Sitech GOTO Quick Start
for Hubble Optics UL14/16/18/20/24
(R 1.4, 04/11/2017)

Adapted from The SIDEREAL TECHNOLOGY
Setup and Operation manuals by Dan Gray, Don Westergren and Chuck Shaw
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1 Introduction

The state of art Sitech controller is extremely powerful and feature rich; but in this document we will only explain the default mode (a very simple but still very powerful one) for UL16, the DragNTrack & GOTO mode, and its basic configuration and operation procedure. For the advanced users who want to explore the full potential of Sitech controller for CCD imaging, please refer to the Sitech Operation Manual.

This powerful combination of Sitech and Skysafari will allow you to push your scope with hand, slew with handpad, track and GOTO, a "revolution" and a "game-changer" that can completely replace your desktop astronomy software and Digital Setting circle devices.

Safety

The servo motors are powerful motors that can do extreme damage to equipment and human life. Please be careful that your telescope doesn't move to a mechanical limit (such as the ground); please also remove the limit ALT bolt in case your scope hit the bolt. You may damage the motors or gears, and you may injure yourself or others. This product is NOT a toy; children should not be allowed to operate it.

You must exercise proper safety precautions, including the wearing of proper clothing and avoiding use in adverse conditions. Shock hazard! Bodily injury hazard! Any device using electricity is a shock and bodily injury hazard. You must hook up the device properly and follow all safety precautions, particularly when using electricity outdoors. If improperly hooked up or improperly operated, electronic components can shock, overheat, melt, and explode. In particular:

1. Never operate when the equipment or cabling is wet or moist, even if there is only a possibility that some of the equipment is wet or moist
2. All grounding points must be connected to the battery (-) terminal before turning on any equipment; the grounds must never be disconnected while the unit is powered on
3. Power leads must not be reversed: instant component failure is a certainty; components will overheat and can explode with violent force
4. Please be careful that your telescope doesn't move to a mechanical limit (such as the ground). You may damage the motors or gears, and you may injure yourself or others.
5. **WARNING: The DC voltages higher than 12 volts are deadly when shocked!!!!**

2 Hardware Setup
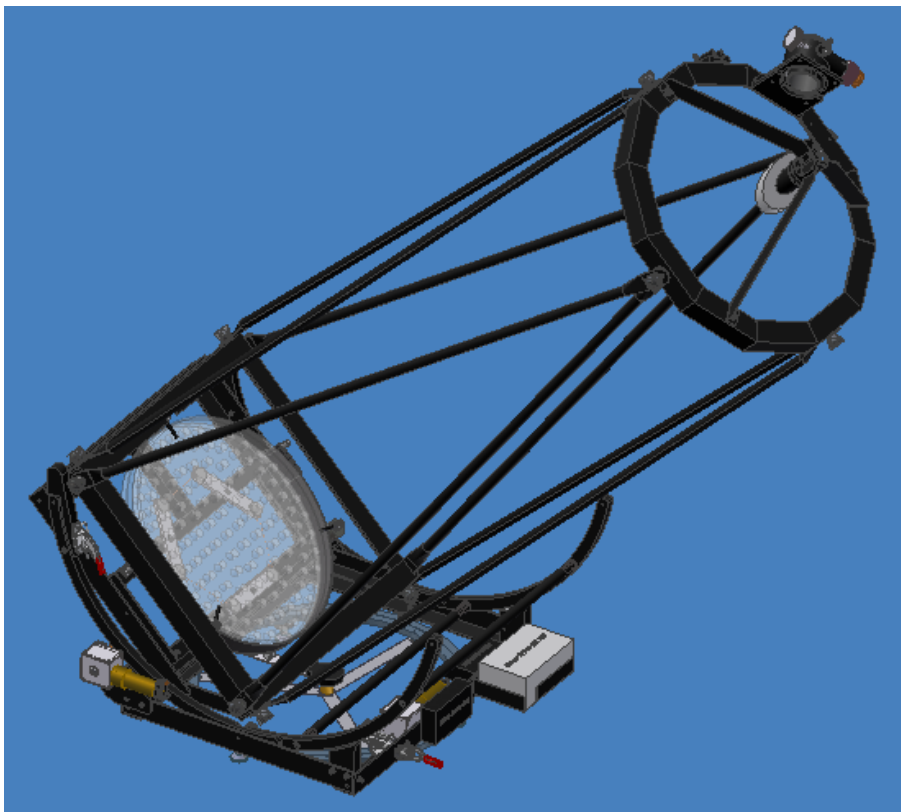
The following sketch shows the essential elements of a servo control system (only shows a single axis to keep the sketch simple).
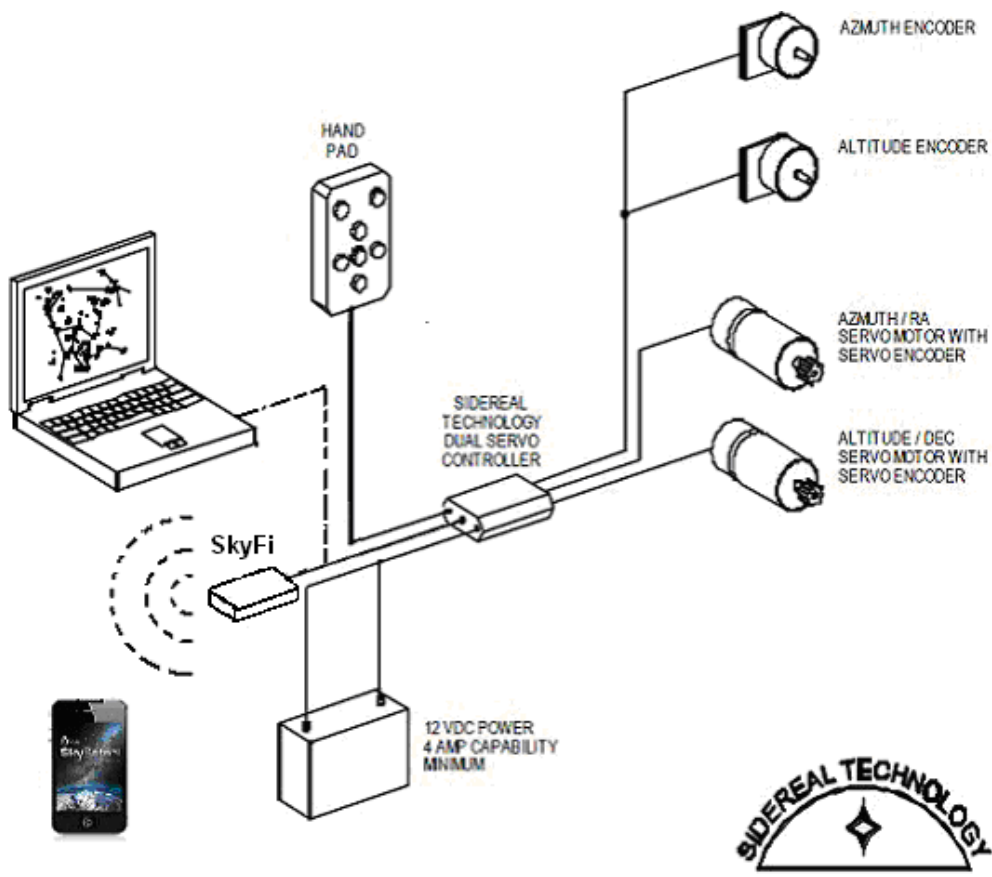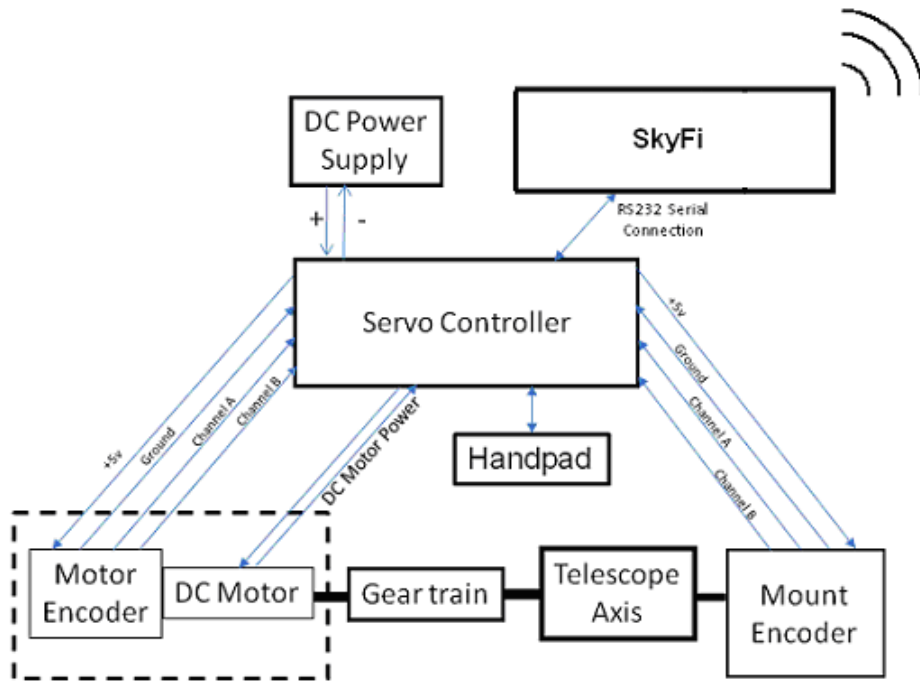
The UL GOTO hardware includes:
- Two servo motors with motor encoders
- SiTech Servo Controller I

- Two **8192 (0r 10,000)** tick telescope encoders
- A wired handpad
- Skyfi wireless receiver
- iPad/iPhone/iPod for GOTO control, a SkyWire serial cable accessory, or a Wi-Fi-to-serial adapter like SkyFi is required to connect iPad/iPhone/iPod to the SiTech controller. You can purchase the Skysafari+/Pro from Apply Store http://itunes.apple.com/us/app/skysafari-3-plus.
- Computer (Optional for operation, necessary for configuration and setup; not provided)
- ALT/AZ gearboxes and mounting assembly
- All necessary cables, and mounting accessories.
- Optional 12V battery holder
- Optional 12V to 19V or 24V 4A converter

3 SiTechExe and ServoConfig Installation

You do not need a PC during operations. However, you MUST use a PC to input configuration settings to the controller. Your Sitech controller has been fully configured for UL16 already; the following procedure is for fine-tuning, re-installation purpose, or for controller that has not been configured for UL16. Of course, you need the full Sitech installation on your PC, if you want to use it to control UL16.

3.1 Computer and Operating System Requirements
The SiTech configuration software system is a Windows Application and runs best on WinXP.

SiTech on Windows requires the Microsoft Dot .Net 1.1 installed. It is free to download at:
http://www.microsoft.com/downloads/details.aspx?FamilyID=262d25e3-f589-4842-8157-034d1e7cf3a3&displaylang=en
If you want to control the SiTech Telescope Driver with a planetarium program, then you should install the ASCOM version 4.1 from here:
http://download.ascom-standards.org/ascom41.exe
Once these two applications are installed, then you are ready to install the SiTech Telescope Driver.

