, using the provided *ServoCAT*-Sky Configuration Utility, is the process of saving to the *ServoCAT* unit the parameters that are pertinent to your telescope. This includes the desired speeds of operation, the accel rates, and the ratio of the gearing. This is necessary for the unit to operate correctly on YOUR scope. It will operate - just not accurately until you tell it the particulars of YOUR scope.

Upgrading is the process of completely reloading the control program into the *ServoCAT* unit. This is sometimes required for updates in function and for bug fixes. IF the system is performing correctly on your setup Upgrading is not necessary!

### 9.1 **Connections for Upgrading the ServoCAT [Black - Gen 3 Units]**

NOTE: If you can do the upgrade with the ServoCAT connected to the telescope that is fine. If not then you'll need a power source for the ServoCAT. It must be REGULATED DC nominal 12V (10 - 16V) and at least 400 mA capable. Also it will need to have an RCA/Phono plug at its power end with center positive connection. We offer these for a nominal fee - contact StellarCAT if you need one.

To upgrade the unit first turn power off to the unit. Remove the cover of the *ServoCAT* unit by removing the 2 recessed screws on the bottom and carefully lifting the cover.

**DO NOT TOUCH THE INTERNAL COMPONENTS UNLESS SPECIFIED!**  
Plug the USB cable into the PC Port on the front of the *ServoCAT* unit and into the PC USB port (always use the same USB port on a particular computer) on the PC that will contain the upgrade utilities. Note the serial port on the PC that the unit is plugged into (use: START/Control Panel/Device Manager/PORTS/USB serial port com X).

On the *ServoCAT* there is a switch accessible from the inside of the unit - labeled UPG (Upgrade) or NORM (normal use). It is located just behind the front panel AUX switch. It is silver with a thin black switch handle.

This switch is used to set the unit into "normal run" or "upgrade" mode. It should "click" when moved in either direction. Use either a small screwdriver or a pencil to access the switch. Do not force it - it does not take too much force. *As always changes made should be made with the unit powered down.*

Switch the upgrade switch to the UPG 'Upgrade' position.

There is a small red jumper near the left middle of the board and just behind the plugged in daughter board - this jumper is marked "UPG". Its normal position is plugged into only one of the two pins there - note this as you will need to return it to this position when done. Remove the red jumper and place it back on both pins so that it shorts the two pins. [This jumper does not exist on Gen2 ServoCATs!]

### 9.2 **Installing the Upgrade Utility**

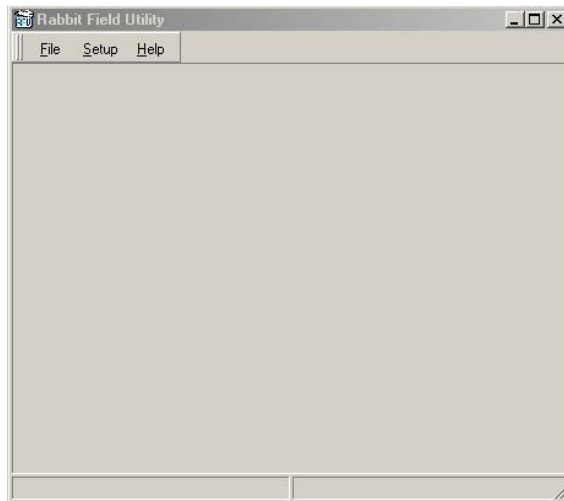
Run the self installing program found on the provided CD-ROM under "Upgrade". It is called **ServoCAT Firmware Upgrade Setup.exe**. It will install the program under the already created

