The EQMOD PROJECT

EQASCOM

The software driver for direct control of the EQ series astronomical mounts.

This document describes the features and use of the EQASCOM driver. It may also document other related topics. This documentation is created using a collaborative approach so your feedback and input is essential.

Since the EQASCOM (frequently referred to as EQMOD) software is continually evolving, the absolute latest details may not be included here. If you have not done so already, you should consider joining the Yahoo technical group dedicated to EQASCOM

http://tech.groups.yahoo.com/group/EQMOD/

where you may find more up to date information. Also, be sure to look at

http://eq-mod.sourceforge.net

This documentation is under constant development as EQASCOM evolves. Please send private mail to JonD to give suggestions, explanations or corrections.

Note: If you are using an older release, you may need to update to a more recent version in order to use some of the features that are documented here.

This version of the documentation was created:

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012-07-14 01:31:20 PM EDT

and was based upon v1.24g of EQMOD and v101 of EQASCOM_Run and v1.12 of EQMosaic and v1.12 of EQTour. There may be later releases.

See some changes as of v1.22g.

Check also the "Summary of Recent Version Changes".

The on-line version of the documentation is available at:

http://www.welshdragoncomputing.ca/eqmod

and may have a link to a more recent PDF document.

Note: The links in the PDF version work with Adobe Reader 8 and later. Other readers or versions may not support linking within the PDF document. The free PDF reader "Foxit" also works (make sure to click the {Hand} icon): http://www.foxitsoftware.com/pdf/reader/download.php

For another source of current information, visit the Yahoo news group:

http://tech.groups.yahoo.com/group/EQMOD/

A great deal of documentation in the form of youtube videos can be found here

http://www.youtube.com/watch?list=PLBB117AE85EB6BF04&v=TExsfjt8aro

Index

The EQMOD PROJECT

-
-
-

Points List and Pointing Accuracy
Detailed description of how alignments are processed
Other Information About Alignment

-
-
-
-
-
-

Parking the mount
Setting Mount Limits
Saving the ini files
Other Settings
Using the EQMOD simulator
Guiding

-
-
-

Autoguider Port Rate
ASCOM PulseGuide settings
Custom track rate

-

Periodic Error (EQ) - VS-PEC

-

-

Frequently Asked Questions (FAQs)

-
-
-
-
-

FAQs - File Location
FAQs - Park
FAQs - Alignment
FAQs - Tracking & Guiding
FAQs - Miscellaneous
Miscellaneous Facts

The EQMOD PROJECT

- [Add on Software that can be Used with EQMOD (but is not required)]
-
-
- [EQASCOM_Run]
- [EQMosaic]
-
-
-
-
-
-
-
-
-
-
-
-
- [Basic Operation]
- [Summary of Using Mosaic]
- [Using the Spiral Button]
- [Mosaic Settings]
- [EQMosaic and Meridian Flips]
- [Mosaic Sessions]
- [Setting the Framesize Default]
- [Notes about EQMosaic]
- About Mosaic FOV settings
- [An Overview of typical EQMosaic setup]
- [Mosaic – Interface Images]
- [Moon Images]
-
-
- [EQTour]
-
-
-
-
-
-
-

The EQMOD PROJECT

EQMOD ASCOM DRIVER

The EQMOD ASCOM Driver is a software module that allows direct control of Synta mounts such as EQG, EQ-6, EQ-5, Sirius, and upgraded older Atlas mounts sold by Orion USA or Skywatcher. It either requires a modification of the hand controller or a small module such as EQDIR from Shoestring Astronomy:

http://www.store.shoestringastronomy.com/index.htm

or a special adapter cable, such as the one available from Pierro Astro:

http://www.pierro-astro.com/

or

Xagyl Communications who have a USB and an RS232 version

to convert RS-232 (or USB) signals to TTL levels to communicate with the motor controller board in the mount directly (no hand controller will then be needed).

For those wishing to build their own interface, the details can be found here:

http://eq-mod.sourceforge.net/eqdirect.htm

although a commercial interface module is recommended since the cost is quite small.