A note about the ASCOM system. ASCOM 4.1 has many telescope and other software drivers as part of the basic ASCOM installation. After installing version 4.1, download and install ASCOM version 5. ASCOM 5 does not come with any individual drivers – you have to find and load each one you want to use. By loading version 4 first, you get the drivers and they are available when you load version 5. The SiTech drivers are the same for both Ascom 4 and 5.

ServoConfig.Exe allows setup of the parameters for the SiTech controller to operate the servo motors, read the encoders, and relate the scope position to the sky (with SiTechExe).

The purpose of ServoConfig is to configure the Sidereal Technology Dual Servo Controller with required information about your telescope. SiTechExe is the SiTech ASCOM driver. **Your controller has been configured for UL16. You DO NOT need to do this if you use it for your UL16.**

You must use ServoConfig to input the following configuration setting to the Controller:

1. Motor Encoder Ticks Per Rev (Alt/Az or RA/DEC)
2. Telescope Encoder Ticks Per Rev (Alt/Az or RA/DEC)
3. Slew Speeds, Pan Speeds, and Guide Speeds.
4. Motor Directions
5. Telescope Encoder Directions

Installation (and subsequent use) of the new SiTech software, requires you to perform the following 4 installs in the following order:

1) Microsoft Dot NET Framework 4.0 (no previous versions are required for Sitech, but other software you use may require earlier versions to also be on your PC). Two options exist to install Dot NET v4. Pick one to use:

a) Download and run the Standalone Dot NET Framework Redistributable Package (~48MB) that installs Dot NET v4 on all current Windows OS's (XP, Win7-32 and Win7-64). This installer will determine your OS and only install the files appropriate for your OS. Afterwards you can delete the large installer file. Use the following link
http://www.microsoft.com/download/en/details.aspx?id=17718

b) Run the Web Installer (~869kb) for the Operating system that you are using. Use the following link and select the one for your operating system and PC (i.e. XP, Win7-32, or Win7-64, etc.):
http://www.microsoft.com/download/en/details.aspx?id=17851

2) ASCOM 6 is required to be installed to be able to run the Sitech 0.90A Installer, and for Sitechexe to interface with any ASCOM compatible programs or hardware. Dot NET v4 must be installed before installing ASCOM 6. ASCOM 6 will install and automatically update from all earlier ASCOM installations (4.1, 5.0, 5.5), i.e. no earlier versions are required. Use the following link to download the ASCOM 6 Platform installer (the Sitech installer will provide the ASCOM driver you will use for the Sitech software):
http://ascom-standards.org/Downloads/Index.htm

3) Run the new SiTech Installer executable (Dot NET Framework version 4 and ASCOM 6 must already be installed) and it will install the new SiTech ASCOM driver and all the files needed to run your controller, including the new ServoConfig version 1.3 that works with all currently available SiTech controllers.

Please understand that the Sitech is a very powerful controller. Only the basic features and installation procedures are covered in this document. For the advanced features, you need to refer to the SiTech official Setup Manual, Operation Manual, the latest release note, and the Yahoo group for detailed information.

4 Sitech SERVO Controller
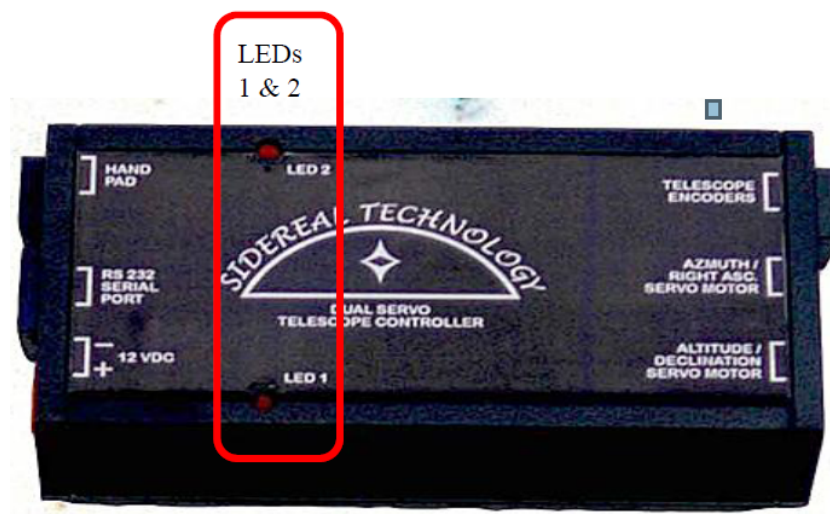
Sitech Controller (I)

4.1 Power

The controller has a power connector/terminal block. Please provide a regulated supply or battery, 4 amp minimum (if full torque is needed) 12 volt D.C. Supply. A 7 amp hour Gel Cell battery is the best portable way to power the unit. This should last 2 or 3 observing nights before recharging is necessary, if you have a low friction, balanced telescope. It has been reported that the Motors can stop working (get into "blink mode" when LED blink in 1 second period) when voltage is lower than 15V DC. An optional 12V to 19V DC power converter can be used for a more stable operation if the 12V battery is used. The controller can handle two servo motors with a peak current draw of 2.4 amps each, but limited to 4.0 amps total at any time. Most of the time the mount is tracking with a low power draw, typically much less than ½ amp per axis. **You can also press the top left and the top right buttons on the handpad simultaneously, and both motors will be returned to the normal (automatic) mode.**
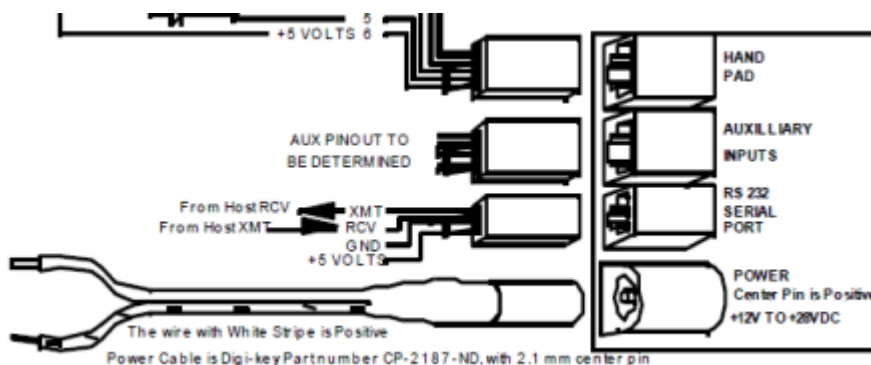
The SiTech servo system runs on 12V-24V DC. However, it has been reported that the Motors can stop working (gets into "blink mode" when LED blink in 1 second period) when voltage is lower than 15V DC. An optional 12V to 19V DC power converter is recommended for a more stable operation if the

12V battery is used.   The controller can handle two servo motors with a peak current draw of 2.4 amps each, but limited to 4.0 amps total at any time. Most of the time the mount is tracking with a low power draw, typically much less than ½ amp per axis. **You can also press the top left and the top right buttons on the handpad simultaneously, and both motors will be returned to the normal (automatic) mode.**

12V to 19V 4A DC voltage converter

4.2 LED Operation

There are two LED's on the controller, labeled LED 1 and LED 2. These LED's can keep you informed about what is happening with the controller.

Normally, LED 1 indicates the status of the Altitude/Declination motor, and LED 2 indicates the status of the Azimuth/Right Ascension motor. The motors have two modes, Automatic, and Manual. If the LED has a steady 1 second period blink, then that motor has been forced to manual by a command from the serial port, or by sensing motor runaway. Motor runaway is caused by 3 possible scenarios, Faulty motor encoder or motor encoder wiring, phasing backwards between motor polarity and motor encoder pulses, or motor can't run as fast as it is being told to run. To return to automatic mode, the controller must be powered down, then powered up again, or the command to return to Auto must be given via a command on the serial port. **You can also press the top left (ESC) and the top right (RTN) buttons on the handpad simultaneously, and both motors will be returned to automatic.**

If both LED's are on very faintly, but steadily, there is a serious problem with the CPU in the controller and the unit will probably need to be returned to our factory for repairs.

If the battery voltage falls below 11 volts, both LED's will flash fast.

4.3 Serial Port Connection

The RS232 serial port is an 8 pin modular jack on the earlier model controllers and a 4 pin modular jack on the later model controllers. Please do not confuse this connector with the motor connectors. It is adjacent to the power connector/terminal block, and on the opposite end of the controller from the motor connectors. Even if you don't intend to use a computer to control your telescope, you will need a computer connected with the serial cable to configure the unit.
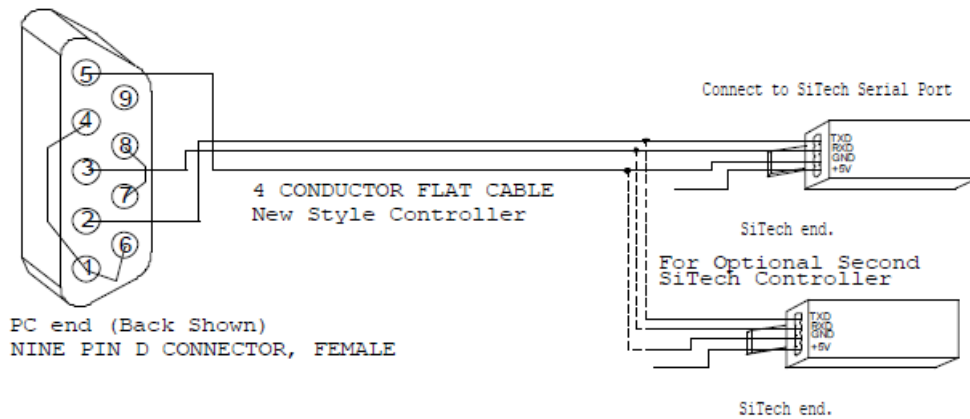
Communication cable for connection to a PC

5 Hand Pad

The **arrow** keys on the handpad will operate the telescope. You can move Altitude and Azimuth at the same time.

If you want the scope to start tracking without initialization, point the telescope at the celestial pole, and then turn the power on the controller. At this point, if you've already set up and saved your latitude, the system will be initialized. It will immediately start tracking. No further initialization is required (while pointing at the celestial pole, the scope won't appear to track because the celestial pole doesn't move!).