Program Folders (x86)/ServoCAT-Sky/Upgrade

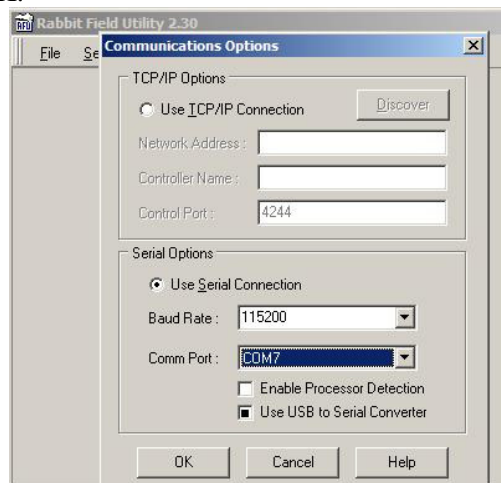
When you request and receive a new firmware upgrade file, which will be a 'bin' file, drag and drop it to this new folder on your PC.

### 9.3 **Running the Upgrade Utility**

The upgrade utility is the executable named RFU.exe. It can be launched from this new folder (UPGRADE) created above or a short cut can be placed on the Windows desktop. It should be version 2.30.



Double click to run the program. Select the **Setup** menu item and **Communications**. Select the "Serial Connection" option, set the proper Comm port (as determined by your USB driver installation process). For Gen3 ServoCAT's or if Gen2 and you are using a USB/serial converter select "**Use USB to Serial Converter**". If "Enable Processor Detect" is checked uncheck it. **CHANGE NOTHING ELSE! If it doesn't work it is NOT a setting on here** - it is 1) the wrong com port selected for your USB connection 2) power and/or jumpers not correct on ServoCAT or 3) USB driver not installed or not installed properly. Select OK.

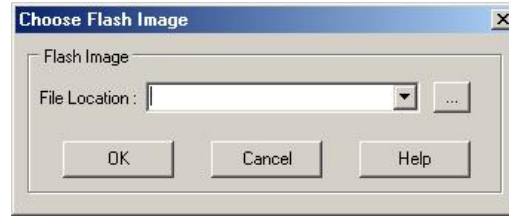


***If using a multicore processor you need to disable the other cores of the processor or the communications will be interrupted by the computer.*** To do this hit "CTRL-ALT-DEL" on your computer and start the TASK MANAGER (also you can start it by right clicking on the tool bar at the bottom of the screen, select TASK MANAGER). Select "processes" ("details" if Windows 8) and go down the list and find RFU.exe\*32. Right click on this item and select "Set Affinity". Turn off all CPUs but one. The following steps work best when done in a matter of < 30 seconds from one to the other.

Turn the **ServoCAT** power on



Now select the File option, choose "Load Flash Image", select the browse function ("...") and find the *ServoCAT-Sxx.bin* file that has been sent to you by StellarCAT. [If you've used this file before it will be in the list and can be selected from their instead]



Once loaded the program will automatically start the download process, otherwise click OPEN or OK. When completed close the RFU program, turn off the power to the *ServoCAT*, remove the programming cable, turn the Upgrade Switch back to its 'NORM' position, and restore the UPG jumper [Gen3 only] to its "normal" position as outlined above. This completes the upgrade process.

#### 9.4 **Problems with the Upgrade Utility**

If you get a message that says "No Rabbit Processor Found"

- Ensure on the SETUP page "Detect Processor" is not checked
- Ensure you are using the correct comm port for the USB cable (see Appendix B)
- Ensure you have the switch set to UPG
- Ensure you have moved the UPG jumper onto both pins [Gen3 only]
- Ensure you have turned power on to the unit before doing the download

If you get a message that says cannot find the Pilot or Coldload files - open SETUP, BOOTLOADER, select the browse box for each of these "... " and find and select them. They should be in the \ServoCAT-Sky\Upgrade folder (or a sub-folder) you created earlier.

#### 9.5 **Downloading the scope parameters**

Whenever an upgrade has been done the user has to re-download the parameters to the *ServoCAT*. If you have done this before and properly saved the ".dat" file as directed in chapters 6-7 then simply re-download this information using *ServoCAT-Sky*. If you have not downloaded to the scope and the scope is not an Obsession then contact your scope vendor for this file (for your scope). If you have a home made scope and you've never downloaded to the *ServoCAT* then you most definitely need to follow the instructions in chapters 6-7 (and should have when the *ServoCAT* was first installed!). Finally if this is an Obsession, and you've not downloaded your own information to the *ServoCAT* (either AutoCAL results and/or customization of the speed parameters) use the default files for the scope type and size you have (contact StellarCAT if you don't have this).