With the EQMOD ASCOM driver, the user will be able to control the EQ mount using any ASCOM compliant planetarium software at 0.144 arcsecond resolution. The driver supports almost all the ASCOM method and properties which include;

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SYNC (via ASCOM / Planetarium Software)
GOTO/SLEW at 0.144 resolution (depending on the accuracy of the planetarium database)
PARK TO HOME/PARK TO CURRENT/UNPARK
1-Point ALIGNMENT & N-Point alignment
PULSEGUIDE (variable rates with 'duration' parameter support and duration override)
ST4 guiding

Other EQMOD Functions:

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SIDEREAL, LUNAR, SOLAR TRACKING
AUTOGUIDER PORT SPEED RATE SETTING (RA and DEC speeds can be set independently)

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VARIABLE SLEW SPEEDS which can be set from x1 to x800 of the sidereal rate
NORTH and SOUTH Hemisphere support
EQMOD SLEWPAD - Use a three button mouse use as a SLEW HAND PADDLE.

GAME CONTROLLER/JOYSTICK control of mount
GPS SUPPORT (using NMEA streams)
USER PROGRAMMABLE TRACKING RATES (both on DEC and RA)
PEC TRAINING (via hand control or PULSEGUIDE sequence) AND PLAYBACK (ring counter position accurate)
•
STORAGE/RECALL of alignment data

Note: This documentation sometimes refers to the “encoders” in the mount. Strictly speaking, the mount doesn't have optical encoders, instead, the mount uses 32bit ring counters to keep track of the stepper motor position. The more appropriate term to describe the stepper motor counters would be "RA position counter" or "DEC position counter" (or just "RA or DEC counter") instead of "encoder".

Copyright

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Disclaimer & Warning

DISCLAIMER:

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Similarly, any hardware 'add-ons' are listed solely for information purposes. The authors cannot guarantee the functionality or quality of any of these third party add-on devices.

WARNING:

Circuit modifications &/or use of software control could invalidate any warranty that you may have. Use this information at your own risk. The modifications & software involve direct access to the stepper motor controls of your mount. Any "mis-control" or "mis-command" / "invalid parameter" or
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"
garbage" data sent to the mount could accidentally activate the stepper motors and allow it to rotate freely" damaging any equipment connected to your mount. It is also possible that any garbage or invalid data sent to the mount could cause its firmware to generate mis-steps pulse sequences to the motors causing it to overheat. Make sure that you perform the modifications and testing while there is no physical "load" or dangling wires on your mount. Be sure to disconnect the power once this event happens or if you notice any unusual sound coming from the motor assembly.

Reporting Bugs and Requesting New Features

If you have a request for a new feature or a bug report you can mention it on the Yahoo technical group. It probably makes sense to first browse the existing bugs & suggestions to see if you can find any issues relevant to what you're about to report. You can then add a comment about the bug or the new feature that you are suggesting. That gives an idea of how many are experiencing the same issue or would like the same improvement. (http://tech.groups.yahoo.com/group/EQMOD/) .

Hardware

Computer Hardware

The EQMOD driver itself does not require a high-powered computer. On the other hand, you will typically be running one or more other programs (notably a planetarium program) that will require a computer with more memory and processing power. A low-end computer that works satisfactorily has the following specifications:

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memory typically 512Mb minimum
CPU (if they work with Windows 98 they'd be OK. This means just about any modern CPU)
an on-board RS232 serial port or an adapter that uses a USB port with an appropriate adapter (see below).

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For imaging, additional ports will be needed for focus controllers, guide camera, image camera
disk drive (the size of the drive has no impact on the use of EQMOD)
a mouse is essential but you really should also have a game controller/joy stick &/or a second 3-button mouse or a numeric USB keypad
A computer with Windows XP SP2 with 512MB main memory and P4 1.6Mhz CPU is known to work satisfactorily. Other users are now starting to use Vista and Win 7(usually requires more memory).
Currently there is no specific support for Linux. However, some users have experimented with versions of WINE.