If your latitude isn't set up and saved to flash ROM, you will have to initialize at the scope zenith and the celestial pole. To initialize the Altitude, move the scope (by hand or with the handpad) up to the scope zenith. It could be convenient to have a mechanical stop mounted on your scope, so it is easy to find this location. Press and hold the **top right** (RTN) key for more than 4 seconds. At this point, the controller adjusts your altitude so it reads 90 deg's.
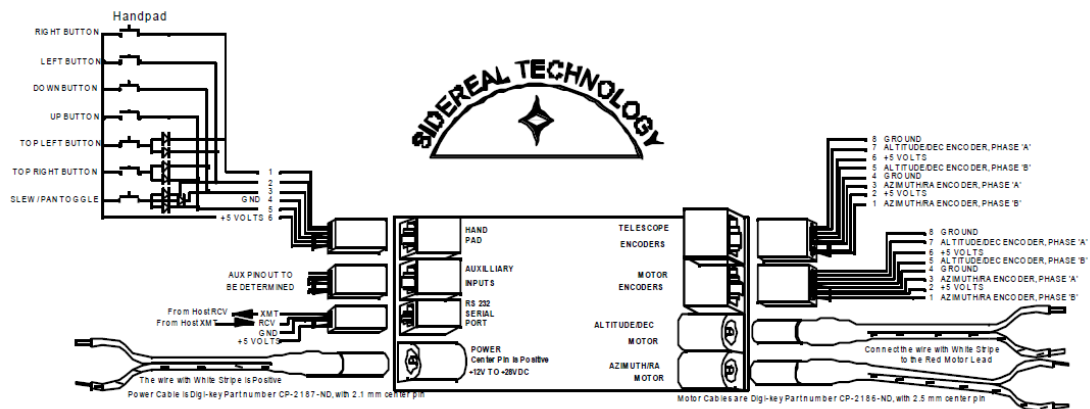

SiTech Wired Hand Pad

To initialize the azimuth, move the scope to the celestial pole. Now press and hold the **top left** key (ESC) for more than 4 seconds. At this point, the controller initializes the azimuth, and if you haven't initialized the altitude, it initializes the altitude to your saved latitude, otherwise it initializes the latitude.

If you have initialized both the altitude and azimuth, you may save the new latitude value by pressing and holding both LEFT(ESC) and RIGHT(RTN) top keys for more than 10 seconds. This saves the latitude to the flash ROM, so next time you can simply initialize the scope on the celestial pole, and press the left hand key for more than 4 seconds.

6 Telescope Encoder Wiring And Setup

Once you have your encoders wired properly, you can connect your computer to the controller with the serial cable and run the ServoConfig software to verify the connection. On the main screen of the software, you should see the encoder values change as the telescope is moved. The altitude numbers should increase on raising the altitude and the azimuth should increase as the telescope is moved clockwise. If the numbers move backwards, you can change the direction by swapping the A and B encoder signals, or use the ServoConfig software and invert the telescope encoder(s).
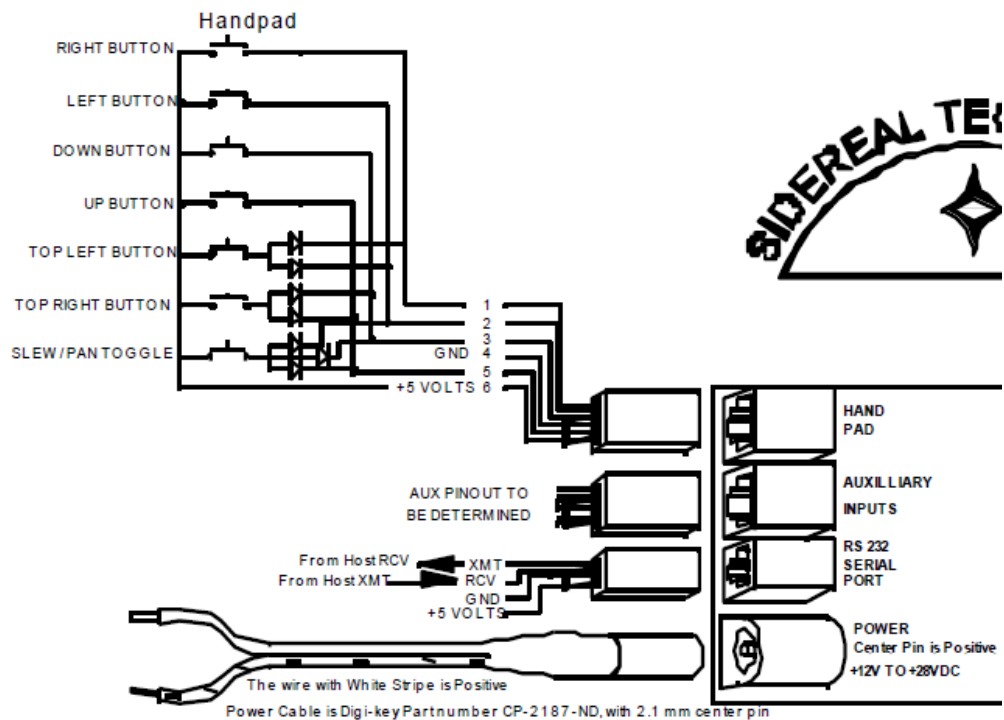
8 GROUND — BLACK
7 ALTITUDE/DEC ENCODER, PHASE 'A' — RED
6 +5 VOLTS — GREEN
5 ALTITUDE/DEC ENCODER, PHASE 'B' — YELLOW
4 GROUND — BLACK
3 AZIMUTH/RA ENCODER, PHASE 'A' — RED
2 +5 VOLTS — GREEN
1 AZIMUTH/RA ENCODER, PHASE 'B' — YELLOW

8 GROUND
7 ALTITUDE/DEC ENCODER, PHASE 'A'
6 +5 VOLTS
5 ALTITUDE/DEC ENCODER, PHASE 'B'
4 GROUND
3 AZIMUTH/RA ENCODER, PHASE 'A'
2 +5 VOLTS
1 AZIMUTH/RA ENCODER, PHASE 'B'

Connect the wire with White Stripe
to the Red Motor Lead

Motor Cables are Digi-key Partnumber CP-2186-ND, with 2.5 mm center pin

Handpad

RIGHT BUTTON
LEFT BUTTON
DOWN BUTTON
UP BUTTON
TOP LEFT BUTTON
TOP RIGHT BUTTON
SLEW/PAN TOGGLE

1
2
3
GND 4
5
+5 VOLTS 6

SIDEREAL TE

HAND PAD

AUX PINOUT TO
BE DETERMINED

AUXILLIARY INPUTS

From Host RCV — XMT
From Host XMT — RCV
GND
+5 VOLTS

RS 232 SERIAL PORT

POWER
Center Pin is Positive
+12V TO +28VDC

The wire with White Stripe is Positive

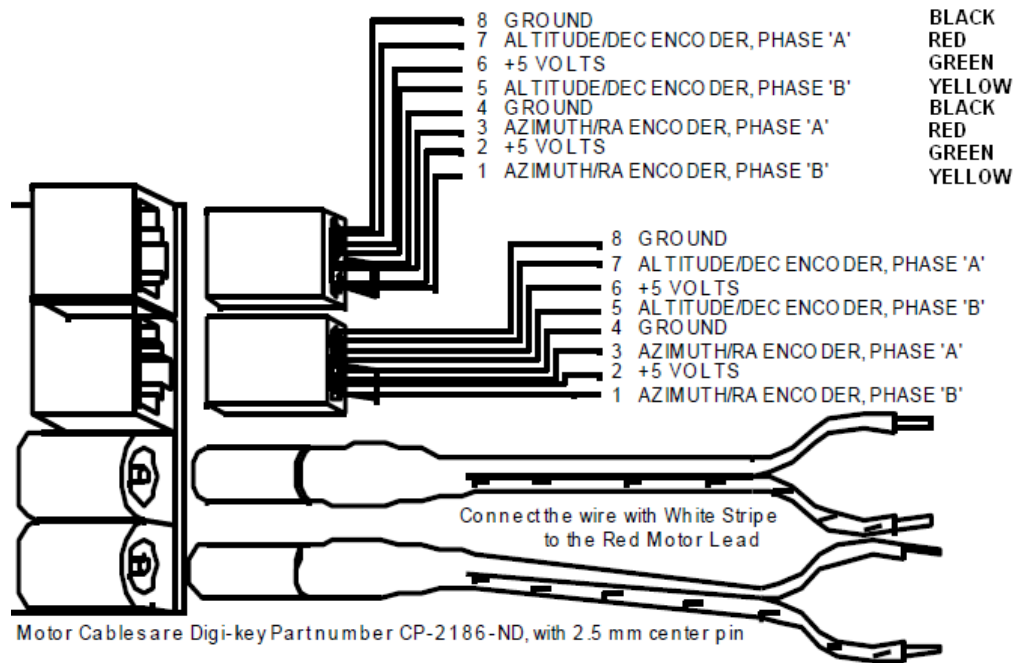Power Cable is Digi-key Partnumber CP-2187-ND, with 2.1 mm center pin

Figure 1:Cables connection to controller

7 Using SERVOCONFIG TO Configure The Controller

Once the mechanical configuration of the motors is completed, and the servo controller, power supply, handpad, motors (and motor encoders) are cabled up, and the telescope encoders (if used) are mounted and also cabled up, and **ServoConfig.exe** is installed and a serial port connection has been provided, its time to use **ServoConfig.exe** to update the controller with important information about your mount. You will need the following information written down to be ready to input into the controller:

You will need the following information written down to be ready to input into the controller:
1. Motor Encoder Ticks per Revolution (Alt/Az)

For the UL14 and UL16, the initial values should be:

- Ticks per Rev (Alt): 500 * 4 * 60.543 * 3 * (790/31.75) = 9038546
- Ticks per Rev (Az): 500 * 4 * 60.543 * 3 * (438/25.4) = 6264055

For the UL18 and UL20, the initial values should be:

- Ticks per Rev (Alt): 500 * 4 * 3 * (790/31.75) * 60.543 = 9038546
- Ticks per Rev (Az): 500 * 4 * 3 * (538/25.4) * 60.543 = 7694205

For the UL24, the initial values should be:

- Ticks per Rev (Alt): 500 * 4 * 3 * (870/40) * 75 =   9787500
- Ticks per Rev (Az): 500 * 4 * 3 * (690/30) * 75 = 10350000

Where 500 (PPR) is the encoder resolution, 4 is for the quadrature decoding, 60.543 is the motor built-in gear ratio, 3 is the external gearbox ratio, 31.75(mm) is the diameter of the Alt drive roller, 790(mm) is the diameter of the Alt bearing, 438 (mm) is the inner diameter of the AZ bearing for UL14/16, 538 (mm) is the inner diameter of the AZ bearing for UL18/20, 25.4(mm) is the diameter of the AZ drive roller.

You are strongly urged to run the Sitech ServoConfig Tick determination to fine tune the above values for your scope.

2. Telescope Encoder Ticks per Rev (Alt/Az)
     8192 for both Alt and Az **(There is no need to specify this in SlewNTrack Mode)**

3. Slew Speeds, Pan Speeds, and Guide Speeds.
The Slew Speed is the speed the mount will rotate when slewing to another target using a GOTO command or if you are in the "Slew" mode with the handpad and push a button.

Pan Speed is what you use when you have slewed to a target, and are tweaking it to the center of the eyepiece or CCD chip.

Guide speed is the speed that you would use to manually guide (or have an auto guider use) for imaging, or for visual observing to tweak the position in the eyepiece.