## 10 EasyTrack

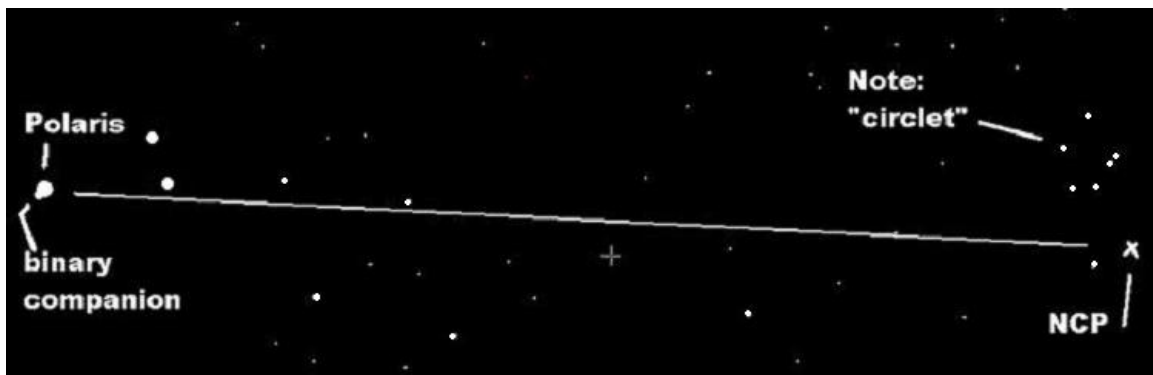
EasyTrack allows tracking without a DSC system connected. This thus provides a means to do tracking with no DSC or to have tracking even if the DSC has a problem (batteries dead, encoders/cable not working correctly, etc). In addition for those that want higher precision tracking it can be turned on before the normal DSC 2 star alignment - in this case it will be tracking when you get to the 2 alignment stars and before you have completed the alignment.

To use EasyTrack you will need to first set your LATitude in the configuration file (see section 6). This should be as accurate as you can get and should be for your normal viewing location. The "quality" of the track, the length of time and object stays in an eyepiece view, will be effected by this. If you have a couple viewing locations you might want to select a value that is the average of the two. Enter this number to 3 decimal places (remember to convert minutes and seconds of LAT to decimal degrees).

Second you may have to set the EasyTrack motion sign value on your configuration sheet. This value is a 0, 1, 2, or 3 for EasyTrack DOB and 0, 1 for EasyTrack EQ and is often determined through testing (it adjusts for how and where the servo motors are mounted onto your scope). This is a relatively easy step. [Note: the default values for the configuration file should work under normal install circumstances].

To use EasyTrack you will need to be able to see Polaris from your site. Also level your scope base.

To Enable EasyTrack engage your axes and turn on the power to your *ServoCAT*. Using the handpad move to and center the scope on the North Celestial Pole (Polaris is less accurate but can be used - track time will however be diminished). The NCP can be found pretty easily as you can use its binary component as an angle determinor - and there is a small "circlet" asterism at about the position of the NCP. Check on a planetarium program and print this out.



### Finding the NCP based on Polaris' position

The closer you can get to the NCP the better the tracking (however it need not be exact!).

With the scope set to the NCP turn the power off on the *ServoCAT*. Flip the speed 1/2 switch (on the front panel) to the "2" position (EasyTrack is a SuperProgram mode which requires it sees the Speed 2 setting on power up). Now hold the CCW if for a dob (ALT/AZ) scope or the DWN button if for an EQ scope - while turning power on. The

Green slew light will come on, go off, and the YELLOW SPm light will come on. Release the button at this time. The scope is now tracking. Use the handpad to move around the sky. The RED DSC light will blink - this is normal!