Mount Hardware

The EQMOD driver allows direct control of Synta mounts such as EQG, EQ-6, EQ-5, Sirius, and upgraded older Atlas mounts sold by Orion USA or SkywatcherOrion/SkyWatcher. It provides software that provides extensive features controlled by a computer. The computer controls the mount from a RS232 serial port or USB port.

The most common alternative is to replace the use of the hand controller with a small module or cable such as EQDIR (from Shoestring Astronomy: http://www.store.shoestringastronomy.com/index.htm). This module is used with a **straight through serial cable** from the serial port on your computer to the DB9 connector on the mount.

Other Sources:\\

Pierro-astro http://www.pierro-astro.com

Xagyl Communications http://www.xagyl.com

First Light Optics http://www.firstlightoptics.com/proddetail.php?prod=HitecAstro_EQDIR

You could also modify your hand controller. Details or modification of the hand controller can be found here although using one of the commercial modules is typically the most common way to go.: http://eq-mod.sourceforge.net/index.htm For those wishing to build their own interface, the details can be found here: http://eqmod.sourceforge.net/eqdirect.htm

These devices convert signals to TTL levels required to communicate directly with the motor controller board in the mount.

Caution: Never try connecting the computer ports to the mount without the appropriate adapter.

Software

Operating Systems

The EQMOD driver works on Windows(tm) most versions. Windows Vista(tm) is relatively new but EQMOD has been run successfully using the Windows XP compatibility mode (use a right click to set this mode). Currently there is no specific support for Linux. However, some users have experimented with versions of WINE.

Planetarium Software

The EQMOD driver is known to work well with the following software applications:

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Starry Night (http://www.starrynight.com/) (sometimes known as SN or SN6)
Hallo Northern Sky (http://www.hnsky.org/software.htm) (sometimes known HNSKY)
Cartes du Ciel (http://www.stargazing.net/astropc/) (sometimes known as CdC)
StarCalc (http://www.relex.ru/~zalex/files_eng.htm)
Stellarium (http://www.stellarium.org/) . You will also need StellariumScope http://www.welshdragoncomputing.ca/ (see the “Astronomy” menu item)

ASCOM software

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An essential component in the setup is the freely available ASCOM software. You can obtain it at the ASCOM web site (http://ascom-standards.org)
The ASCOM driver software provides a mechanism for standardizing the interface between many of the pieces of hardware and software typically used in your observatory.
Although it includes a component known as POTH (Plain Old Telescope Hub) that allows several devices to interface with the telescope at the same time **current releases of the EQMOD driver do not require the use of POTH.**

Guiding Software

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PHD (http://www.stark-labs.com/) - free guiding software
Guidemaster (http://www.guidemaster.de) - free guiding software
MaximDL (http://www.cyanogen.com/products/index.htm)- essentially imaging software but it does have some telescope control functions that permit guiding.

Polar Alignment

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Alignmaster (http://www.naa.net/garzarolli/alignmaster/)
WebCamScheinern (http://wcs.ruthner.at/index-en.php)

PoleAlignMax(http://users.bsdwebsolutions.com/~larryweber/)- free but needs MaximDL or CCDSoft

Downloading the EQMOD Software

The software is best downloaded from the Yahoo EQMOD news group
(http://tech.groups.yahoo.com/group/EQMOD/files/A%20EQMOD%20Release/)
1
2
. Login and go to the files section.
. Look for the folder *A EQMOD Release*
Inside you will see several folders. The folder *EQASCOM* contains the latest release. Each version is identified with a name that includes a version number and probably a letter.
For example:
or some future version such as:

EQASCOM_V126k_Setup.exe

EQASCOM_V124g_Setup.exe

For those wishing to work with developing the program, the source code is also available within the setup program.
You will typically want the most recent version since it will have the latest features and fixes. If the most recent release exhibits some problems that have not been resolved you can always select a previous release.
You may also be able to obtain the latest version from
https://sourceforge.net/project/showfiles.php?group_id=182628
without joining the Yahoo group. Occasionally the the version at this location may be a version behind the version available on Yahoo.

