AstroHub

Installation and User's Guide

November 25, 2004
Version 1.11

Aquest, Inc.
Boca Raton, FL

TABLE OF CONTENTS

Introduction

Congratulations on your purchase of the revolutionary AstroHub!

The AstroHub will significantly improve the reliability of your astronomy system while greatly reducing system cabling, eliminating multiple adapters and control units, and generally simplifying the overall system. With the AstroHub and available plug-ins your current suite of software will function as it always did since the overriding AstroHub design requirement was compatibility with all existing software and popular astronomy and imaging hardware products.

A single USB cable from your computer to the AstroHub and direct short cables from it to all of the elements of your astronomy system is all you need. (Your current cables will generally work but shorter ones will be better). Most products with some form of hand box or control unit can be operated without the provided control unit as all of these functions are part of the AstroHub system.

While any software currently available can be used with the AstroHub, additional function and features are available through additional software provided with your AstroHub. A Windows COM (Component Object Model) object is provided which can be used to write simple to very complex scripts to control you system operation and/or included in application software of any type. Linux users can utilize the detailed command protocol to do much of the same function at the serial command level.

An ASCOM telescope hub is provided which, along with the freely available ASCOM platform, can further extend the features available to you. For example, mount power control of the telescope can be automatically provided as part of Park and Unpark functions of all ASCOM telescope drivers.

Please read this user's manual and those provided for the plug-ins available or shipped with your AstroHub. There are many, many features that you will want to acquaint yourself with and put into action as your system warrants.

Also, a collection of Tips, Techniques, and other miscellaneous useful information will be maintained at the following link. Please feel free to email Aquest Tech Support if you have any additional items you wish to contribute or for any help you may require in installing or using your AstroHub.

http://www.aquest-inc.com/AstroHub/astrohub_tips.htm

Updates or additional software, as it becomes available, may be freely downloaded from:
http://www.aquest-inc.com/AstroHub/downloads.htm

If you would like to be alerted to any AstroHub news, the availability of new or updated software, or the addition of information in the Tips and Techniques section, please email us to be added to the email distribution list. Of course, we will only use your address for this purpose and you can request to be removed from the list at any time.

Thank you purchasing our products. Enjoy them!

Note: Please install the AstroHub software prior to connecting the AstroHub to your computer.

Feature Description

It is useful to understand the basic features and operation of the AstroHub prior to software and hardware installation. Here is a brief description. Detailed setup and usage information will be given later in this manual

Overall Architecture and Packaging

The AstroHub consists of a compact unit housing a base board and up to two "plug-in cards". Most of the system is powered from the upstream USB host. An external power input can be supplied for providing power to downstream USB ports or other peripheral devices such as focusers or filter wheels. Manual or automatic (on Park or Unpark) mount power switching is provided and the mount power can optionally be used as the external power supply thus saving another cable. (See the Power section below for more information).

The base board houses a 7 port USB 2.0 (USB 1.1 compatible) hub. This is connected via a standard USB cable to the host PC.

Base Unit Features

Two downstream USB 2.0 ports are available for use with CCD cameras or any other USB device (including a USB Hub). The base unit provides a Focuser/RS-232 port and a Mount/RS-232 port. These ports are general purpose RS-232 ports but have optionally useable special functions as well.

The Focuser port has an onboard PCFocus™ system capable of driving any motorized, encoder based focuser (e.g. JMI™ focusers, Meade Microfocuser™, etc.). The PCFocus system can be utilized with any ASCOM supported software (e.g. Maxim DL/CCD™) or with the included FocusAide software package. Since a PCFocus ASCOM driver is available this function is fully scriptable as are most functions of the AstroHub and can be driven with any commercially available or custom software supporting ASCOM.

The Mount port is also a fully functional RS-232 port and is designed to be a pass-through to the mount from software such as TheSky, SkyMap, or any other software that can command telescope mount "GoTo" operations. The AstroHub mount channel has a microprocessor which listens to serial communication between the PC and the mount and can process special commands assigned to it such as power control of the mount. Despite most mounts operating at 9600 8-N-1 serial port parameters some mounts depart and operate at other speeds (e.g. Takahashi Temma™ mounts operate at 19200 8-E-1). Provision for 4 different Baud rates and parity settings is included through the use of jumpers on the base board.

Also included in the base AstroHub is a full Guider interface capable of being driven by any application software with either classic guiding or timed pulse guiding. The guider system can automatically sense an active low (e.g. ST-4) interface or an active high (e.g. older Gemini mounts) connected to it and simply guide with no relay or opto-isolator boxes through our "Plug and Guide"™ technology. The AstroHub includes four colored guide direction LEDs which illuminate while any guiding action is in process.

Connectors on the base board as well as connected to plug-ins are of the same type and gender as the devices they are replacing or emulating. For example, the Focuser port consists of 3 connectors. A DB9M for the standard RS-232 output, a RJ-11/6 for direct connection to a JMI

"DRO Encoder" or Aquest PCFocus-LX™ for user with the Meade Microfocuser™, and a 3.5mm stereo audio connector for attaching a +/-9V or ground closure button box for manually moving the focuser are included.

To accomplish the goal of a single cable from the PC to the AstroHub and a series of short, direct run cables from the AstroHub outputs to the scope, cameras, and astronomy system components; a set of plug-in cards have been developed. To eliminate the need for the multitude of "control boxes" for devices such as focuser, filter wheels, etc., these functions are performed by microprocessors on the plug-in cards and replace the control boxes completely. For example, if the Common Stepper plug-in is configured through its jumpers to be a RoboFocus controller, it totally performs this function including the temperature reporting function and completely emulates the RoboFocus supplied control unit so it is no longer needed.

Plug-ins

There are currently three plug-in cards available for the AstroHub. More will be developed as new functions or devices are introduced into the market. Two plug-in sockets are provided on the AstroHub base board allowing any combination of up to two plug-ins to be installed. This includes two plug-ins of the same type.

Each plug-in is the same size and plugs into the base board on two rigid connectors and one ribbon cable. The ribbon cable is used to change the pin-out on the base board output connector such that the device being emulated can use the same cable as was used with the provided but now unused device control box. For example, if the Common Stepper plug-in is configured as a True Technology™ filter wheel controller, the ribbon cable would be installed so the associated AstroHub output connector appeared the same as the connector on the True Technology control unit.

As is the case of the Mount and Guider microprocessors on the base board, all microprocessor based plug-in cards have firmware that may be re-flashed by users or dealers to allow for rapid updates or increased function. This is done through the single USB cable from the host PC using a utility program and flash memory data file.

The available plug-in cards and a brief description of each follow.

Common Stepper

This microprocessor based card has the ability to become these devices control units:

- RoboFocus™ Focuser (including temperature compensation)
- True Technology™ Filter Wheel
- Finger Lakes Instruments™ Focusers and Filter Wheels.
- Optec™ Focuser

The device type is determined by jumpers on the plug-in and direct the resident firmware to execute so as to accomplish the required function. New devices can easily be added by additional firmware module development. The new firmware can be flashed into the microprocessor by using the USB cable connected to the AstroHub.

The compatibility of the emulation is designed to be 100% so the device's native control program can be used as well as any commercially available or personally developed software. Existing scripts using standard drivers (e.g. ASCOM) will also work unmodified. For example, The RoboFocus Control Program (RFCP) will work unmodified.

Aux Port
The Aux Port plug-in can be used to provide either an additional USB 2.0 downstream port or an additional RS-232 port. Jumpers on the card select between USB or RS-232 outputs. Connectors on the base board provide the output means for either port. Note that if the AstroHub is connected to a USB 1.1 upstream host the USB outputs from the AstroHub will be USB 1.1

In addition, a special output connector is provided for driving SBIG and Homeyer filter wheels used without a camera. Software capable of driving this output (e.g. Maxim DL/CCD™) is required. The Aux Port card must be configured as a serial port card for these functions to work. The serial port can be used for other things when a filter wheel is not being used as separate connectors are provided for the filter wheel(s) and the RS-232 port. The only limitation is one imposed by Windows® where only one program can open a specific serial port at one time.

Control Port
The Control Port is a general purpose control card which includes the following:

- 4 optically isolated inputs
- 4 optically isolated outputs
- SPDT relay contacts
- Persistent user accessible memory
- Digital voltage measurement of main and mount power inputs

The 4 digital inputs are software readable either by external polling of scripts and software or internal polling by using the supplied COM class and associated control port automation interface. This class is available in the supplied Astro_Hub.OCX which is fully described in Appendix A to this manual. In addition, the automation interface provides for an event which fires when any of the four input lines changes state.

Two of the inputs are additionally connected to the associated serial port CTS and DSR lines. This allows application software to use operating system services to "immediately" be notified if one of these lines changing state. A software automation level event is also provided. This feature provides for notification of two of the four input lines changing state much more quickly than in a polling environment.

Outputs can be statically set via software or script or accurately pulsed from 10ms to 9999ms. Pulsing can "arm" certain outputs to be fired on another event or fired immediately. All pulsed outputs fire an event when the pulse time as elapsed. A fifth "virtual output" is provided for general use for accurate delays in software or any other use desired.

The Control Port also provides for user accessible persistent memory useable from scripts and application software. There are 32 Words (2 bytes) and 32 Longs (4 bytes) available for any use and will retain values indefinitely when the power to the AstroHub is off.

The main 12V input voltage as well as the mount power, if connected, are continuously measured and the results provided to scripts and application software requesting this information.