Slew Speeds: 2 dps (degrees per second) for the AZM axis and 1 dps for the ALT axis
Pan Speeds: 3 mps (minutes per sec)
**Guide speed: 60 sps (seconds per second)**

It is very important to set the ALT slew speed to about 1dps (about 1/2 of the ALT slew speed) to avoid the controller getting into "blink mode" occasionally. Considering you can slew both Axes at the same time using the SiTech Hadpad, and normally there is only up to 45 degrees (45°-90°)

you can slew in ALT axis, so there will be no performance loss by setting ALT slew speed to 1 dps.

Just to be clear, each servo motor has a small encoder attached to it. This provides closed loop control of the motor, and is referred to as the "Motor Encoder". **These Motor Encoders are not the Telescope Encoders which are installed for ALT/Az axes.**

7.1 Main Screen Overview

Now it is the to start ServoConfig.
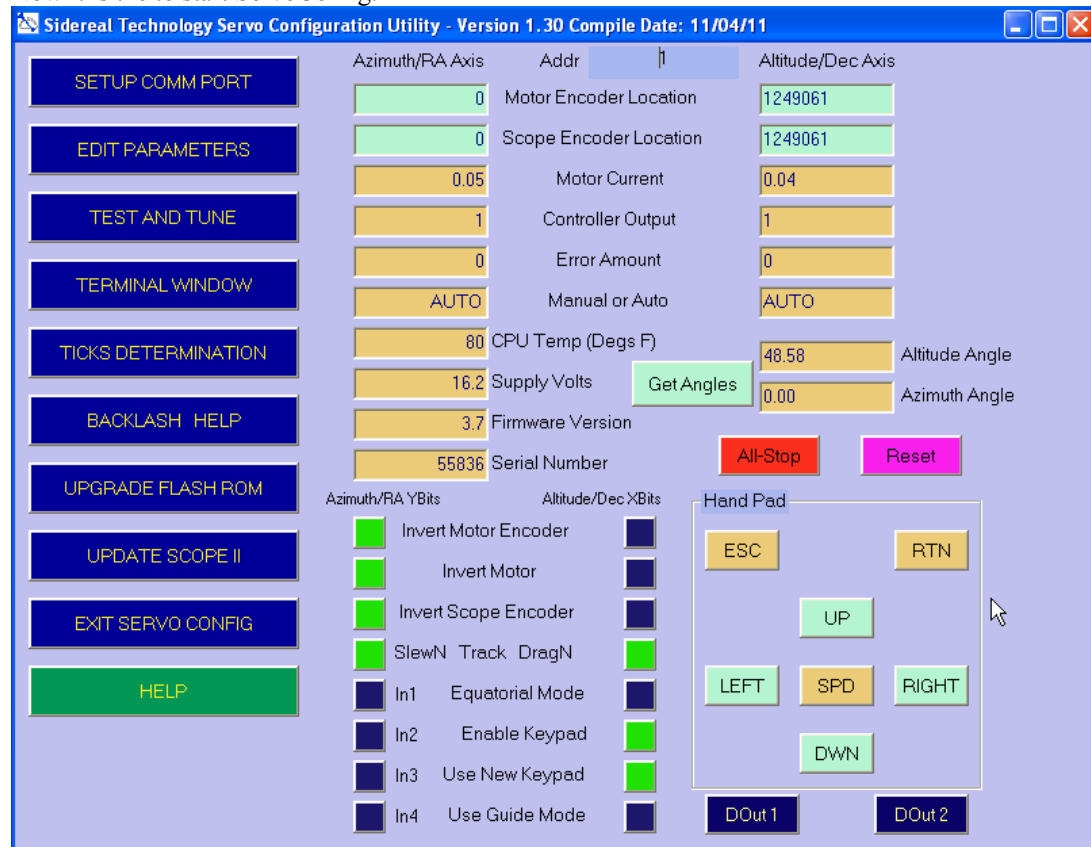
This is the main screen of the ServoConfig. There are 4 main "areas" on the main screen.

7.1.1 Text Box Area

Various self explanatory information is updated automatically if there is communication between this program and the SiTech Servo Controller.

If there is no communication, there is a red message that appears at the top of this area to let you know there is "Bad Comm" as shown above. If there is communication, the "module address" (**not the Comm Port number**) is displayed at the top center of the screen

The light green boxes are boxes where you can change the values.

7.1.2 Virtual Handpad Area

Also, the same light green color of buttons are on the 4 directional inputs on the handpad indicator.
You can click on these four buttons, and the motors will move correspondingly.
To Stop any motor movement, click on the red E-STOP button.

The ESC, RTN, and SPD virtual buttons are indicators only, and have no effect when clicking on them.
Also, if you have a handpad receiver, there are two digital outputs available for the system to use. You can test them by clicking on the two buttons labeled DOut1 and DOut2.

You must press the purple "Reset" button on the ServoConfig every time after you have used SitecExe. Otherwise, you will not be able to use the "ESC" button on the real hand pad.

7.1.3 X and Y bits status area
In the lower center area labeled "Azimuth/RA Ybits", and "Altitude/Dec Xbits", there are "indicators" that turn from dark blue to green to indicate that state described is "on".

7.2 Setup Comm Port
You can select which PC comm port to use with this button.
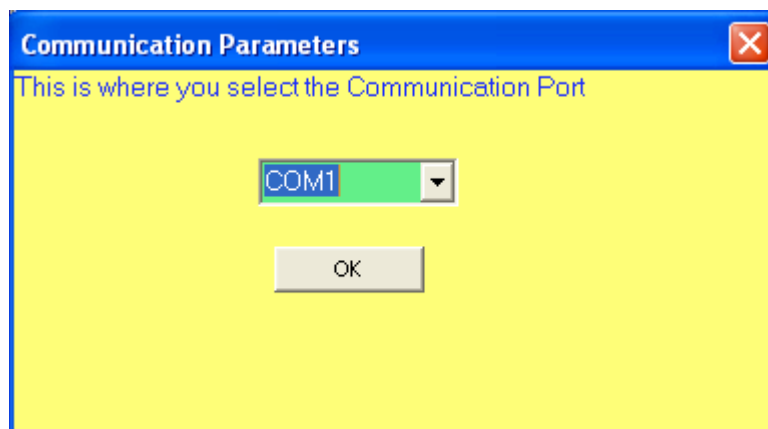
You will have to "Send Configuration to Controller" from the "Misc. and Action" page to send and save the parameters to the controller.

7.3 Edit Parameters
When you select Edit Parameters, you must choose where the data you want to edit will come from. You have 4 choices. The Controller; a file you've previously saved (the file extension will be .car); the main Window; or default data. A screen pops up for you to make the selection:
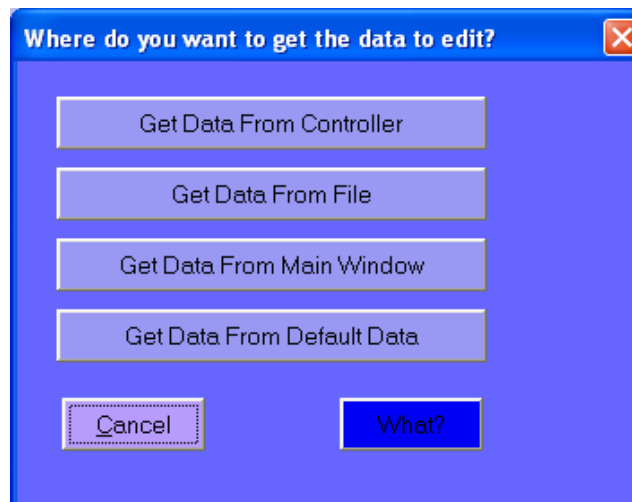
The data that populates the windows in the Edit Parameters Tool will come from whichever of these sources you pick. **Most of the time you will use the "Get Data From Controller" option.** Select this option as we go through initially setting up your controller.

7.3.1 Motors/Encoders Tab

All of the Magenta colored text boxes can be edited. The red boxes at the bottom are the XBits and the YBits and are automatically updated when you select the options using the radio buttons.

Clicking the Cancel button will return you to the main menu, but the data you've edited will be lost (unless you saved it to the controller or to a file using the "Misc. and Action" page).

UL16 Motor/Encoder Configuration

You can set the guide speed to:

Slew Speeds: 2 dps (degrees per second)
Pan Speeds: 3 mps (minutes per sec)
Guide speed: 60 sps (seconds per second)

	Azimuth/Right Asc Motor			Altitude/Declination Motor		
		6264055	No of Ticks per Scope Rev	9038546		
DPS	3.00	1751669	Slew Speed	842507	1.00	DPS
MPS	3.0	29194	Pan Speed	42125	3.0	MPS
SPS	60	9731	Guide Speed	14042	60	SPS
dpsps	1.67	500	Default Acceleration	500	1.16	dpsps

Acceleration
The Acceleration is the rate at which the motor ramps up to speed.

Use **500** first. This number should be entered as "raw" value; the right entry box for the Az motor, the left entry box for the Alt motor:

	Azimuth/Right Asc Motor			Altitude/Declination Motor		
		6264055	No of Ticks per Scope Rev	9038546		
DPS	3.00	1751669	Slew Speed	842507	1.00	DPS
MPS	3.0	29194	Pan Speed	42125	3.0	MPS
SPS	60	9731	Guide Speed	14042	60	SPS
dpsps	1.67	500	Default Acceleration	500	1.16	dpsps

Default Acceleration

Proportional, Integral, and Derivative (PID) Gain
The Proportional, Integral and Derivative are motor tuning parameters. Again, these are best adjusted using the "TEST and TUNE" main menu item. There is a more complete description of these parameters on the TEST and TUNE dialog box. The default values of 15,000, 2500, 4000 work for most all motors.

Error Limit
The error limit is the point where the controller stops the motor if the motor is not moving properly. The ERROR is the difference (in motor encoder ticks) between where the motor is, and where it should be. Use the default of 12800.

Output Limit
If you are using a 12 volt motor, but supplying the controller with 24 volts, you will want to put an output limit on. The default is 100%, which is full output. With a 12 volt motor supplied with 24 volts, you would want this value to be 50%. **Use 100%.**

Current Limit
The controllers are rated at max **2.4 amps**, each motor, and a maximum of 4 amps, both motors combined at the same time (i.e. if both are set to 2.4, the controller can only provide 4.0 instead of 4.8). You can make the current limit be less than the 2.4 amps default, by lowering this value. The value 2.4 represents limiting the current to 2.4 amps. You will have less torque when lowering this value.

Integral Limit
The Integral portion of the PID control adds more and more to the output over time, until the motor reaches the desired position or the set point. Sometimes this can go too far, and it takes too long to "un-correct" when slowing back down. To solve this problem, you can limit the integral windup using this parameter. **The default is 22,000.**

Invert Motor Encoder Direction Radio Button

You must check the following buttons (see the above figure) for the AZ motor:
- Invert Motor Encoder Direction
- Invert Motor Direction
- Invert Scope Encoder

Backlash
Use the Backlash Help Tool to refine your estimate of your backlash later. For now you may want to leave it zero.