**NOTE: This system REQUIRES it is engaged at all times! If you disengage at any time or slip it will no longer track accurately.**

**Correcting EasyTrack Direction Errors** (initial setup only):

[The following assumes you are starting with a EasyTrack Sign of 0 (default)]

If the track direction is wrong for either axis this means the "EasyTrack Sign" value is wrong. To correct this note if it is going the opposite direction in ALT when pointed directly East or West (very little AZ movement when pointed East or West). If it is going the wrong direction the direction factor needs to be a "-". Then slew the scope to the South - is it tracking the opposite direction here? If it is not tracking correctly here the direction factor needs to be a "-". Using these two sign factors determine which number to enter into the EasyTrack Sign number.

| EasyTrack Sign | AZ Direction Factor | ALT Direction Factor |
|----------------|---------------------|----------------------|
| 0              | +                   | +                    |
| 1              | +                   | -                    |
| 2              | -                   | -                    |
| 3              | -                   | +                    |

To test if it is tracking correctly when :  
if a DOB or ALT/AZ mount (fork): Move to roughly 40° ALT, 120° AZ. The scope should move CW and UP.  
If an EQ mount: the scope should move from the east towards the west.

**KEEP THE UNIT DRY!**

# 11 Appendix A - Troubleshooting

**TERMS:** *ServoCAT* referred to as CAT  
 Hand Controller referred to as HC  
 Argo Navis referred to as AN

|                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|---------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| No lights on <i>ServoCAT</i>                                                          | -Confirm power plug plugged in to a 12V source.<br>-Confirm source is not current limiting [greater than 3.5A capability]<br>-Check any fuses in line with the power cord<br>-Ensure the "LEDs" switch is set to ON and the ESTOP is set to "OK"<br>-Confirm the power light can be seen in the back of the unit (through the small hole)<br>-confirm the power rail power switch, for this cable, is flipped on                                                                                                                                                                                                                                                                                                                                                                                                          |
| RED LED (DSC) not on, Green (Slew) LED is on                                          | -AN not plugged in and/or turned on<br>-AN baud not set to 19.2K<br>-Wrong internal jumper setting for DSC in use (different from SC to AN)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| GREEN (Slew) LED not on                                                               | -E-Stop / OK button set to OK; push motion button on handpad<br>-no power on unit, check above (if HC lights are on power is probably ok)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| YELLOW (Sync) LED not on                                                              | -Only activated by a SYNC command from the HC. Toggles off by pushing this again.<br>AN should be connected and aligned                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Motor turns slow                                                                      | -Download your systems parameters using <i>ServoCAT</i> Config (sect 5-7)<br>-Speed slide switch on handpad set to GUIDE or JOG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Motor turns wrong direction                                                           | -Download your systems parameters using <i>ServoCAT</i> Config (sect 2 & 5).<br>Track Direction to correct this. [If change TRACK also change GOTO flag]<br>-If Altitude motor check to be sure the cable is wrapped the correct direction (CCW)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Motor does GOTO in wrong direction                                                    | -Download your systems parameters using <i>ServoCAT</i> Config (sect 2 & 5). GOTO Direction to correct this. Each axis has its own parameter.<br>[If change GOTO also change TRACK flag]<br>-Ensure DSC has correct encoder sign setting - the DSC has to work BEFORE the CAT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| HC LEDs not on                                                                        | -Ensure HC cable plugged in all the way at both ends.<br>-Check cable for breaks<br>-Confirm CAT powered up with its LED's on as well as its YELlow handpad LED.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 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.<br>-Check the ESTOP switch.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| GOTO stops short                                                                      | Ensure hand controller cable is plugged in.<br>-Ratios not set right.<br>-Input voltage (battery) low<br>-too high a speed programmed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| Motor "runs away" at high speed                                                       | -Check cable connections to motor at motor and at back of <i>ServoCAT</i> - focus on the smaller cable. Make sure it's "snapped" in. Make sure they're not swapped with the ALT cables.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
| Motor does not run at all                                                             | -Assuming all else is fine (power ok) check cable connection to motor at motor and at back of <i>ServoCAT</i> - focus on the large cable. Make sure it's "snapped" in.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Some times 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 factory - these can be included.<br>-NOTE Axis Limit will accomplish the same thing without switches. See the Config section 5, 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Configuration program does not download                                               | Follow the sequence:<br>a) Power off CAT, plug in USB cable from PC Port to the PC.<br>b) Leave power OFF CAT and start <i>ServoCAT</i> config program<br>c) Change values as needed and SAVE the values!<br>d) Go to Communications menu item and set comm port CORRECTLY!<br>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".<br>f) Power up the CAT.<br>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. After a successful transfer it will put up a panel saying so.                                                                                                |
| 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 |