Software Support

The AstroHub is provided with a complete installation program that installs all required software and optionally installs several other software packages as described below.

The installer installs documentation (such as this manual), a setup and control program, the AstroHub software automation interface, registry settings, and all hardware drivers required for

USB enumeration and operation. ***The software should be fully installed before the AstroHub is connected to the PC.***

Set Up Program - A full function set up program is provided which configures the AstroHub and plug-ins to your preferences as well as allows for basic functional testing of the complete setup. A full section is provided below outlining the operation of set up program.

Astro_Hub.OCX - As has been already described, a COM class is provided which includes multiple interfaces to control and operate the AstroHub. This is not required at all if you wish to operate your system with commercially available software. Its use can significantly enhance the features available to you with your AstroHub but is optional.

The automation interfaces included in the COM object are:

- Control Port
- Mount
- TelescopeStatus
- Guider

Show Devices Utility - Since the AstroHub has multiple embedded USB to serial adapters, these can be "installed" at various COM ports as determined by the operating system. See Appendix B for more information on how to exert more control over this process. This ShowDevices utility is a quick way to see what AstroHub devices are installed and on what COM Port.

AstroHub.exe - A full function ASCOM hub based on the Plain Old Telescope Handset (POTH) by Jon Brewster is provided which utilizes the AstroHub mount interface to control power to the mount automatically or manually. The power control is integrated with the Park/Unpark facilities and can optionally power down the mount when it parks.

Software Installation

Warning: The hardware should NOT be connected prior to the software installation.

The software for the AstroHub is designed to run under Windows 98SE, 2000, and XP. The computer to be connected to the AstroHub requires at least one USB port. The USB port can be either USB 2.0 or USB 1.1 and the AstroHub will operate at whatever speed the upstream port runs at.

During the software installation, ASCOM software may be installed (with your permission) which will enhance the use of your AstroHub. It is recommended that install at least the runtime portion of the ASCOM Platform if it is not already installed on your system. If you already have ASCOM installed you will not be asked to re-install it and only the PCFocus ASCOM driver will be updated and the AstroHub telescope hub installed.

In addition, FocusAide™ and PCFocus™ are provided at no charge to AstroHub users. If the installation program finds an existing installation of FocusAide it will update required portions without changing any of your settings. If FocusAide is not installed, it will be and you will need to register the software with your dealer to use it beyond the 15 day trial period. Details of this are explained below.

To install software:

1. Insert the AstroHub CD in the CD-ROM or DVD-ROM drive
2. Click Start
3. Click Run
4. Type <drive letter>**:**Setup and press Enter (where <drive letter> is the letter of your CD-ROM or DVD-ROM drive)
5. Follow on-screen directions

Registration

None of the software provided with your AstroHub requires registration except for FocusAide which is a full function version of the commercially available product and must be registered to use it past 15 days of the first use. Registration codes are provided at no cost to AstroHub owners.

FocusAide will operate fully for 15 days to allow you time to contact your dealer to obtain a registration code. We will require the information presented on the registration screen (Registered To Name, Product Code, Use (Choose "Other"), and the serial number from the bottom of your AstroHub unit.

Simply start FocusAide, click the **Register** button on any of the **Settings/Status** tabs and enter the information. A Product code will be generated for you. You may copy and paste the information into the form at the Aquest web site by using the Copy to Clipboard button. Be sure to provide a valid email address as the registration code will be emailed to you. When you receive the registration code simply enter it in to the registration screen and press Enter or click OK. Your software is now fully functional and the registration screen will no longer appear when the program starts up. If you need to refer to the registered name or product code, click the **Register** button on the **Settings/Status** tabs.

AstroHub Hardware Setup

All of the drivers and software required for operation of your AstroHub have been installed in the required place on your hard disk. This includes all of the USB "Plug and Play" files. Simply connecting the hardware will begin the driver installation process which should proceed automatically except for acceptance of certain steps by you as the installation proceeds.

Please complete reading this section of the manual before connecting your hardware to ensure a smooth, trouble free installation. Your AstroHub is a complex device and much work has gone into assuring that installation and setup will run cleanly. It is important to follow the installation procedure exactly.

There are five steps to installing and setting up the hardware:

1. Setting up the AstroHub base board jumpers to your preferences
2. Installing Plug-ins
3. Initial USB device enumeration by Windows
4. Connecting external power
5. Running the Set Up program to complete setup and perform tests to assure full function

Setting up the Base AstroHub

Jumpers are provided in six locations on the base board to allow the AstroHub to be configured exactly as you desire. Each location is imprinted on the printed circuit board with a Jxx label and text describing the function and in most cases what each position means. Some locations do not have the full nomenclature due to space limitations. All of this is summarized in Table 1 below. Figure 1 shows the locations of the jumpers