Once you've made the changes you want, you MUST click on the "Misc and Action" tab and "Send Configuration to Controller".

Clicking the OK button will return you to the main menu, and the data you've edited will be sent back to the main structure.
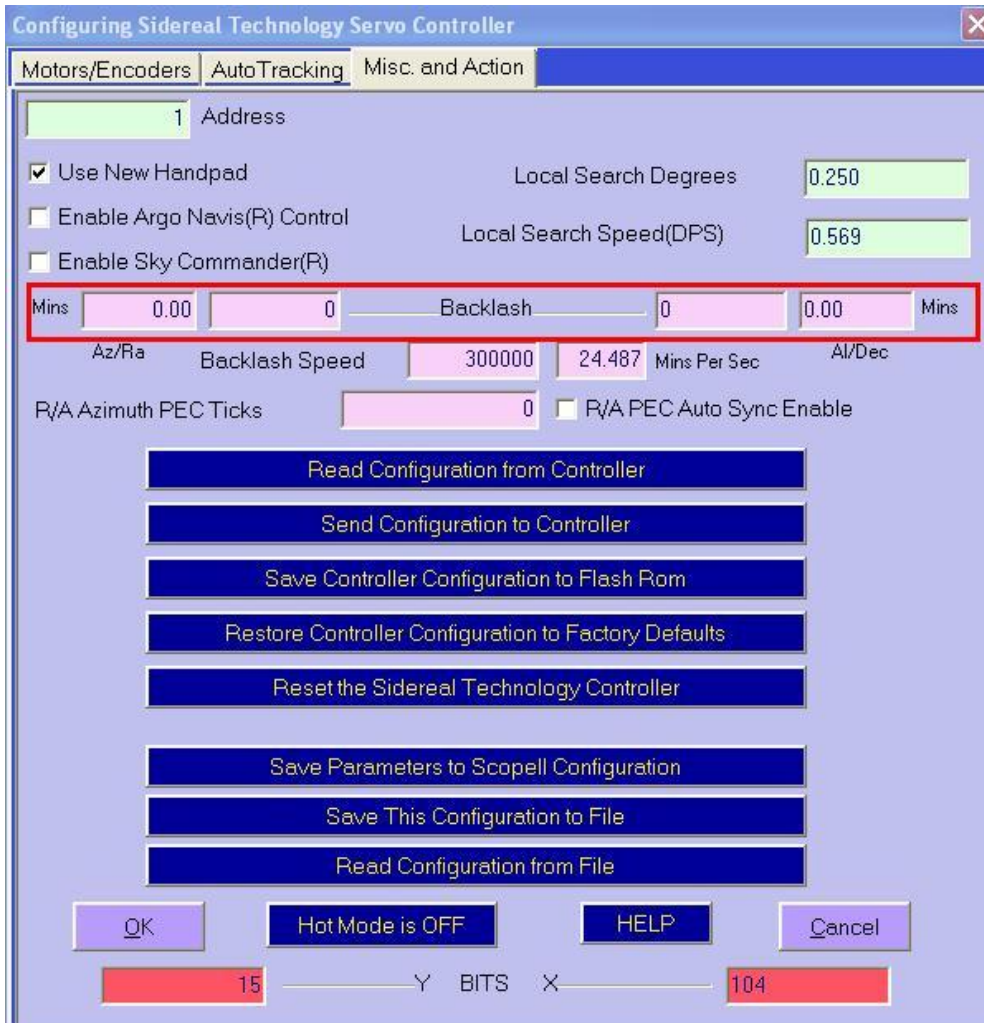
7.3.4 Auto Tracking tab Dialog

You need enter the motor and scope encoder information in this screen. Normally, you will need to select the DragNTrack mode. However, you may want to use the SlewNTrack Mode first. In the SlewNTrack mode, the Sitech controller will ignore the Scope encode. BTW, you cannot drag your scope manually in the SlewNTrack Mode.
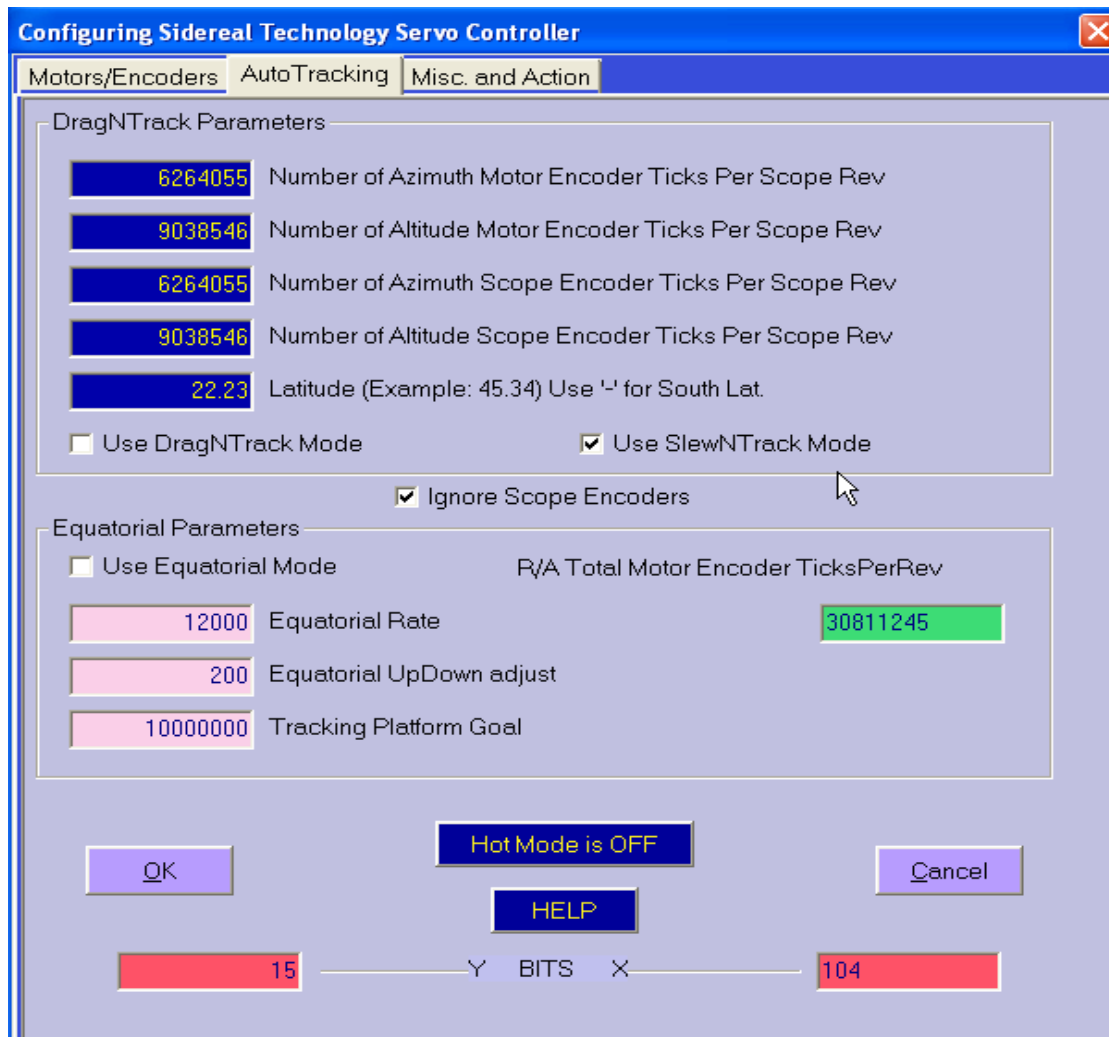
Drag and Track Mode

Slew and Track Mode

To save to the FLASH ROM, you must select the "Misc. and Action" page, and select the item "Send Configuration to Controller" and "Save Controller Configuration to Flash Rom".

7.4 Controller Firmware Update

The current latest version of firmware in the SiTech controller is 37A. If you have a version of firmware prior to this, you should upgrade. You can download version 35A at: http://www.siderealtechnology.com/V37A.BIN

Download the file and place it in your working directory for this program (C:/ServoConfig). Then select the "UPGRADE FLASH ROM" option, browse to this file, and you will be upgraded.
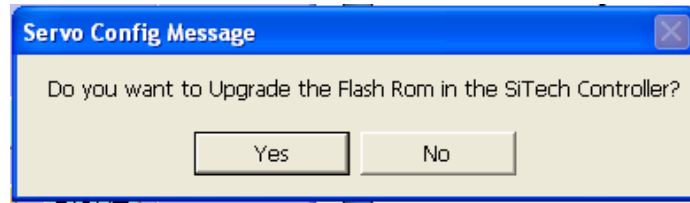
You will get the screen above to confirm you want to upgrade, if you do, click YES

The screen above will appear to allow you to browse to the right file, highlight it and click on open. The update process will start and you can monitor it as it uploads the new firmware. When complete, you will get a window pop up that tells you it is complete. **Till that window comes up, watch the digital neurosurgery show going on and do not mess with anything!**
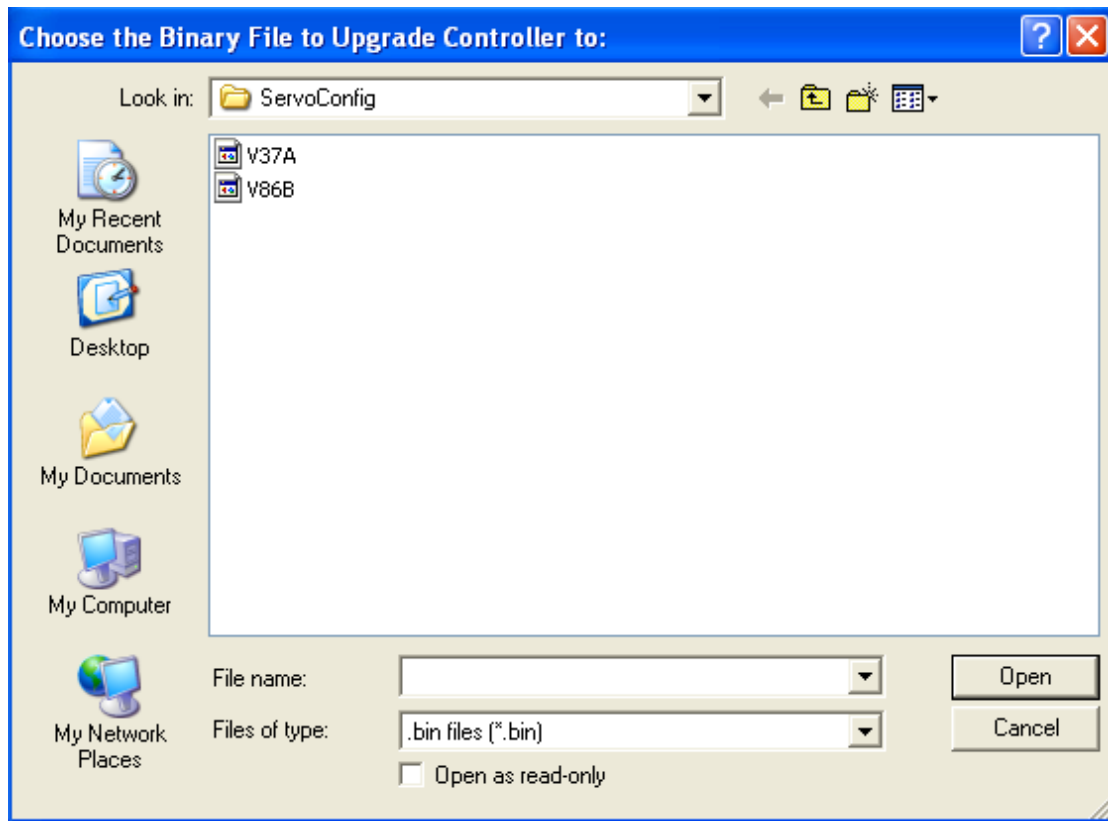
Every great once in a while, the FLASH ROM can get scrambled somehow. If that happens, there is a way to still get the firmware loaded. Power OFF the controller. Plug in a wired handpad (if RF handpad, use the handpad with a cable wired directly to the controller). Then, while holding down the top two buttons on the handpad, power the controller up. Once powered up, release the top two buttons (ESC and RTN). Then you can do the firmware update to the current firmware.....