Installing the EQMOD Driver

Installation of all recent versions

Before you try installing EQMOD, make sure you have installed the ASCOM driver:
(http://ascom-standards.org). EQASCOM will work with v4 of ASCOM but you are advised to update to the latest ASCOM version

Then:

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. Run the program file you downloaded (*EQASCOM_V124g_Setup.exe* for example). The file will have a name and number appropriate to the current release.
. You will probably receive a warning from Windows but it is safe to proceed as long as you have obtained the program from a reliable source.
. You will have the option of installing the source files but these would only be needed if you plan on developing the code.

4

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. Finish the installation.
. After you have completed the installation you should see the "EQMOD ASCOM Scope Driver" as an option when you try to connect to the mount from your planetarium program.
. When you connect to EQASCOM, you will be able to confirm that you have the current version installed since the version is always displayed in the upper part of the window.

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Once this is done, check again on the ASCOM Telescope Chooser dialog in your planetarium program (i.e. try to connect to a telescope and look for the "EQMOD ASCOM Scope Driver").
You should also see EQMOD ASCOM Simulator as a choice. Information about running the simulator version is documented later on in this manual.

Upgrading from Previous Versions

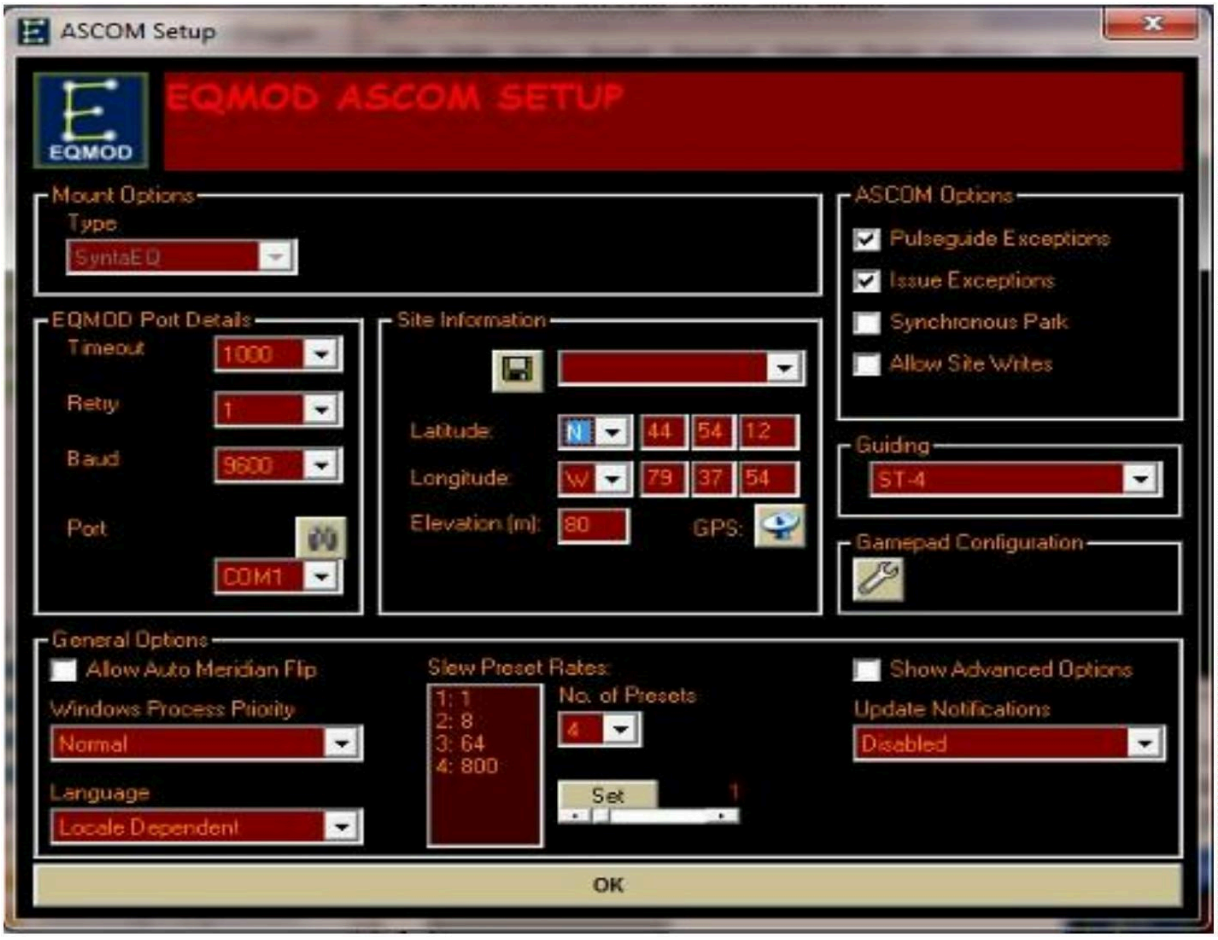
No special upgrade installation is required. It is not necessary to uninstall the older version. Simply install the new version “over the top” of the previous version.