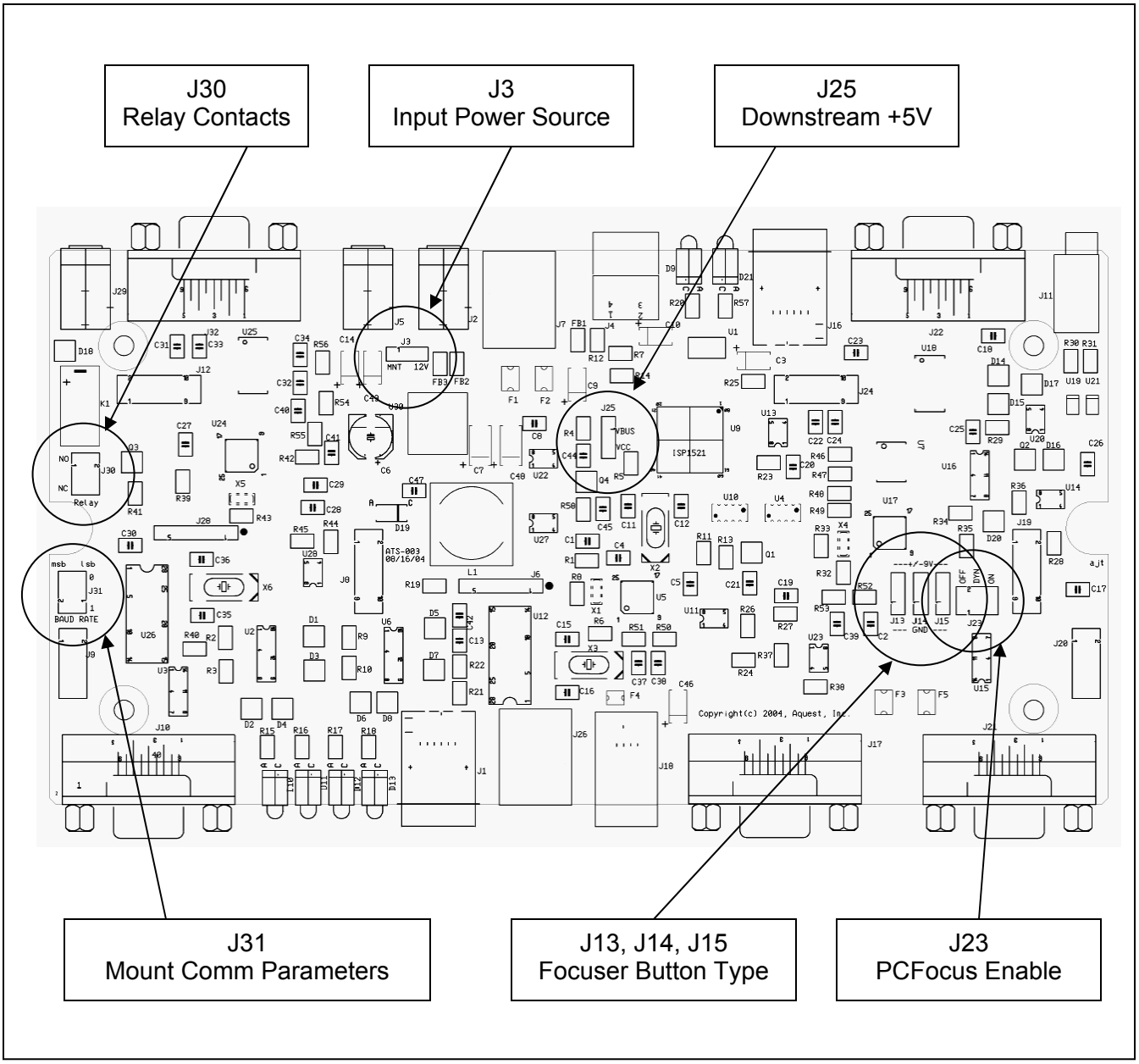


Figure 1

AstroHub Base Board Jumpers

Jumper	Function	Available Selections	Factory Default
J30	Mount power relay contact configuration as either Normally Open (NO) or Normally Closed (NC). In the NO position the mount power is off if the AstroHub is off and NC allows to power to the mount to be on with the AstroHub off. There is also a software setting to specify whether the AstroHub firmware starts with the relay energized or not. With these two settings any power up situation can be configured to suit your needs	NO NC	NO
J3	AstroHub Power Source is a way to use the mount power input voltage as the source for the rest of the AstroHub instead of connecting two power cables to the AstroHub. Normally, 12V input power is used for the AstroHub but any voltage from 10V to 28VDC can be used. This jumper simply connects the mount input power connector to the 12V input connector internal to your AstroHub. ***Warning: The "12V power input voltage" is delivered to any focuser, filter wheel, or other device that uses 12V external power. Be certain that if you power your AstroHub from mount power with this jumper that all of your peripherals can operate on that voltage. Some mounts operate at 18V or more and therefore could damage a device designed to operate at 12V. No internal regulation of this voltage is done except for internal use 5V so be sure your mount voltage is safe for your other devices.***	12V Input Mount Input	12V Input
J25	Most of the AstroHub baseboard and some of the plug-in circuitry operate from the USB VBUS power line. While the current draw is very low, some USB ports or hubs require an external power supply if any load is connected to them. This jumper allows you to select the VBUS line or the internal 5V power supply (generated from the 12V power input) to power much of the internal circuitry. If you find your USB port or hub will not adequately power the AstroHub you can either use an external supply to the upstream port/hub or switch this jumper and use the internal 5V supply. The later necessitates connection of the 12V external power input on the AstroHub.	USB VBUS Internal 5V	USB VBUS
J31	Most mounts operate with communication parameters of 9600 Baud, 8 data bits, no parity, and 1 stop bit (9600 8N1). There are some exceptions to this so provision is made for various sets of parameters. Set these jumpers to match your mounts RS-232 (Go To) requirements. Jumper positions [] are: 9600 8N1: [] [] / o o 19200 8E1: [] o / o [] 9600 8E1: o [] / [] o 9600 8O1: o o / [] []	9600 8N1 19200 8E1 9600 8E1 9600 8O1	9600 8N1
J13 J14 J15	There is a special connector available for connecting an external "button box" to manually move the focuser when using the onboard PCFocus. If you have a JMI focuser you may use the simple box provided with your focuser which supplies +/-9V to the focuser. If these jumpers are set the opposite way you can use a simple button box with two buttons which close to ground. A 3.5mm stereo audio connector is required in the latter case and a mono audio connector is supplied with the JMI button box. (Note: provision for an external manually control for stepper motor based focusers is also provided. See the Common Stepper Plug-in manual for details)	3 jumpers set: +/- 9V Ground Closure	+/- 9V
J23	PCFocus Enable. Windows does strange things during the boot process which causes transient signals on the serial port lines during USB enumeration. If this jumper were not provided a PCFocus connected focuser would move off the current focus position. This jumper has three states, one of which is the "dynamic" setting. Here the PCFocus circuit is automatically enabled whenever PCFocus.exe, FocusAide.exe or the PCFocus ASCOM driver is running. The PCFocus circuit is disabled otherwise. Note: The onboard PCFocus circuit only requires the Focuser/RS-232 port it is attached to when it is operating (i.e. with any of the three programs listed above). At other times the serial port can be used for any other purpose. The dynamic setting makes the switch-over automatic.	Off Dynamic Always On	Dynamic

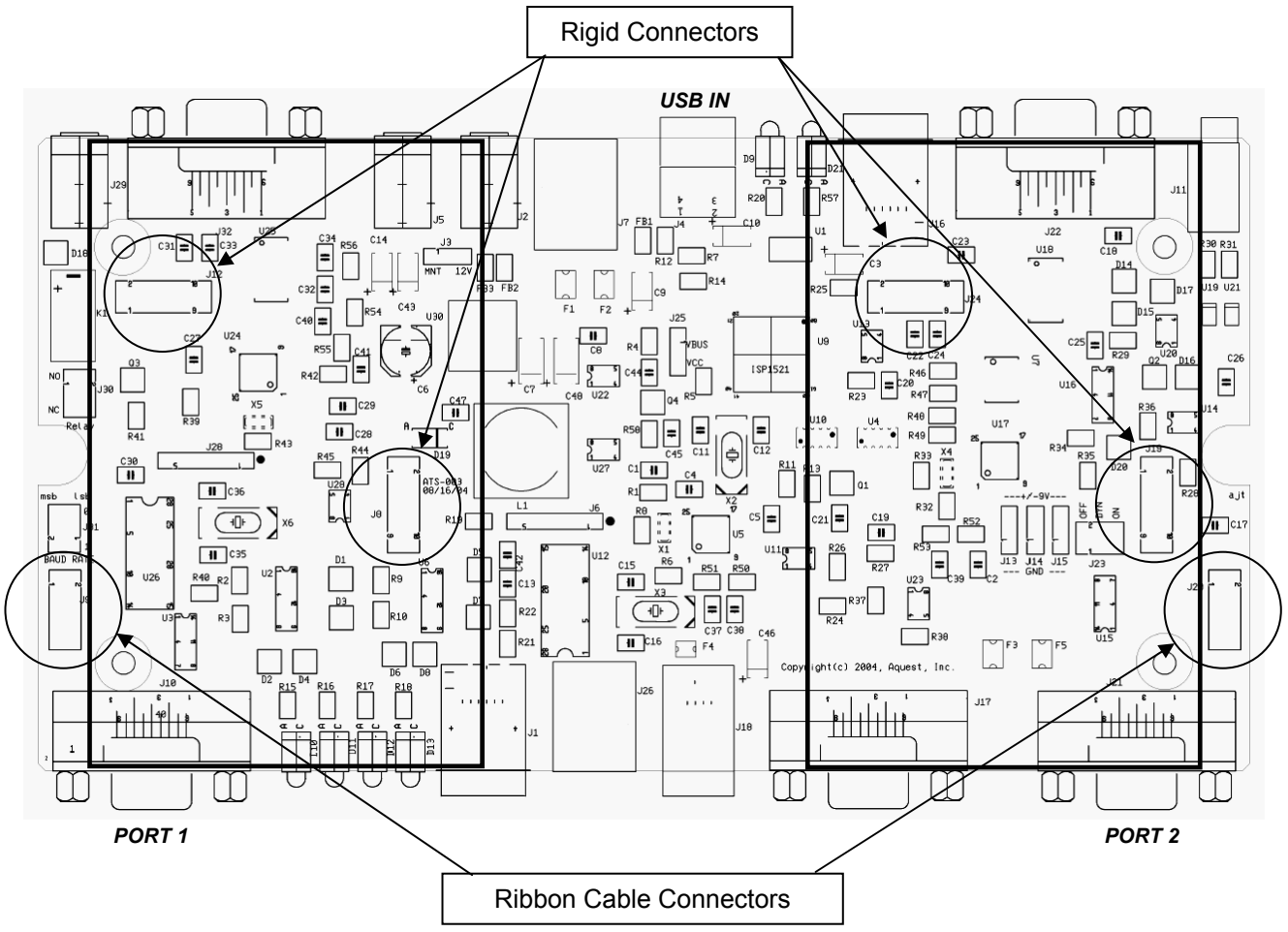
Jumper Settings - Table 1

Installing Plug-ins

AstroHub plug-ins are very easy to configure and install. Some plug-ins have jumpers that need to be set and all require that the supplied ribbon cable be properly connected. Consult Appendix D of this manual or the back of the card that came with your plug-in(s) to see the connector and jumper configuration options. You should set the jumpers on your plug-ins to the configuration you wish and determine which ribbon cable connector you will use before proceeding with the plug-in installation.

All plug-ins are installed the same way in terms of connection to the base board. There are two rigid connectors and a ribbon cable used to make these connections. It makes no difference which base board socket you insert a plug-in into as the plug-ins report their position and type to the internal firmware and setup program when it runs. For reference, if you view the base board with the USB IN connector up or away from you the, left side of the AstroHub unit is where Plug-in 1 is and Plug-in 2 is on the right.

Also viewing the base board as above, you will note there are DB9F connectors at the bottom of the board near the side of the printed circuit board on both sides. Right above them and at the edge of the card are 2x5 header connectors where the ribbon cables go. Here is a drawing to see where things are:



The Port 1 external connector and part of the Misc. Port connector are associated with Plug-in 1 and Port 2 and the rest of the Misc. Port connector are for Plug-in 2.

To begin the installation, plug the ribbon cable into the base board connector so the cable is pointing toward the center of the board and the unplugged ribbon cable connector is pointing up. Determine which ribbon connector on the plug-in that you need to use from the information provided with the plug-in. Some plug-ins only have one ribbon cable connector and others have multiple ones. Position the plug-in card over the rigid connectors to see how they will align and with the card in this orientation plug the free end of the ribbon cable into the plug-in card in the appropriate connector.

A nylon spacer and 1" long screw were provided with your plug-in. These can be used to mechanically secure the plug-in card to the base if desired. There is plenty of retention in the rigid connectors so this isn't mandatory but you can assemble it this way if you choose. To do it, remove one of the screws that are holding the printed circuit board into the base unit enclosure. Position the nylon spacer over the hole and plug the plug-in card into the base board trapping the spacer between them. Insert the 1" long screw through the plug-in and spacer and tighten it gently so as to not strip the plastic bosses in the enclosure.

Whether or not the screw and spacer are used, assure that the two main connectors on the plug-in card properly mate with the connectors on the base board. Also, assure the ribbon cable is neatly folded over as required and not pinched against any component or connector.

USB Device Enumeration by Windows

Windows has a system called "Plug and Play" that detects any device attached to the computer and automatically installs and runs any software required for the device. Some people refer to this as "Plug and Pray" as it is prone to problems. We have gone to great lengths to provide accurate install files and drivers so this process will be trouble free.