8 GOTO Operations

There are many ways to control the telescope via Sitech controllers. Please refer to the Sitech Operation manual for the detailed instructions.

8.1 Drag&Track, SlewNTrack Operations via Handpad

If you want the scope to start tracking without initialization, point the telescope at the celestial pole, and then turn the power on the controller. At this point, if you've already set up and saved your latitude, the system will be initialized. It will immediately start tracking. No further initialization is required (while pointing at the celestial pole, the scope won't appear to track because the celestial pole doesn't move!).

If your latitude isn't set up and saved to SiTech controller flash ROM, you will have to initialize at the scope zenith and the celestial pole. To initialize the Altitude, move the scope with the handpad up to the scope zenith. Press and hold the top right (RTN) key for more than 4 seconds. At this point, the controller adjusts your altitude so it reads 90 deg's.

To initialize the azimuth, move the scope to the celestial pole. Now press and hold the top left key (ESC) for more than 4 seconds. At this point, the controller initializes the azimuth, and if you haven't initialized the altitude, it initializes the altitude to your saved latitude, otherwise it initializes the latitude.

If you have initialized both the altitude and azimuth, you may save the new latitude value by pressing and holding both top keys for more than 10 seconds. This saves the latitude to the flash ROM, so next time you can simply initialize the scope on the celestial pole, and press the left hand key for more than 4 seconds.

You will toggle through slew/pan/guide modes by pressing the SPD button.

For the DragNTrack to work properly, it's important to note that the UP handpad key needs to move the telescope up in altitude and the RIGHT key needs move the telescope azimuth in a clockwise direction.

It would be easy to put a negative number into the slew and pan rates to obtain these results, and the controller would respond with the opposite direction, but the trigonometry would still be wrong.
It's also important to note that when the telescope is moving clockwise, the azimuth telescope encoder should be increasing, and when the telescope is moving up, the altitude telescope encoder should be increasing. If these move backwards, then the direction needs to be changed using the ServoConfig software, or change the wiring of the encoders.

To perform photography, or for very fine centering, it may be desirable to enter the guide mode. This is done by holding down the top right key (**RTN**), then pressing the right key (→). Now the speed changes by adding or subtracting the guide rate from the current tracking rates. To revert back to the normal mode, hold down the top right key (**RTN**), and press the right key (→) again. If you are using servo version 1.6 and you have a radio handpad receiver, you will toggle through slew/pan/guide modes using the SPD button.

You may slew the telescope with the handpad, or move the telescope by hand by loosening the clutches and moving and retightening them, and when done slewing or moving, the telescope will immediately start tracking again, at the new drive rates based on the telescopes altitude, azimuth and the latitude. To stop tracking, press the top right key. To start tracking again, press it again. When the tracking is stopped, the LED's will blink off briefly every few seconds (version 1.6 of firmware and later).

Please note that the scope will be out of sync with SkySafari if you drag it after the initial alignment; you have to align the scope using SkySafari every time after you drag it. This hopefully will be fixed in future release soon.

Review of Initialization options

You must press the purple "Reset" button on the ServoConfig every time after you have used SitecExe. Otherwise, you will not be able to use the "ESC" button on the real hand pad.

It may be confusing, because there are several ways to initialize the telescope. The user has three choices.

Choice 1:
Before turning on power to the controller, position the telescope by hand (loosing the both quick release clamp when doing so) to the celestial pole (NOT at Polaris! The Celestial pole! NCP for the north hemisphere, SCP for south hemisphere). Remember to put back the release clamp now. Then, turn on power.

The controller initializes the azimuth, and initializes the altitude to the same value as the last saved latitude. Using Choice 1 means you don't even have to use the hand pad, and you don't even need to connect it to the controller! **Although you MUST have previously saved your latitude.**

Choice 2:
Step 1. Move the scope to the telescope zenith (with help of a level for the better result) and hold down the top right hand button **(RTN)** for more than 5 seconds (when the LED on the controller flashes fast, you may let up). The controller initializes the altitude position at 90 deg's.
Step 2. Move scope to celestial pole, and hold down the top left hand bottom button **(ESC)** for more than 5 seconds (when the LED on the controller flashes fast, you may let up).
Your scope is now initialized, and the DragNTrack or SlewNTrack will be working (assuming the Servo controller is properly configured). (Note, must have version 1.6 of firmware for this to work properly).

Scope latitude is the effective latitude of your scope. It is the same as your own latitude if your scope is level, but will be slightly different latitude if the scope is not level in a north/south direction. This process will calculate your latitude. **If you want to save this automatically calculated latitude in the Servo Controllers' Flash ROM, simply press and hold both the top right (RTN) key and the top left (ESC) key simultaneously for more than 10 seconds.**

Choice 3:
Slew the scope to celestial pole, and hold down the top left button (**ESC**) for 4 seconds
The controller initializes the azimuth and initializes the altitude at the same value as the last saved latitude. This is difference from choice 1.

With choice 1, you must move the scope to point the NCP by hand, and then power it on; you don't even need to connect a handpad with Choice 1. With choice 3, you turn on the power first, and slew the scope to the NCP, and then press "ESC" button. Of course, you can move the scope by hand with Choice 3 too. The advantage of Choice 1 is that you don't even need a handpad. The advantage of Choice 3 is that, with a handpad, it is much easier to slew the scope more accurately to the NCP!

Before a user can use choice 1 or choice 3, the latitude needs to be set up and saved to flash ROM.
If a user used choice 2, they may want to save the latitude, so next time they don't have to initialize at the zenith. This is done by holding down both the left and the right hand bottom buttons for more than 10 seconds right after the choice 2 initialization. This action will save the latitude into the flash ROM, thereby making it possible that next time the telescope is set up (assuming the base is reasonably level, and you are near the same latitude), the user will not have to use choice 2, but only choice 1 or choice 3.

Here are some screen shots from Earth Centered Universe that show placement for celestial pole alignment. The QuickFinder has the two middle circles but not the outer circle. The two middle circles are the same size in both the QuickFinder and the Telrad. Limiting magnitude is 6.0.

Telrad Placement for North Celestial Pole Alignment
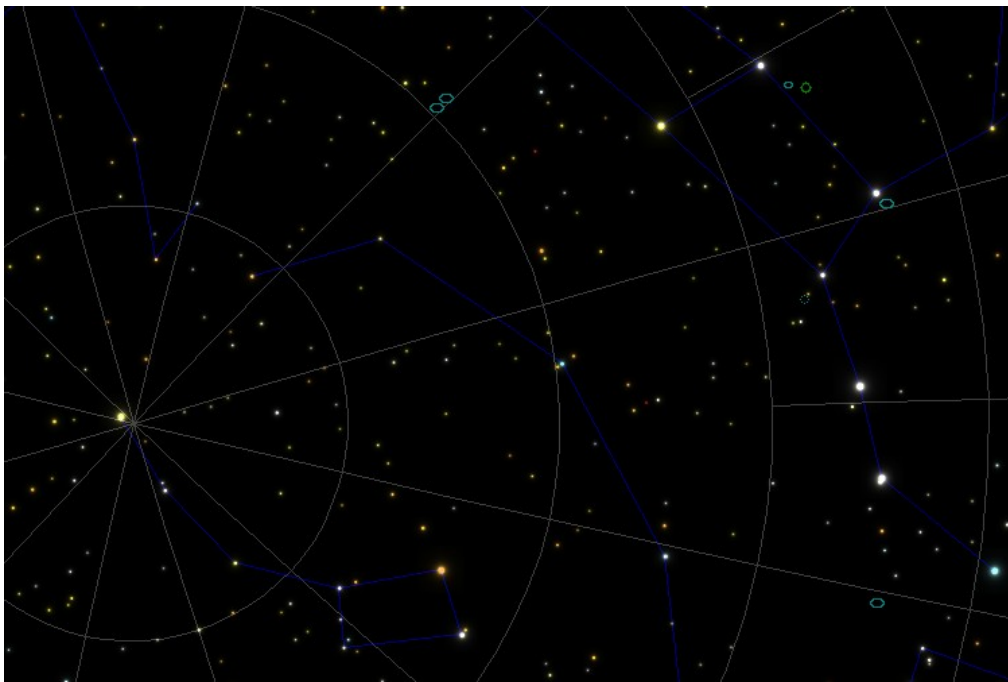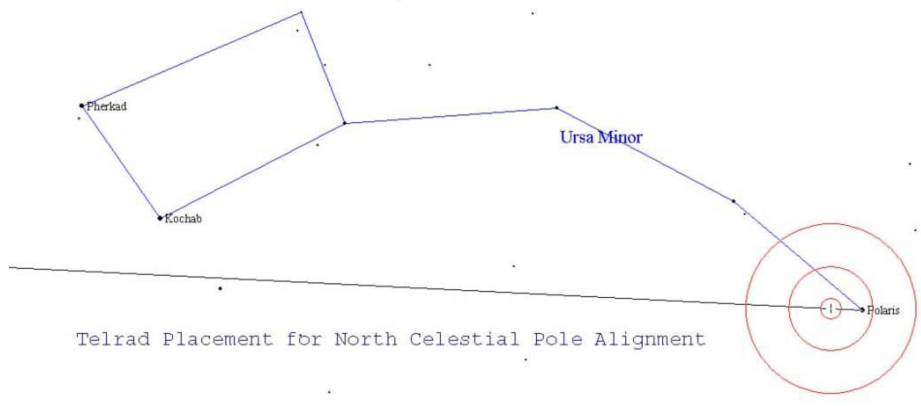
NCP (SkyGazer Screen Capture)

You should be able easily to find the 'Great Bear' or 'Big Dipper'. Then follow the 2 stars at the end of the 'bucket' to find the pole star (Polaris) at the end of the 'little dipper' arm. The distance between the Dubhe (the last star at the end of the bucket) and the and the Polaris is about 5 times of that between Dubhe and Merak (the 2 stars at the end of the 'bucket').