Initial Setup

Once you have installed the software with the current setup package, you will want to do an initial setup. You only need to do this once, so installing later versions will simply use the setup from the previous installation.
You can download http://eq-mod.sourceforge.net/docs/EQASCOM_QuickStart.pdf or follow the instructions that follow in this manual.
You will find the script “Setup EQASCOM” installed with the EQASCOM package, typically found:

Start | Programs | EQMOD | EQASCOM | Scripts | Setup EQASCOM

When you run the script the following window will appear:



Initial Setup (continued)

Typical values for the port would be:

Timeout:
Retry:
Baud:
Port:
1000
2
9600
?

Finding the port is sometimes tricky but the setup program can help. With the mount connected to the computer and powered up and the correct Baud set (typically 9600), click the icon. 

The setup program will test various ports and should be able to find the port used by the mount. Once you determine the port be sure to connect your mount to the same computer port each time to avoid having to search for the port.

Make sure you set the Latitude & Longitude to match your observing location.

If you have a GPS module, you can use the GPS icon to set these values.

There is more information about using a GPS module elsewhere in this document. 

For all other options, the default values are usually the ones you would want to use.

Click the [OK] button when finished with settings.

Initial Setup (continued)

Initial setup with EQASCOM_Run

EQMOD is not a stand-alone program. It is software that acts as a driver between other applications (such as your planetarium program). For this reason you would usually start a planetarium program that would then start EQMOD and connect to your mount.

However, as an initial test (to avoid the complexity of figuring out how to interface your planetarium program), you should consider using the *EQASCOM_Run* utility to start EQMOD. It can be found at:

Start | *Programs* | *EQMOD* | *EQASCOM* | *EQASCOM_Run*

This utility will start up EQMOD to make sure that EQMOD can connect to your mount. If EQMOD connects successfully, you will see the EQMOD window.

Initial Setup (continued)

You should now try the following (please monitor the movement of your mount:

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. Click the [Unpark] button.

. Click the N, S, E, W buttons to see if you can slew the mount.

. If the mount slews a very small amount you may need to use the RA Rate/DEC Rate sliders to increase the rate so you can detect the mount movement.

Now look at the full setup window. Click the [Setup] button:

You will find it near the top of the opening window:

Initial Setup (continued)

Once you click on the button the full setup window will be displayed. Clicking the [Setup] button again will reduce the window to its initial size.

At this point, the only critical items are the Latitude and Longitude settings. You should confirm that they have been set correctly. You will also need to confirm that your planetarium program is also using the same settings (including time)

Initial Setup (continued)

Initial setup with Planetarium program

If all seems to be working satisfactorily, it's time to try with your planetarium program. Every planetarium program has different steps in order to initiate the connection. For details refer to the “
Using EQMOD with a Planetarium program” topic.
Once you initiate the connection:
1

2
. You will also need to confirm that your planetarium program is also using the same Latitude/Longitude settings as well as time as EQMOD.
. The ASCOM chooser dialog will appear.
3
. Select EQMOD ASCOM EQ5/6. There is another option if you want to run the simulator “
EQMOD ASCOM Simulator” so choose the one that is appropriate for what you're trying to do.
4