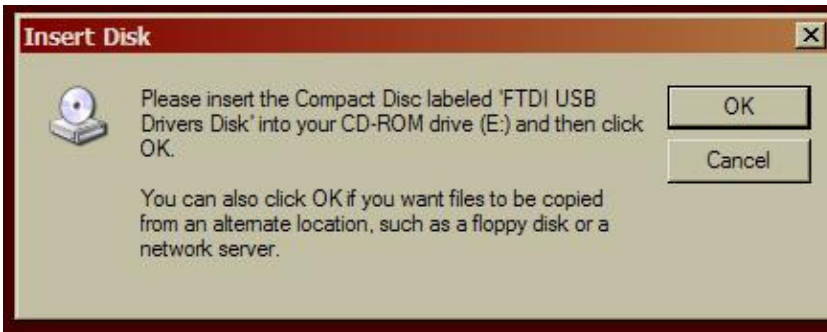
## 12 Appendix B - USB Installation - XP Computer.



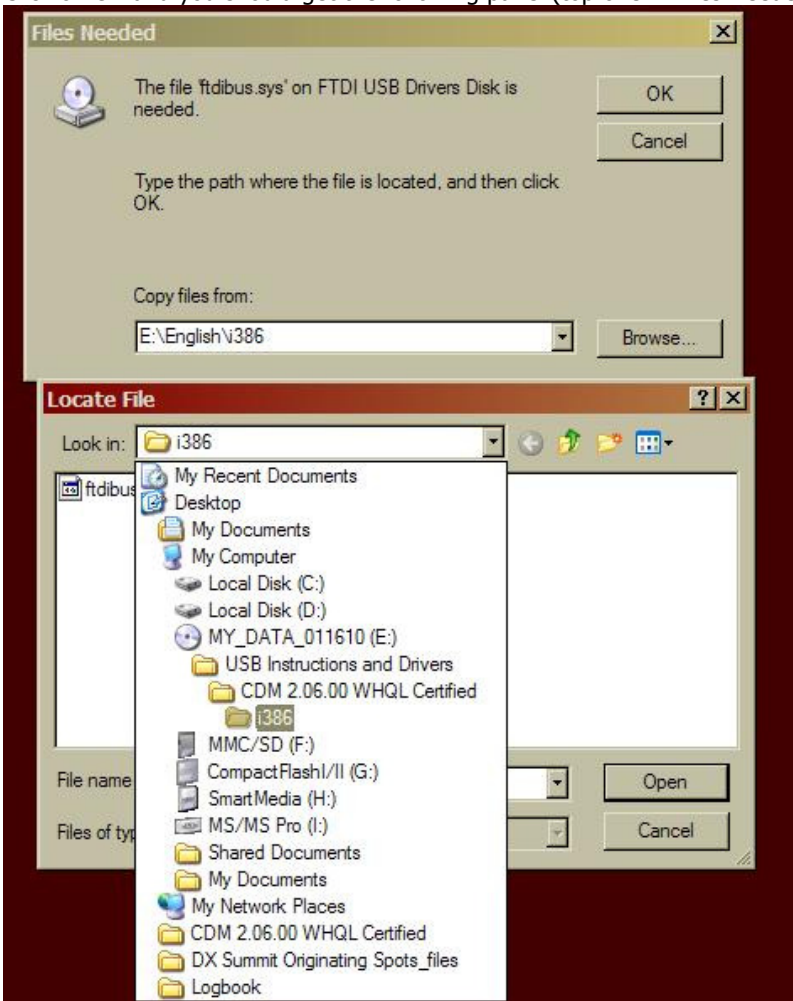
**This is for the driver installation on an XP system. For Vista, Windows 7 and 8 refer to the documents on the CD under "USB Instructions and Drivers ". NOTE for Windows 7 and 8 if the computer has an internet connection it will automatically install itself! Go to "Selecting a "good" (useable) COM port" below to find out which com port it selected.**