When you plug the USB cable into your AstroHub, Plug and Play will install multiple devices. The drivers for these are not "Microsoft Certified" but are nonetheless perfectly safe and reliable. Unfortunately, Microsoft has programmed the operating systems to pop up a message box on every device that installs. In addition to that, every device found will cause a "New Hardware Found" box to appear and then another box will pop up requiring you to click "Finish. A fully loaded AstroHub potentially contains 10 USB devices so as many as 30 pop-up boxes could appear! You can eliminate 1/3 of the pop-up warnings by stopping Windows 2000 or XP from warning you every time of an "unsigned driver".

You can do this as follows:

Click Start | Control Panel | System | Hardware | Driver Signing and the following dialog should appear. Disable driver signing by clicking "Ignore" and then clicking OK.

You can return the setting to Warn or Block after the AstroHub installation is complete.

One last point before we proceed: Windows will arbitrarily assign available COM ports to each device. These may not be to your liking or at too high a number to be used in your current application software. You can reassign COM ports using the Device Manager and the drivers supplied with your AstroHub and reinstall all the software and hardware drivers or you can clean up the COM port assignments before you start and have Windows assign your AstroHub ports to low number COM ports. See the Appendix B dealing with this subject for details.

So... now we are (finally) ready! There is no need to connect any astronomy devices to the AstroHub with plug-ins installed nor is external 12V power required. The full hardware installation can be done by simply plugging the upstream USB cable into your AstroHub. Once you do this, one by one, Windows will discover each new device and pop-up a "New Hardware Found" dialog.

Whenever a "New Hardware Found" dialog appears, click the option to find the installation files automatically.

At this point, if you did not disable signed driver checking you will be warned that the software is not certified by Microsoft (despite it already being installed or, in the case of the main internal USB hub, a Microsoft supplied driver!!). Click OK and continue.
After a short time another dialog will appear telling you the device has been installed.... click "Finish". Do this for each device until Windows has completed the installation. Note: In Windows 98, the installation will proceed with no intervention as Windows 98 isn't a "secure" operating system and all of these checks are not included by Microsoft.

Note that many of the AstroHub embedded devices will install twice; once as a USB Controller and then again as a COM Port. They can all be viewed in the Windows Device Manager or by using the supplied utility ShowDevices.exe. This utility can be used to set up all your astronomy application software that requires a COM port for the specific device being attached to. You can print a copy of all the ports or simply use the on-screen display of them. See the "Using the Software" section of this manual for details.

Connecting External Power

It is now time to connect external power to the AstroHub and finish the setup. Some of the functions of your AstroHub run entirely on USB power in which case external power is not required. The following list of functions require external 10V to 28V input power. If you are not using any of these functions, external 12V power is not required. ***Note the warning above about using an external "12V" power input that is greater than 12V if AstroHub powered devices such as focuser or filter wheels are being used. Consult the device manufacturer for allowable voltages.***

Functions requiring external power:

- Downstream USB ports (base board or Aux Port USB ports)
- PCFocus
- Mount Power switching
- Common Stepper Plug-in
- Aux Port Plug-in if using the filter wheel pulsed output

All other functions operate from USB bus power and no external input power is required.

Running the Set Up Program

You must run the supplied setup program AHSetUp.exe to complete the set up and perform tests to assure everything is functioning. This program will automatically determine which COM Port each device is on and open each port to assure communication can be established. For every device found an entry in the left window will be created showing the device COM port and allow selections of the "Properties" for each device. Clicking the top level AstroHub entry and any of the Properties selections will bring up a separate panel with settings and tests for that device. An example of each panel and explanation of each control on the panel follows.

The setup program will make entries in your system registry to record information other software needs. This, as well as most functions of the setup program, is automatically performed for you.

To run the setup program:

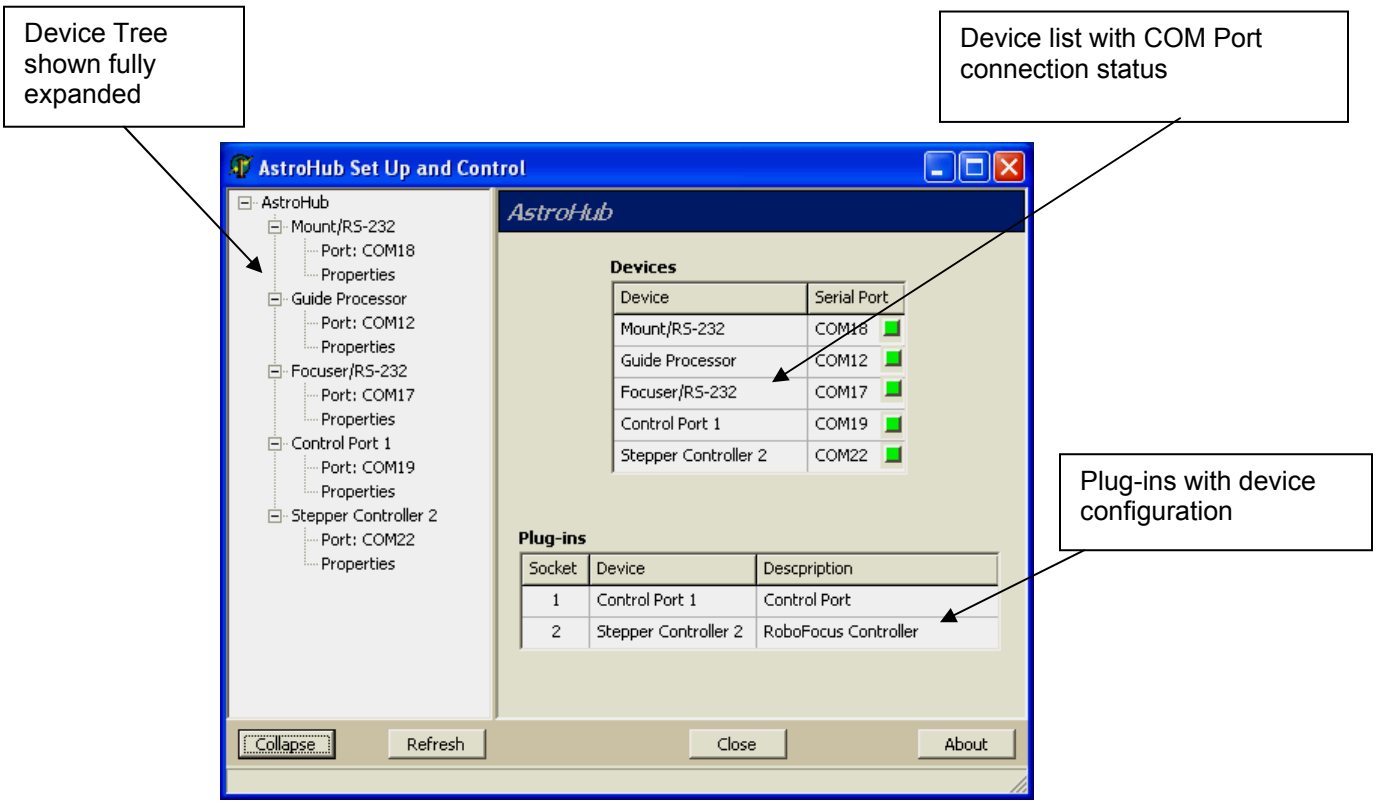
1. Click Start
2. Select Programs
3. Select AstroHub
4. Click AstroHub Set Up

Set Up Program Screens

When the setup program starts it determines which devices are present in the AstroHub and connects to each one to assure communication can be established. Errors or attempts to correct the situation will be displayed if any problems are encountered. The green "LEDs" indicate successful communication. The program opens to the main screen shown here. You can cause the program to start with the device tree fully expanded by adding the word "expand" after the program name in the Windows shortcut.

Clicking the Properties entry on any device will display the set up and test page for that device. Each of these pages is shown below including information about the plug-in pages. The AstroHub base board contains the Mount, Guider, and Focuser controllers. The following screen shots show the Properties pages for these controllers.

The set up program main screen is shown below. Each port is listed and communications with that port automatically established. Both plug-in sockets are queried to determine which plug-in is installed. If all the "LEDs" are green you may proceed to each subsequent port or plug-in to set it up and test it.


Device Tree shown fully expanded
Device list with COM Port connection status
Plug-ins with device configuration
AstroHub Set Up and Control
AstroHub
Mount/RS-232
Port: COM18
Properties
Guide Processor
Port: COM12
Properties
Focuser/RS-232
Port: COM17
Properties
Control Port 1
Port: COM19
Properties
Stepper Controller 2
Port: COM22
Properties
AstroHub
Devices
Device
Serial Port
Mount/RS-232
COM18
Guide Processor
COM12
Focuser/RS-232
COM17
Control Port 1
COM19
Stepper Controller 2
COM22
Plug-ins
Socket
Device
Descpription
1
Control Port 1
Control Port
2
Stepper Controller 2
RoboFocus Controller
Collapse
Refresh
Close
About

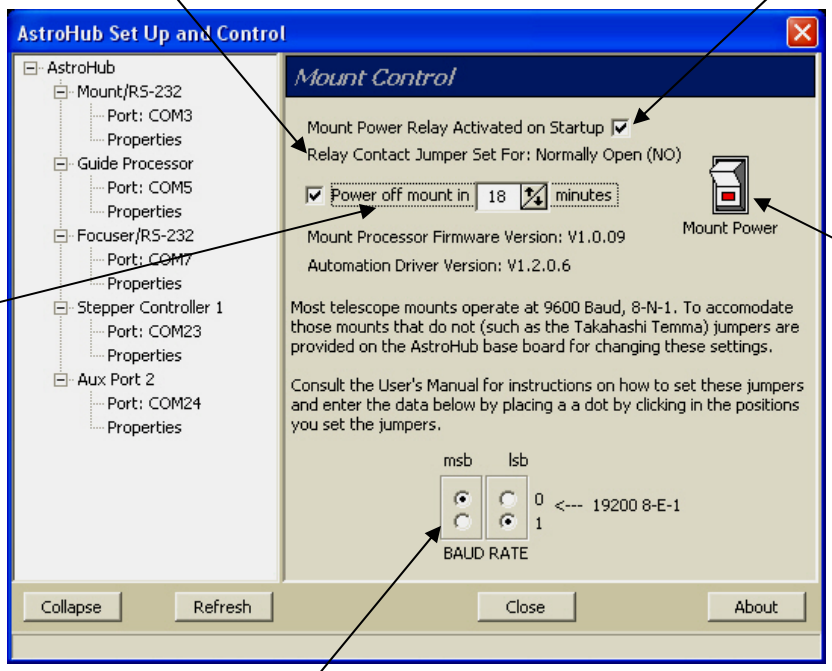
Click the Mount "Properties" entry in the Device Tree to proceed.