Telrad Placement for South Celestial Pole Alignment
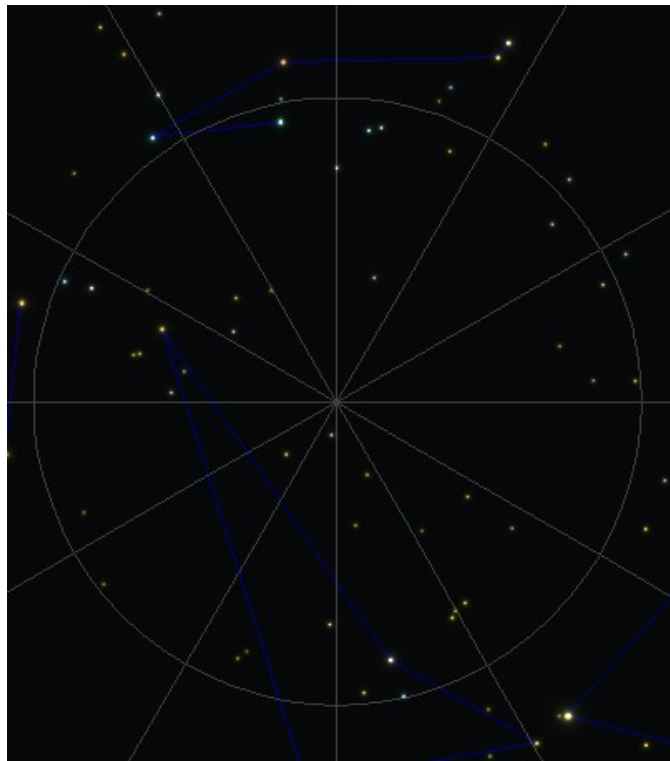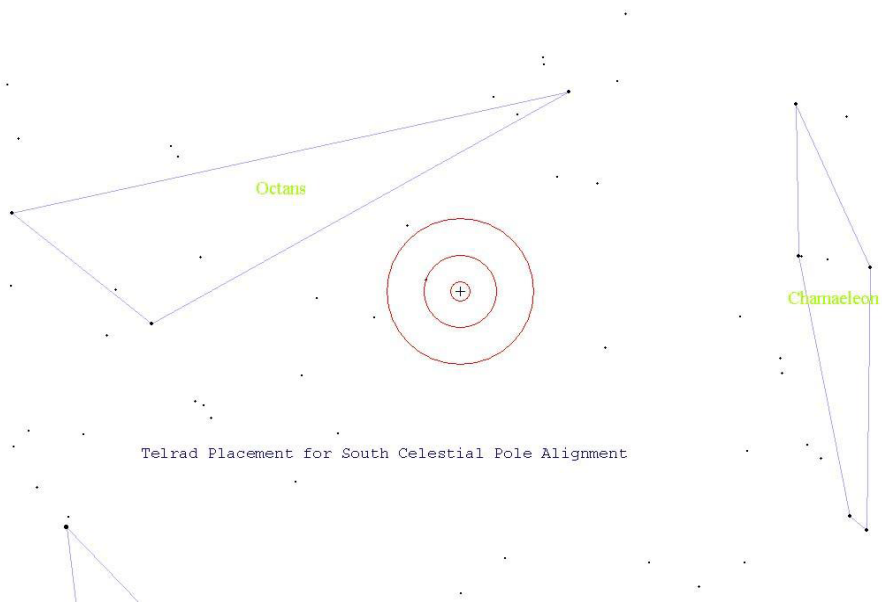

SCP (SkyGazer Screen Capture)

While the controller is in the DragNTrack mode, the serial port can be connected to a laptop running almost any planetarium software. Set your software to connect to a "Tangent" encoder interface box, and you will be able to surf the sky using the planetarium software! When setting up your planetarium software, set up both encoder resolutions to 18000. Also, do not use the option that your telescope is on a tracking platform. Think of it like a telescope without a platform where you have this little guy pushing it all the time, exactly keeping up with the stars. That's what your planetarium program will "think"!

Also, set the baud rate of your planetarium software to 19200, no parity, 8 data bits, and 1 stop bit.

8.2 Local Search

You must use ServoConfig to set up the local search radius and speed under **"Misc. and Action"** tab.
Here is how to use the Local Search feature:

- While aimed at the area of sky you believe the object to be is, hold down the Top Left key (ESC)
  of the keypad, and then quickly (within 4 seconds, otherwise the it will initialize a controller reset)
  press the UP (↑) key. You can also initiate it for a higher power eyepiece which halves the circle
  radius, by holding down the Top Left key, and pressing the DOWN (↓) key.

- To increase the search speed, hold down the Top Left key and press the UP key.
- To decrease the search speed, hold down the Top Left key and press the DOWN key.
- To reverse directions and start working inwards, press the DOWN key. You can revert to the
  normal
- To PAUSE the search, press the speed key. To resume, press the UP, DOWN, or the speed key
  again
- To exit the Local Search mode, press the LEFT or the RIGHT direction key.
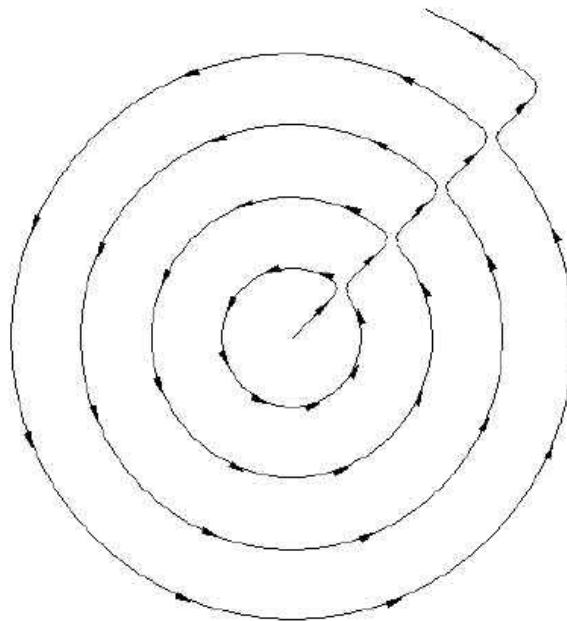
8.2 GoTo Operation via Sky Safari

Please understand that Sky Safari is not available on MS window based systems.

8.2.1 Sky Safari Setup

Connection to SiTech:
Via a WiFi-to-RJ11 through a SkyFi wireless adapter. The adapter creates a local 802.11 wireless
network (not an Internet access point). It can also be used with other PC or Mac software, providing the
computer is running a virtual serial port through its WiFi adapter.

Handpad requirement and operation:

SkySafari provides a slider switch to select slew, pan or guide speed and four direction control arrow
buttons. The SkyFi WiFi unit can replace most handpad's operations. Or, both the handpad and
SkySafari can be used concurrently. SkySafari can also be used as a flashlight when night vision mode
is selected and the iOS device's brightness control is sufficiently high. SkySafari **cannot** reset the
SiTech controller; so you still need the Sitech Handpad for certain operations.

a. Scope Type: SiTech Controller
b. Mount Type: Alt-Azimuth GoTo (or German Equatorial, or Equatorial Platform)
c. Readout Rate: 10 per second
d. Encoder Steps Per Revolution: Get Automatically "ON"

8.2.2 Operation with SkySafari

a. Align telescope on NCP and power up SiTech
b. Power up SkyFi adapter and iOS device (iPhone, iPad, etc.)
c. Start SkySafari app and tap "Scope" to bring up telescope control menu
d. Tap "Connect" to establish communication with the controller.
e. Drag or Slew (using Sitech Handpad or SkySafari)telescope to an object
f. Tap "Search" to bring up object selection menus. Tap appropriate search menu (Planets, Moons, Asteroids, Comets, Satellites, Named Stars, Brightest Stars, Nearest Stars, Double Stars, Deep Sky Objects, Messier Objects, Caldwell Objects or Asterisms) or type object's name
g. Scroll through list and tap on desired object
h. Tap "Center" button. Display will show telescope crosshairs centered over the selected object in the sky. Tap "Align" button. This aligns SkySafari's model with the telescope.
i. To slew automatically to another object, select it as described above. Instead of tapping "Center", tap "GoTo." Telescope will slew to new object. Repeat for subsequent objects.
j. Objects can also be selected by scrolling and zooming the sky display, tapping on them on the sky display, then tapping "GoTo" button.

Accuracy of slewing and tracking:
Tracking is performed solely by the SiTech controller. Whatever slewing and tracking results you would get with SiTech in computer-less operation is what you'll get with SkySafari. SkySafari does not read telescope encoders if available; it only uses servo motor encoders. SkySafari does not incorporate a two-star alignment, nor can it correct for mount errors. It helps to align the controller on the NCP, have accurate tick count determination, level the mount, and minimize clutch or drive slippage. Tapping on "Align" after a "GoTo" may also improve accuracy.

Please note that with current release (Skysafari 3.1 Plus/ Pro), the scope will be out of alignment if you drag it after the alignment; you have to re-align the scope after you drag it. This hopefully will be fixed in future release soon.

(The Skysafri Setup and Operation instruction is courtesy of Bruce Sayre)

For detailed SkySafari Plus/Pro instruction, please refer to:
http://www.southernstars.com/support/manual/manual.shtml

8.3. Telescope Control via SitechEXE on PC

Sitech's extremely powerful SitechExe.exe can be used for the telescope control from a MS Window's based PC. You must connect your PC to the SiTech controller with a RS232 serial port when the SitechExe.exe is used. You may use an USB-to-RS232 converter if there is no RS232 port on your PC.

Please refer to Sitech Operation manual and the SitectExe 0.90 Release note for the detailed operation instruction.
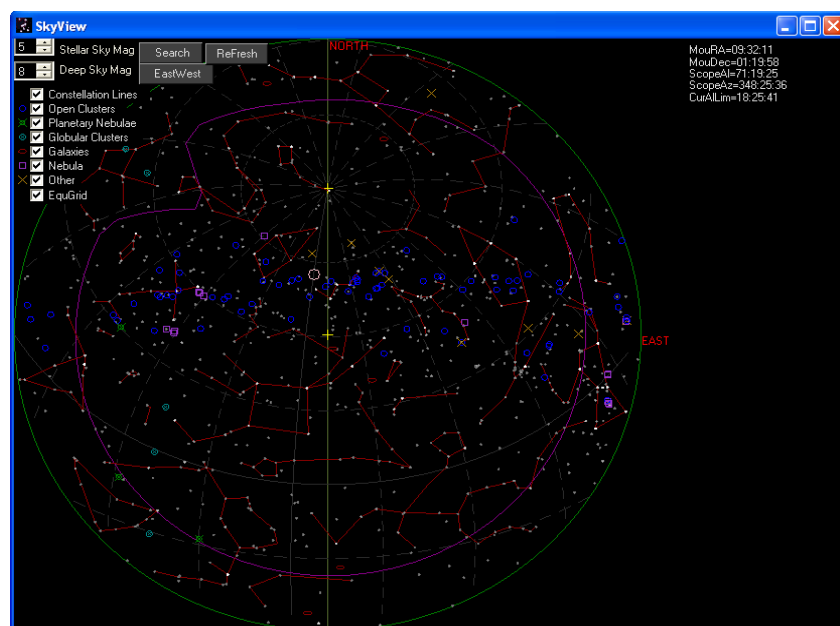
SitechEXE SkyView Planetarium program

The following is a brief but extremely helpful instruction on how to use SitechEXE by Chuck Shaw. (http://finance.groups.yahoo.com/group/SiTechservo/message/17343)

I simply roll it out onto the patio, power up the controller and laptop, and while the laptop is booting up I run down the 3 scope dolly jack screws to make it steady and get the mount pretty level (I have a bubble level on the inside of the rocker box).