Insert the *ServoCAT* CD into the CD player.

Insert the USB cable into the *ServoCAT* and into the PC USB port that you will routinely use for the *ServoCAT* (it's best to always use the same USB port on the PC or laptop from install through use). You should get a panel similar to the one above. NOTE: it might be the Install Wizard - if so select Automatic and let it find the driver files - if you need to help it BROWSE to the CD, USB Drivers, i386 and allow it to find the proper files.



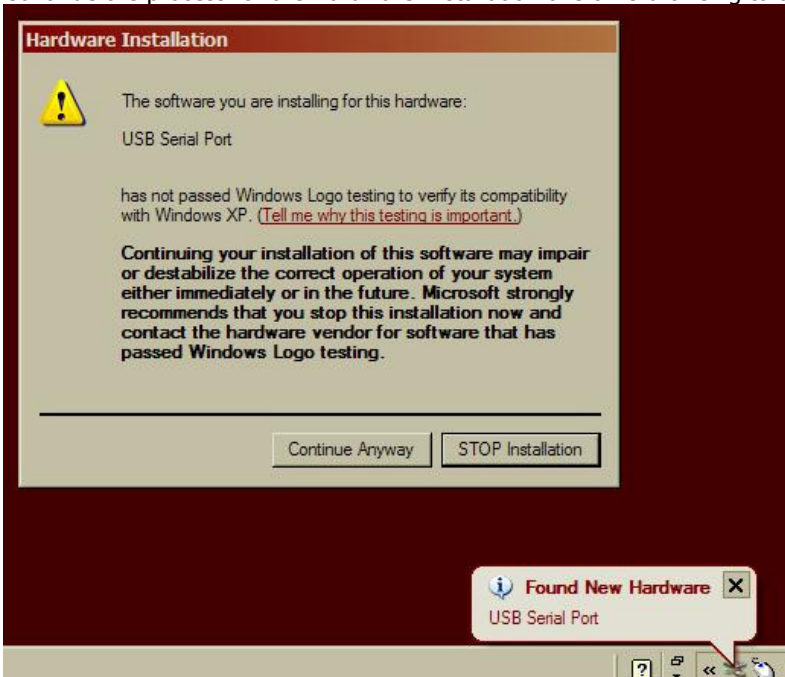
Click on OK and you should get the following panel (top one - "Files Needed"):