The Mount Control panel can be used to manually control the mount power as well as set up various settings on the mount processor. Setting the mount communication jumpers to match your mount's requirements is important and the results of the jumper setting are shown here.

Jumpers on the AstroHub base board can be set so the mount power relay switches mount power on when the AstroHub is off (NC) or on only when the AstroHub is on (NO).

This line tells you how the jumpers are set.

Check this box to have the relay energize when the mount processor starts (when the USB cable is plugged in or the PC is booted). Operation is such that "energized" means power is connected to the mount if the contact jumper is set to Normally Open (NO)



The automation interface for the mount has provision for setting a built-in timer to power off the mount in any number of minutes. This function can be employed here or in a simple script.

Manually controls mount power via the power relay that you can hear clicking as this switch is toggled

Mount communication parameters jumper settings found by the set up program. *Assure the jumpers are set to match your mount.* Change them here if you change them on the base board

The Guider settings are made using the panel below.

The Guider Type will be correctly shown only if a ground connection exists between the mount and the AstroHub. This will always be the case if mount power is switched through the AstroHub or an RS-232 connection is made from the AstroHub to the mount. The guiding outputs will be automatically switched to whichever type of mount is connected and this panel shows what type it is (for information only).

All guiding software sends bytes of information to the guider to pulse the auto-guider input on the mount. The bit configuration is:

0	0	0	0	b3	b2	b1	b0

where different software assigns different guide directions to the bits as follows:

Direction	Cookbook	Starlight Xpress*	Direct
North	b3	b2	b3
South	b2	b1	b2
East	b0	b3	b1
West	b1	b0	b0

*Default

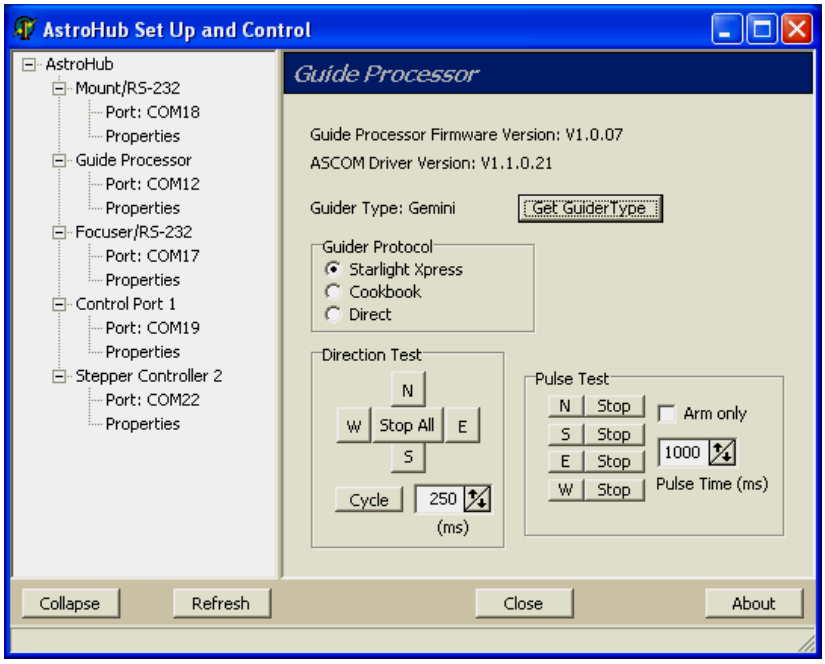
This is not related to the CCD camera in use but the "relay box" or other guide unit such as the STAR2000. These units interpret the bits differently as show in the table. Your AstroHub can be set to emulate any of these protocols and the setting is saved in the guide processor's persistent memory.

Warning: The Direction Test and Pulse Test controls will move your mount if it is connected.

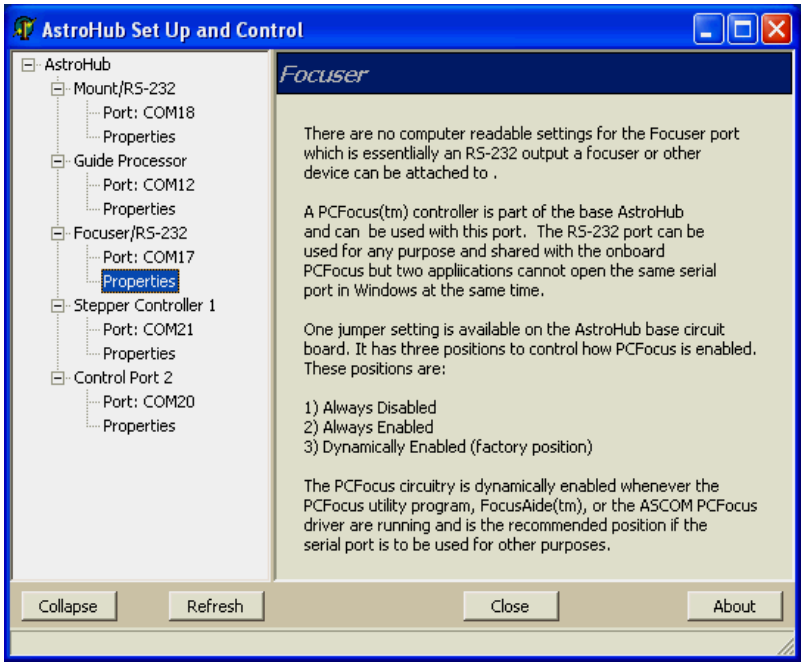
The Direction Test controls are used to learn which direction the mount will move for a specific input from the guide software into the AstroHub. The pin-outs and polarities of the AstroHub Guider were carefully designed to allow you to simply unplug your current guider and plug the AstroHub in its place and not have to make any settings changes in your guide software. There is great confusion in the terminology, polarity, and even connector pin-outs in the industry so you should verify that the settings in your guide software are still valid in terms of directions and even swapping the X and Y axis.

The Pulse Test is similar in terms of moving the mount. You can "Arm" a direction by checking the Arm box and clicking a direction. Then change the pulse duration, uncheck the Arm box and click another direction. Both directions will start pulsing at the exact same time when the second direction button is clicked and end at different times. The guider LEDs on the AstroHub unit will flash accordingly. Some application software takes advantage of a feature such as this to make a "diagonal move". Of course, if you click opposing directions the action will be nullified.

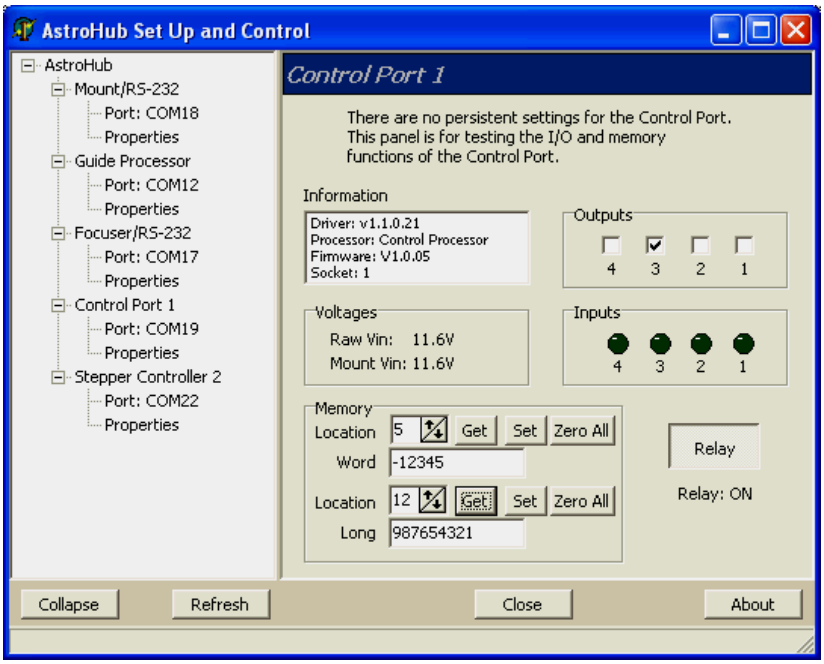
Guider Panel:



Focuser Panel:



The Control Port has no settings to make. The Control Port panel below contains controls to test the entire Control Port plug-in. If two Control Ports are available in a single AstroHub, two of these panels will be displayed. Note that the Raw Vin "12V" input as well as the Mount Vin voltages are continually measured and made available. These values can be read by scripts or application software by use of the AstroHub automation software or via serial commands.