I start SitechEXE, and while it's starting I put in my 12mm reticule eyepiece. Then I aim the scope at a known star (usually off in the east, and do an offset init on the star and that's it… The mount is tracking and is accurate enough for casual observing and GOTOs for the rest of the evening.   If I do a GOTO to some other part of the sky, and do another Offset init in that other part of the sky to make GOTO's in that new area more accurate.

I do not usually use SETPARK and PARK and UNPARK since the scope is rolled in and out, and the PARK routine counts on the fact the scope has not been moved from its park position so the UNPARK is accurate. Move it and UNPARK will not be accurate…

If I want to do Satellite Tracking, I build a PXP Model, before trying to track Sats. It only takes about 15 minutes total to build a 9 to 12 star model after rolling out and doing my normal setup ops to the point the scope is tracking. That's generally enough for acceptable tracking for most satellites. I do not usually use a camera with my ALT/AZ so I let the PXP script build the locations, and use Sky View to then do short slews to nearby stars, tweak them in the crosshair EP and do CalStar Inits and then unPause the script for the next Cal Point. I start this as soon as you can start seeing 4th mag stars in the eyepiece (the sky is still bright), because there are a lot more satellites visible shortly after dusk.

Note, once you run SitechEXE, the DragNTrack/ SlewNTrack modes, and the ESC button for initialization is disabled. You need to reconfigure the DragNTrack/ SlewNTrack modes and press "Reset" in the ServoConfig before you can use these handpad functions again.

8.4 Telescope control via ASCOM Compliant Planetarium programs

One of the most powerful and useful SiTech capabilities is to interface with ASCOM Compliant Planetarium programs and telescope control routines inside CCD imaging programs. The following popular Planetarium programs are described in SiTech Ooperation manual:

- Earth Centered Universe (ECU)
- TheSky™
- Cartes du Ciel
- *MegaStar*

8.5 Local Search

9 Limited Warranty

Optel Engineering Group Inc., Seller, warrants to the original purchaser only, that goods sold will be free of material defects in design, materials and workmanship for a period of 6 months following the date of shipment by Seller to Buyer. Seller will repair or replace, or refund the purchase price as to, goods that do not conform to the foregoing warranty, provided the cause of the nonconformity does not arise from or relate to modification, misuse, or abuse by the customer, and provided a warranty claim. Repair or replacement of the product or refund of the purchase price, at Seller's sole option, shall be the Buyer's exclusive remedies. Seller shall not be responsible for any indirect, special or consequential damages arising from use of the products. Goods subject to this warranty must be shipped postage pre-paid by Buyer to the Seller.

If the controller has been damaged by modification, lightning, faulty wiring, moisture, or other misuse, the warranty is void.

10 Technical Support

Hubble Optics (Optel Engineering Group Inc.) will provide the support for the basic operations by email. You will receive a response, generally within 24 hours. For the advanced features beyond this document, please refer to the SiTech Setup Manual, Operation Manual, SiTech ASCOM Instruction, the latest release note, SiTech and Sky Safari yahoo groups. You may also contact Sidereal Technology and Southern Star (for SkySafari) for the technical support.
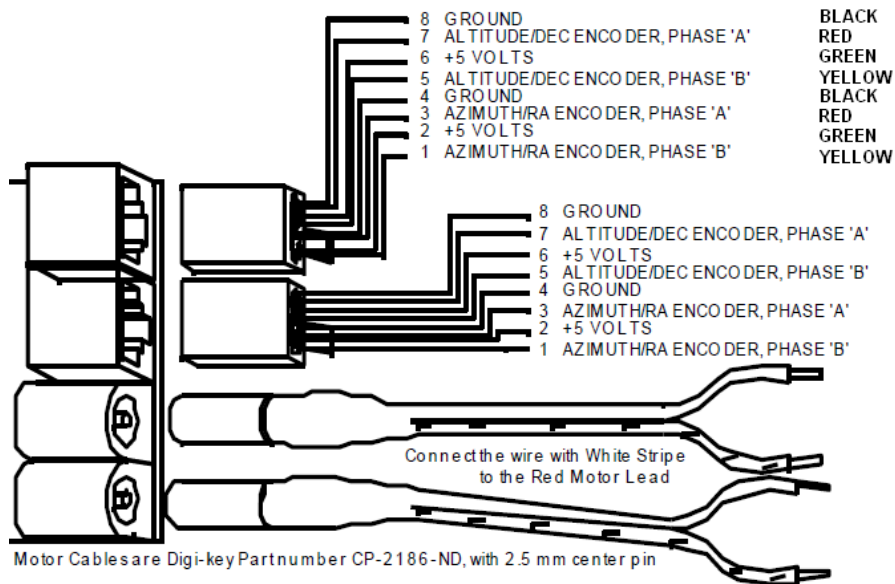
Sitech Manuals:
http://www.siderealtechnology.com/page8.html

Sitech Yahoo group:
http://tech.groups.yahoo.com/group/SiTechservo/

SkySafari Yahoo group:
http://tech.groups.yahoo.com/group/southern_stars/

SkySafari Manual:
http://www.southernstars.com/support/manual/index.html

Appendix A: Motor and Motor Encoder Pin Out

Pin	Signal	Color
8	GROUND	BLACK
7	ALTITUDE/DEC ENCODER, PHASE 'A'	RED
6	+5 VOLTS	GREEN
5	ALTITUDE/DEC ENCODER, PHASE 'B'	YELLOW
4	GROUND	BLACK
3	AZIMUTH/RA ENCODER, PHASE 'A'	RED
2	+5 VOLTS	GREEN
1	AZIMUTH/RA ENCODER, PHASE 'B'	YELLOW

8 GROUND
7 ALTITUDE/DEC ENCODER, PHASE 'A'
6 +5 VOLTS
5 ALTITUDE/DEC ENCODER, PHASE 'B'
4 GROUND
3 AZIMUTH/RA ENCODER, PHASE 'A'
2 +5 VOLTS
1 AZIMUTH/RA ENCODER, PHASE 'B'

Connect the wire with White Stripe to the Red Motor Lead

Motor Cables are Digi-key Part number CP-2186-ND, with 2.5 mm center pin

RJ45

RJ11   RJ11

AZM/RA   Smooth side up,   ALT/DEC
Encoder   Clip side down   Encoder

Mount and Motor Encoder Connections
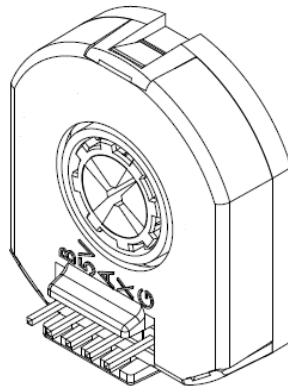
G: Black, Ground
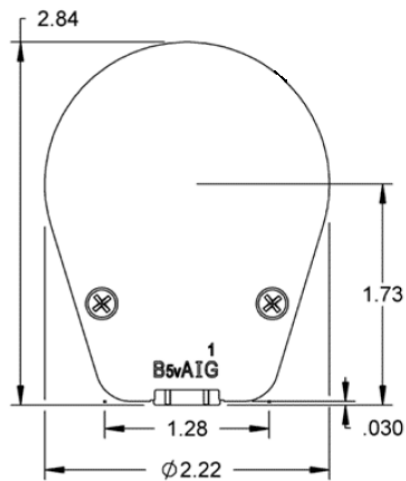**X: Not used**
A: Red, A Channel
5V: Green, +5V
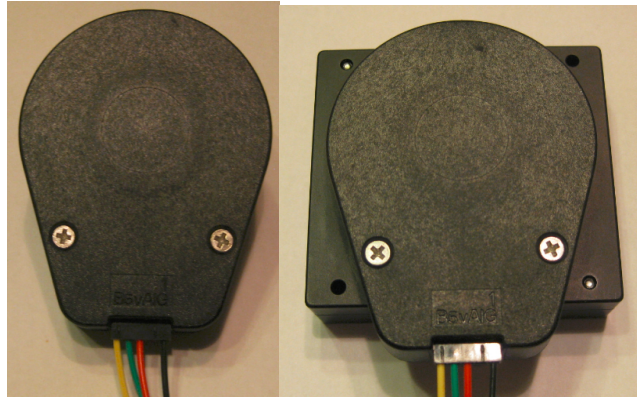**B:, Yellew: B Channel**

Note that the real color of the wire may be different from this document.
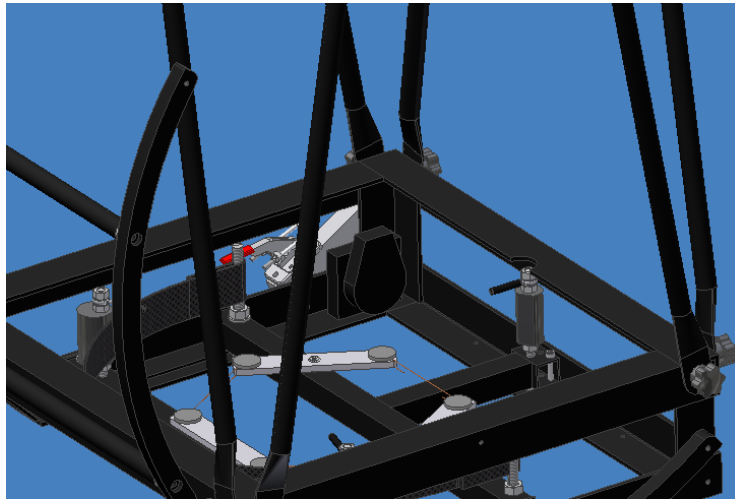

Motor Encoder (The pin "X", the index pin, is not used)

ALT/AZ Scope Encoder (The pin "I", the index pin, is not used)

ALT (right) /AZ (left) Scope Encoders

ALT Scope Encoder Installation

Please note that although, the exact location of the T6 encoder is not important; the direction and precise orientation of the T6 Encoder is critical to the accuracy of the ALT pointing. The T6 encoder should be exactly perpendicular to the ALT bearing axis with the direction shown in above image.

Appendix B: Troubleshooting

Please refer to the Appendix F in SiTech Operation Manual