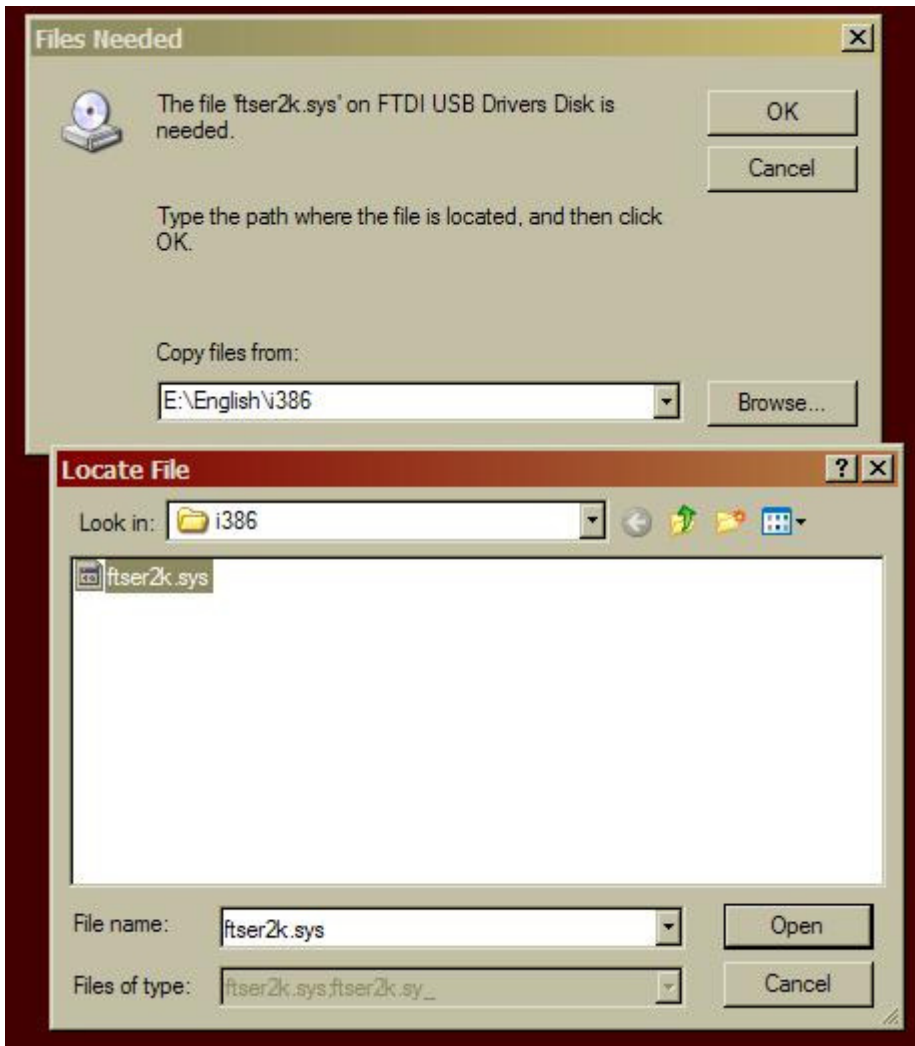


Select Browse, the CD in the drop down list, USB Instructions and Drivers/CDM 2.06.../i386 at which point the "ftdibus.sys" file should be available. Click on it and hit "OPEN" as shown below. Click on OK.



Continue the process for the Hardware Installation this time browsing to the ftser2K.sys file.





**Selecting a "good" (useable) COM port.** [note: the USB cable from the ServoCAT to the PC MUST be plugged in before doing the procedure below]

If the COM port is higher than 8 it will not be accessible to most legacy software including the *ServoCAT*-Sky program. To find which serial port the installation assigned to the device and to change it do the following:

- Go to the bottom left of the screen and select "START"
- Select Control Panel
- Select System
- Select Hardware
- Select Device Manager
- Select "Ports"
- Find the device that says "USB Serial Port (COMx)".

This is the com port ('x' above) to which it was assigned. If this is 8 or less than use this number in any program that needs access to the *ServoCAT*. If its higher than 8 do this:

- Double click on the "USB Serial Port (Comx)"
- Select Port Settings
- Select Advanced
- Change COM # to the first one from 2 - 8 that is not in use
- Hit OK, OK to get out of this.

Use this COM port for any device that needs access to the *ServoCAT*.

[For Win2000 systems there are .inf files at the root of the CDM folder]



## 13 Appendix C - Simple Test to improve tracking

-Do an alignment... the base should be reasonably level for this alignment.  
Move/Point the scope in AZ and ALT to

90 – your LATitude

If you're at 35° LAT point it to  $90-35 = 55^\circ$  in AZ and ALT.