The Stepper plug-in panel (not shown) will request additional information if the plug-in in configured to drive a Finger Lakes Instrumentation device and that is whether the connected device is a focuser or filter wheel and if the latter how many filter positions. Some basic test function is also provided for this case.

At this point your AstroHub is fully set up and can be connected to you astronomy set up. The next section describes how to do that.

System Connection

As you can see, the sides of the AstroHub are full of connectors and indicators. The function of each connector on the AstroHub is printed on the end panel. You can connect the existing cables you are using or obtain short cables with the same pin-outs and connector types. Most cables are standard cables that are readily available unless the manufacturer of the device you are connecting the AstroHub to used a special proprietary cable.

The end panels of your AstroHub are shown below with a short description what the connector is cabled to in your system. See Appendix C on connector pin-outs for details on specific connectors.

Connector/Indicator	Type	Function	Comments
FOCUSER CTL	3.5mm audio	Attach a "button box" for manually moving the focuser using the PCFocus Controller	The button box can be either as supplied with JMI focusers (supplies +/- 9V) using a mono audio connector or a box with two buttons that connect to ground using a stereo audio connector. Set base board jumpers accordingly
Focuser RS-232	DB9M	Full RS-232 serial port	Useable for any other serial function when PCFocus is not connected to the serial port through software
FOCUSER PCFocus	RJ-11/6	PCFocus output	See the FocusAide and PCFocus User's manual found in the FocusAide installation folder
USB PWR	LED	Indicates the hub controller has applied power to downstream USB ports	Shows either VBUS or VCC downstream power status.
USB RDY	LED	Indicates the USB 2.0 hub has been enumerated and is active	Hub controller chip flashes this LED as a health monitor
USB IN	USB-B	Connection to a host PC USB 2.0 high speed USB port	If connected to a low or full speed USB 1.1 upstream port, the hub controller with down speed to match the speed as will all downstream ports.
USB OUT	USB-A DUAL	Two full function USB 2.0, high speed ports	12V or mount power must be connected
MAIN PWR	2.1mm I.D. 5.5mm O.D. Power (tip +)	Nominal 12V input power for running all functions in the AstroHub not powered from USB power from the host	Allowable voltage range: 10V to 28V. Note this voltage is directly fed to non-USB devices powered by the AstroHub such as focusers, filter wheels, etc. *If other than 12V is used consult with the device manufacturer on allowable voltage for powering the attached device.*
MOUNT PWR IN	2.1mm I.D. 5.5mm O.D. Power (tip +)	Input power to be switch controlled by the AstroHub	An internal jumper is provided in the AstroHub which will internally connect this connector to the MAIN PWR connector to save a power cable. Note the caution about AstroHub powered devices.
MOUNT RS-232	DB9M	Full RS-232 serial port with a microprocessor connected for additional mount control function	Useable for any serial port function but typically connected to the telescope mount's RS-232 input for control such as "Go To"
MOUNT PWR OUT	2.1mm I.D 5.5mm O.D. Power (tip +)	Switched version of the MOUNT PWR IN line	The internal mount power relay is rated at: **Max. Switching Voltage:** 250VAC, 220VDC. **Max. Switching Current:** 5A. **Max Carrying Current:** 2A @30VDC, 3A @20VDC **Expected Mechanical Life:** Approx. 100 million operations.

Connector/Indicator	Type	Function	Comments
PORT 1	DB9F	Plug-in socket 1 output including RS-232 if Aux Port plug-in is used and configured as a RS-232 port	See Appendix C and specific plug-in documentation.
GUIDER NSEW	LED	Colored indicators denoting when a mount auto-guider move has been commanded	LEDs will be illuminated during pulsing of the specific auto-guide direction.
GUIDER OUT	RJ-11/6	"Plug and Guide" connector where no relay box or opto-isolator box is required. Functionally compatible with the Starlight Xpress STAR2000™.	Pin out is the same as an SBIG camera auto-guiding output such that a straight-thru modular cable to an LX-200 auto-guider input would be used. See Appendix C. Will automatically switch polarity if connected to an "ST-4" compatible input (e.g. LX-200) or a active high interface (e.g. older Gemini mounts)
AUX USB	USB-A DUAL	Active if one or two Aux Port plug-ins are used and configured as full function USB 2.0 high speed ports.	Corresponding plug-in socket numbers are shown.
FILT WHL	RJ-11/4	For direct connection (i.e. no camera) to an SBIG, Optec, or Homeyer filter wheel.	Telephone handset modular plug.
MISC PORT	DB9F	Connector for buttons inputs for the Common Stepper plug-in and relay contacts of the Control Port plug-in. In addition, 100ma of regulated internal +5V and raw input 12V can be taken from this connector.	See Appendix C and specific plug-in documentation. Relay contacts are rated the same as the mount power relay shown above
PORT 2	DB9F	Plug-in socket 2 output including RS-232 if Aux Port plug-in is used and configured as a RS-232 port	See Appendix C and specific plug-in documentation.

Basic Operation of Your AstroHub

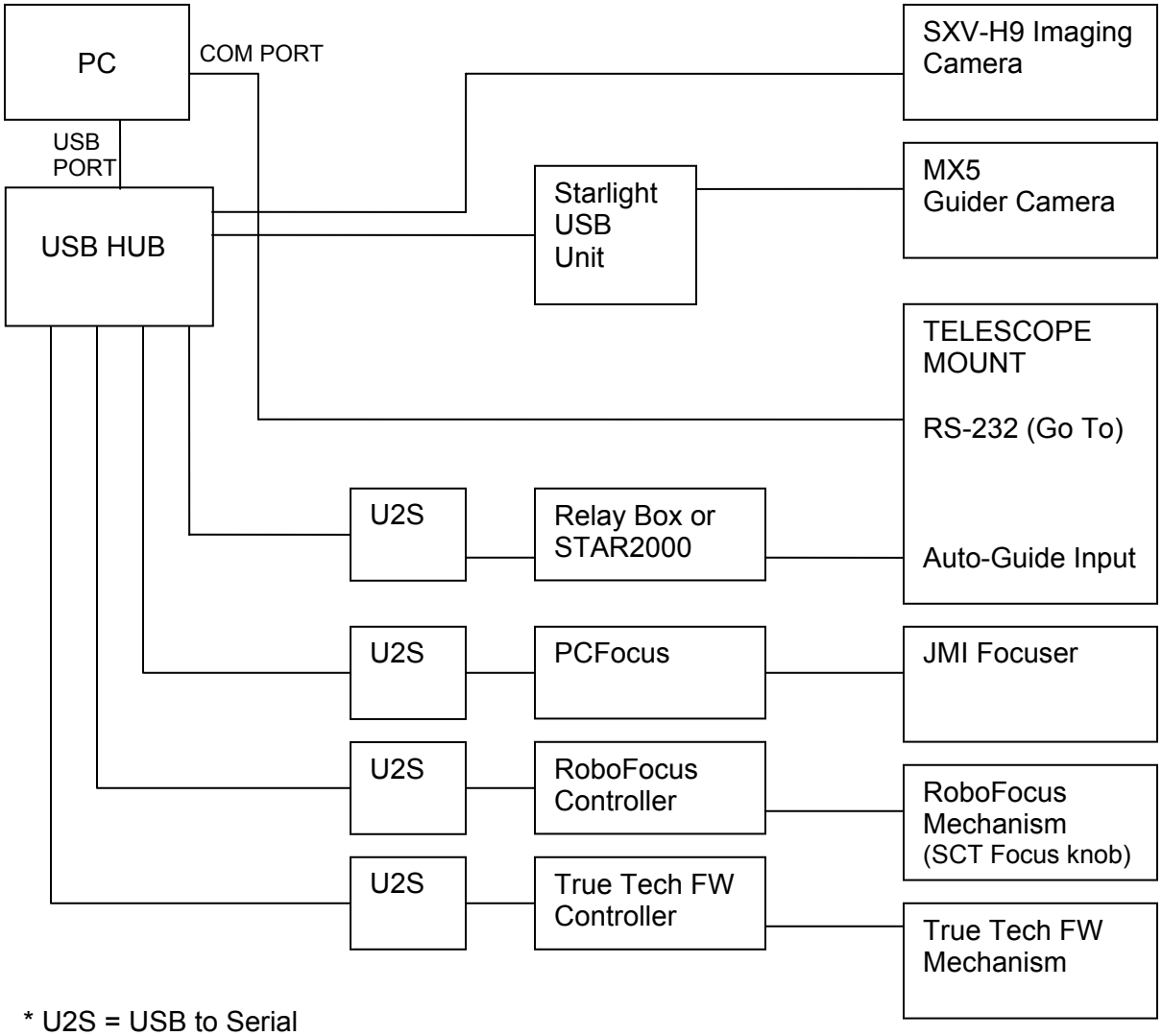
If you are using your AstroHub for imaging we recommend that you attach it to your OTA or mount such that it moves (along with all of the relevant cables) with the OTA and cable drag is greatly reduced. All you would have is the USB cable to the AstroHub as the rest would be part of the "mount/OTA assembly". Use, 3M Dual Lock™, Velcro, or other method to make the attachment.

When the AstroHub is connected to a PC and 12V (or mount power) is applied it appears to all of your existing software as it did without the AstroHub. For the most part this means a set of COM ports or USB ports. The result is that using your AstroHub is transparent to what you did when you operated your system in the past.

You do need to tell your application software what ports the various devices are on. A utility called ShowDevices will summarize this information for you and even let you copy the information and print it. Just connect the AstroHub and run the program. Here is a sample output:

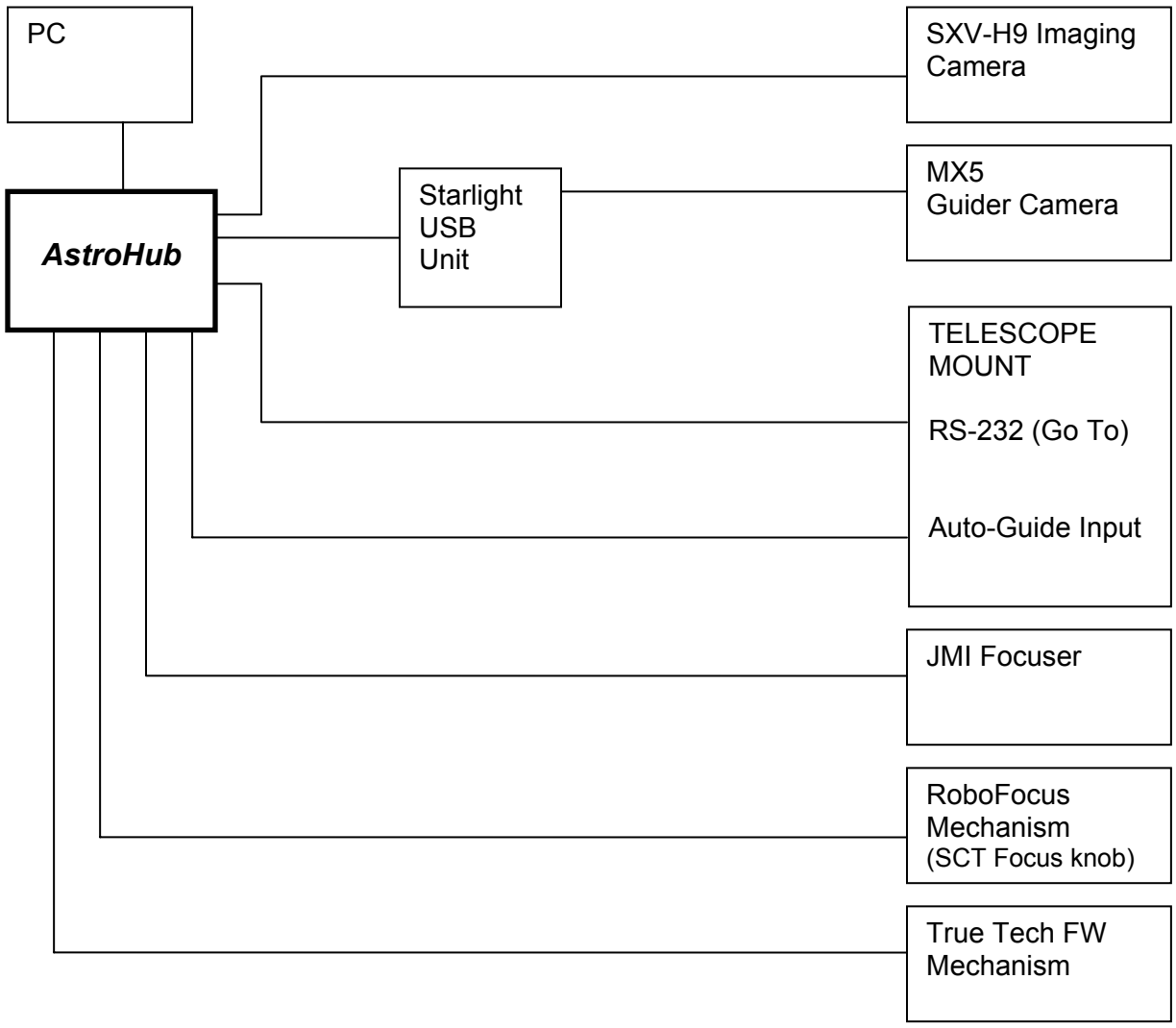
Almost all of the special control boxes you are currently using can be eliminated. Examples of what can be eliminated are the RoboFocus control unit, the True Tech Filter wheel controller, any FLI in line box, etc. If you are using a parallel port CCD camera you will have to connect this directly bypassing the AstroHub as parallel port devices are not supported. Use of a Starlight Xpress camera with external USB box is accomplished by connecting the USB box to one of the downstream USB ports on the AstroHub and the other cable from the USB box to the camera.

Here is a typical system without an AstroHub:



* U2S = USB to Serial Adapter

Here is the same system with an AstroHub:



Software Automation and Scripting

Your AstroHub comes with a powerful software module which is a COM (Microsoft Component Object Model) object with multiple interfaces. There is an interface for the Mount, Guider, Control Port(s), and Telescope Status. The details of all of the properties and methods are shown in the Appendix A. Use of the interfaces is called automation and can be a part of application software or scripts.

Application software developers are including native AstroHub support into their commercially available software to further take advantage of the enhanced features in the AstroHub. Without the use of the automation interface your AstroHub is still fully compatible with all software available whether it is commercially available software, custom software, or custom scripts.

Scripting with the AstroHub can bring significant function to your system operation using the AstroHub automation module provided. Some example scripts were installed in the AstroHub installation folder. Here is an example of how to toggle the relay on the control port:

```
set cp = CreateObject("Astro_Hub.ControlPort")
cp.OpenPort(the port number goes here)
if cp.Relay then cp.Relay = FALSE else cp.Relay = TRUE
cp.ClosePort
set cp = Nothing
```

You can find this and the following scripts as samples in the AstroHub folder or you can copy and paste the above text into Notepad and save the file as relay.vbs on your desktop. Use the ShowDevices utility to determine what COM port your control port is on and insert that number in the cp.OpenPort command above.

Double click the relay.vbs file icon to run the script. If you have a control port card and the USB cable is connected to you AstroHub you should hear the relay click each time the script is run.

You can do a similar thing with the mount power control relay using a property of the mount interface called PowerState. PowerState takes into consideration the jumper settings you made for the mount power relay contacts and physically connects or disconnects power to the mount. Here it would be handy to have two scripts, one to apply power to the mount and one to turn it off. Note that the Mount and Guider interfaces have auto-open functions which will determine the correct COM port and open it.

Create a file called MountON.vbs like this:

```
set mount = CreateObject("Astro_Hub.Mount")
mount.AutoOpenBlind
mount.PowerState = TRUE
mount.ClosePort
set mount = Nothing
```

The corresponding file, MountOFF.vbs, for turning the power off is:

```
set mount = CreateObject("Astro_Hub.Mount")
mount.AutoOpenBlind
mount.PowerState = FALSE
mount.ClosePort
set mount = Nothing
```

Consult Appendix A for a detailed listing of all interfaces and their associated properties, methods, and events.

Use with ASCOM

While the AstroHub works with any commercial software including any that does not support ASCOM, some of the advanced features are only available in an ASCOM environment.

For example, ASCOM Telescope drivers have methods to Park and Unpark the telescope mount. With the AstroHub hardware and the supplied ASCOM telescope hub, *astrohub.exe*, you can optionally have the mount power turned on or off automatically when the scope is Unparked or Parked, respectively. You must use astrohub.exe as the telescope hub for this function to work. As commercial software that implement an ASCOM telescope hub such as Astronomer's Control Panel™ or Maxim DL/MaxPoint™ incorporate the features that are in astrohub.exe, the need to use astrohub.exe as the main telescope hub will be eliminated. Until then, your setup will effectively have two telescope hubs since astrohub.exe is required.

Note: astrohub.exe exposes an additional property called Telescope.PowerState that is the same as the Mount.PowerState property and can be used with only the telescope hub and not the provided AstroHub automation mount interface and example script to toggle the mount power via the telescope hub is:

```
Dim x
set t = CreateObject("AstroHub.Telescope")
x = t.PowerState
Wscript.echo("PowerState is currently: " & CStr(x))
if x then t.PowerState = FALSE else t.PowerState = TRUE
set t = Nothing
```

Note that there is no underscore in "AstroHub" above. This is because the astrohub.exe ASCOM hub includes a telescope interface. The astro_hub.ocx software automation interface is named "astro_hub" (with the underscore) to distinguish it from the hub interface.

Appendix A describes the multiple automation interfaces available that can be used in conjunction with ASCOM software or scripts.

Appendix A - Automation Interfaces

The automation interfaces for the AstroHub are included in the file astro_hub.ocx which was installed and registered when the AstroHub software was installed.

The specification document for this is:

AstroHub Automation Interface.pdf

Click the link to open the document if viewing from a PDF file. The above file is located in your AstroHub installation folder and on the installation CD.