From this location do a MODE TOUR on the Argo and find any object near by - doesn't matter. It should be within a degree or so (usually a star but any object will do).

Do a GOTO to it. Confirm the GUIDE numbers show less than 0.05 degrees in both axes. If not hit GOTO again.

Now while looking at the displayed Argo Navis GUIDE numbers: SLEW the scope in AZ (only) until they show an offset in the AZ axis of about 100 degrees. The value itself is not overly critical. Whatever it is as read from the Argo GUIDE display - the left hand value is the AZ - write this number AND its arrow direction down!

The following applies when doing the test on either ALT or AZ axes.

Push the GOTO – it will start to move – now watch carefully the GUIDE value for this axis (left for AZ, right for ALT). The scope will move a distance and then come to a stop. It will then quickly pick up and start moving again. You need to get the GUIDE value when it first stops – as well as the direction sign. Its important it is when it FIRST STOPS.

An Example: you do the moves and record the values and the arrow directions.

-If the sign before you did the GOTO is the same as the sign when it (first) stops then you will calculate a correction factor based on :

distance at first stop / total distance. Add 1 to this value.

-if the sign of the first move is different when it stops then you will calculate a correction factor based on :

distance at end of stop / total distance. Subtract this from 1.

Multiply the correction value by the ratio for that axis that had previously been programmed into the *ServoCAT*. So lets assume you are testing the AZ and you move away and the GUIDE value shows 103< (both the direction, as shown by the arrow, and the value). You write down 103<. You hit the GOTO, release it, it starts to move. Watch the display. It will count down. When it stops (the first time) note the value at that instant in time as well as the arrow. Say it is 1<8. (read this as 1.8

with a < direction) Since the sign is the same this means it is still on the same side of the object and ended up being short going to it. So you'd have :

$$1.8 / 103 = 0.0175.$$

Add 1 since the signs are the same making the correction factor 1.0175. Multiply this by the previously programmed ratio for that axis. Lets say the value that is in the *ServoCAT* now is 7825. The new value would be  $1.0175 \times 7825 = 7961$ . This is the new value to program in for this axis.

For the ALT first point the scope directly south with the tube at say 10 or 15 degrees up, do a MODE TOUR, find a nearby object and do a GOTO to it. Now move up in the ALT by say 50 degrees as shown by the offset (right hand ) GUIDE value. Write this offset down including the arrow direction.

Now hit the GOTO and watch for that first number as well as the sign. Repeat the math to determine the correction factor as shown above.

This will very accurately correct the tracking. Note the way the system is designed the ratio is not overly critical for GOTO's it will 'get you where you need to be' even if the ratio is off as much as 10% - a VERY large amount which should never happen. It will however directly affect tracking. Further note – you can confirm these results after having calculated the correction factor and downloaded these new values to the *ServoCAT*. Repeat the tests and you should typically see the AZ end up less than  $1^\circ$  when it first stops (out of 100) – and less than  $0.5^\circ$  on the ALT. Once you've done this and confirmed (i.e. know that you correctly calculated the new ratios and KNOW that they've been downloaded by seeing the "settings successfully transferred" panel from *ServoCAT-Sky*) DON'T go back and change them again.

Don't assume that they've been lost or corrupted if one night tracking doesn't appear to be as good. If correctly put into the *ServoCAT* they can NOT be altered or lost! Tracking has several variables that input into it including the quality of the alignment and mechanical issue – these values generated from doing the tests above will provide the best overall values (without doing an AutoCAL). If it is still off then there are other things going on. One such 'other thing' is the backlash compensation. When shipped from the factory the *ServoCAT* is intentionally set low for backlash compensation. It needs to be done in situ - on the scope by the end user. If incorrectly set it will show as both a delay in the time it takes for the scope to start to move once the yellow handpad button is pushed to what will appear to be loss of tracking (it will drift while the lash is taken up). The latter is NOT related to the ratios and thus it needs to be 'fixed' appropriately. There is a document on the CD entitled: Backlash Optimization. Use it to do so.

END OF MANUAL