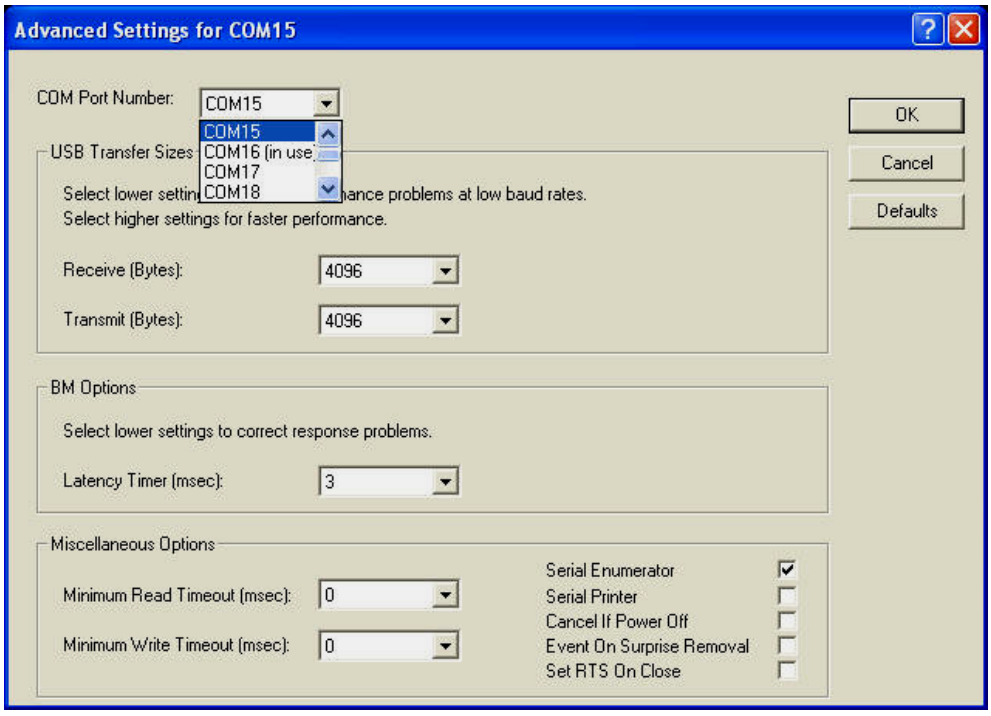
Appendix B - COM Port Reconfiguration

When the AstroHub hardware was installed and appeared in the Windows Device Manager, COM Port numbers were assigned by Windows that may be too high for existing software to deal with. For example, many Visual Basic programs can only support 16 COM ports.

The USB to serial adapters that are used in many places in the AstroHub have software drivers that can be used to change the COM Port number. To do this you can
Open the Device Manager, expand the Ports section, and make changes there.

Connect the AstroHub via USB to the PC. All of the virtual COM ports will be displayed in the Device Manager with the COM port number shown.

For any port you wish to change, right click on the port listing and select Properties. Select the Port Settings tab and click the Advanced button. A dialog will appear with a drop down box showing which COM ports you may use and which are already in use for another device. Note that COM16 below is "in use".



In many cases, the COM port you wish to use is already in use and may be used by a device that was previously installed and no longer used or could be used at a high COM port number. Note that "in use" does not mean that the COM port is open; it means the number was allocated to another device that may or may not be installed at the time. A good example is a USB to serial adapter that is not connected now but when it is connected will assume the COM port allocated to it.

Com Port number assignments are stored in this registry key (for other than Windows 98):

HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\COM Name Arbiter

in a binary value called ComDB. Deleting the ComDB entry will reset all allocated COM PORT numbers.

Prior to deleting the ComDB value you should connect your AstroHub and go to Device Manager and uninstall every Aquest entry in the Ports section. Do this by right-clicking and selecting Uninstall. Disconnect the AstroHub. Then plug your USB to serial adapters in and uninstall them in the Device manager as well. If there are any other USB or other pluggable devices that install as COM ports you should attach them and uninstall them as well. Now delete the ComDB value.

Reconnect the AstroHub and it will go through enumeration and installation process using the lowest COM port numbers available. You can adjust port assignments as described above but do it before you reinstall and other COM port devices.

Appendix C - Connector Pin-outs

Port1/Port2 Plug-in Connectors

DB9 Pin	RS-232	RoboFocus	True Tech FW	FLI Devices	Optec Focuser	Control Port	DB9 Pin
1	CD	COIL1 +	GND	COIL1 +	GND	OUT1	**1**
2	RX (in)	COIL1 -	INDEX	COIL1 -	+12V	OUT2	**2**
3	TX (out)	COIL2 +	COIL1 -	COIL2 +	TEMP	OUT3	**3**
4	DTR	COIL2 -	COIL1 +	COIL2 -	+5	OUT4	**4**
5	GND	+12V	+12V	+5V	COIL1 +	IN1	**5**
6	DSR		HOME	HOME	COIL1 -	IN2	**6**
7	RTS		LED ON	GND	COIL2 +	IN3	**7**
8	CTS	TEMP	COIL2 -		COIL2 -	IN4	**8**
9	RI	GND	COIL2 +			GND	**9**

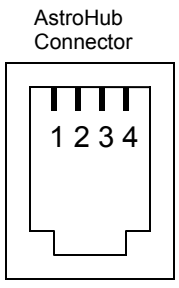
Misc. Port Plug-in Connector

DB9 Pin	Stepper	Control Port
1	SW1-1	NC-1
2	GND	COM-1
3	SW2-1	NO-1
4	SW1-2	NC-2
5	GND	COM-2
6	SW2-2	NO-2
7	GND	GND
8	+5V	+5V
9	+12V	+12V

Note: SW1-1 is switch 1 on plug-in 1
SW2-1 is switch 2 on plug-in 1
NC-1 is the relay normally closed contact on plug-in 1
etc.

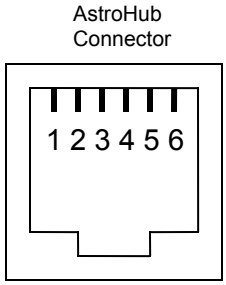
Filter Wheel Connector (from Aux Port Plug-in)

RJ-11 Pin	Filter Wheel
1	GND
2	+12V
3	PULSE
4	



Guider Connector

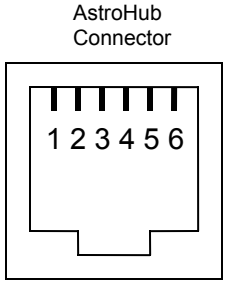
RJ-11 Pin	Guider
1	East
2	North
3	South
4	West
5	Common*
6	



* AstroHub Common is auto-switched:
GND - "ST-4"/LX-200 compatible
+5V - Older Gemini compatible

PCFocus Connector

RJ-11 Pin	PCFocus
1	Motor +
2	Encoder (DSR)
3	+5V
4	Encoder (CTS)
5	GND
6	Motor -

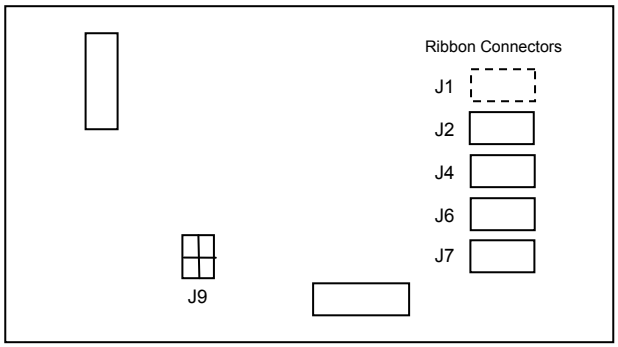


Power Connectors (all)

TIP = + plus
RING = - minus
SIZE = 2.1mm I.D. 5.5mm O.D.

Appendix D- Plug-in Configurations

Stepper Plug-in Configuration



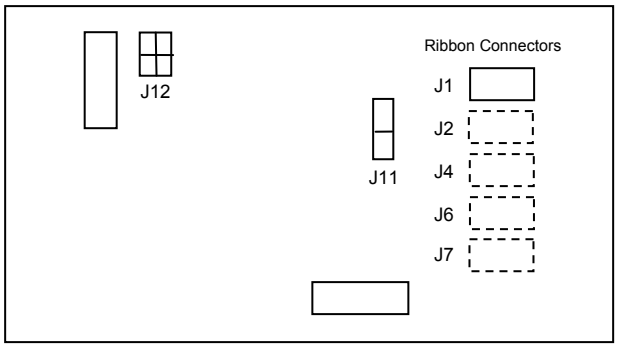
J9 (Type) Jumpers:

o o [] [] RoboFocus	o [] [] o True Tech FW	[] o o [] Optec Focuser	[] [] o o FLI FW or Focuser

Ribbon Connectors:

J2: RoboFocus
J4: True Tech Filter Wheel
J6: Optec Focuser
J7: FLI Focuser of Filter Wheels

Aux Port Plug-in Configuration



J11 (Enable for SBIG or Homeyer Wheels):

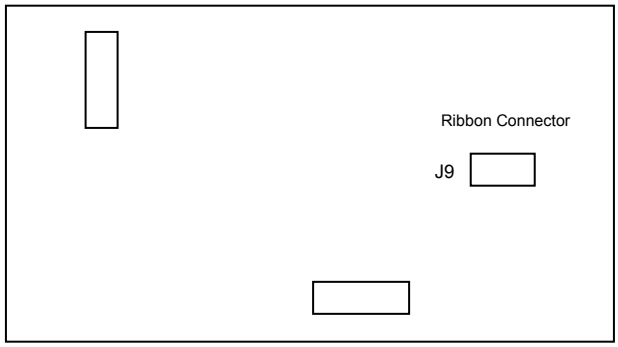
o [] Disable	[] o Enable

J12 (RS-232/USB):

o o [] [] USB	[] [] o o RS-232

Ribbon Connectors:
J1: Aux Serial/USB Connector

Control Port
Plug-in Configuration



Ribbon Connector:
J9: Control Port Connector