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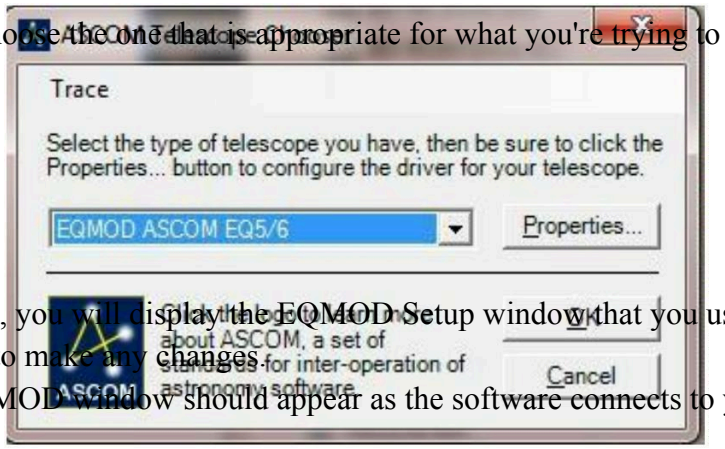
. If you click the [Properties] button, you will display the EQMOD Setup window that you used previously. You should not need to make any changes.
. Click the [OK] button and the EQMOD window should appear as the software connects to your mount.
. At this point, you should be able to use the planetarium program to slew the mount. If this is your first attempt, be cautious that the mount is moving as expected. Once you have everything working, you should find that the mount works in a very reliable manner under the control of your computer. **Even so, you should always exercise caution.**



Using EQMOD with a Planetarium program

EQMOD is not a stand-alone program. It is software that acts as a driver between other applications (such as your planetarium program). For this reason you need another application to start EQMOD. Start your planetarium program and then connect to the mount from within the planetarium program. This will start up the EQMOD driver.

(Note: Other add-on modules such as *EQTour* and *EQMosaic* and *EQASCOM_Run* will also start up EQMOD even without a planetarium program. Information about these add-on modules can be found in a elsewhere in this documentation).

Because there are many different combinations of software (and hardware) you will have to use the following examples to guide your own startup steps.

Caution: It's very important that EQMOD and your planetarium program agree upon your Latitude/Longitude. A common problem is forgetting to set these values in **both** the planetarium program and EQMOD. Setting an accurate time is also very important. GPS or Internet time is a good idea.

Information: If the "EQMOD ASCOM Scope Driver" does not appear in the ASCOM chooser window in the instructions below, you have an EQMOD installation issue. Check the installation instructions earlier in this manual.

Examples of planetarium usage follows:

Cartes du Ciel (CdC)

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. Start the planetarium program

. Select "Telescope | Select Scope Interface" and click ASCOM

. In the ASCOM Telescope interface window that appears click [Select]. If the window does not appear select "Telescope | Configuration Panel" first.

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. In the ASCOM "chooser" window that appears, select "EQMOD ASCOM Scope Driver"

. In the ASCOM Telescope interface window that appears click [Select]. If the window does not appear select "Telescope | Configuration Panel" first.

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. When connected the EQMOD ASCOM driver window will appear.

. Verify that CdC and EQMOD agree upon settings for time/date/Latitude/Longitude.

Using EQMOD with a Planetarium program (continued)

Hallo Northern Sky (HNSKY)

1
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. Start the planetarium program
. Select "Screen | ASCOM Telescope driver"
. In the ASCOM "chooser" window that appears, select "EQMOD ASCOM Scope Driver"
. EQMOD will connect
. You will want to move the EQMOD window aside to reveal the message window underneath.
. Click the [OK] button to dismiss the message window (otherwise you may have trouble
accessing some of the HNSKY features).
7
8
. When connected the EQMOD ASCOM driver window will appear.
. Verify that HNSKY and EQMOD agree upon settings for time/date/Latitude/Longitude.

Hint: If you select HNSKY's "File | Save status" before exiting the program, HNSKY will remember that you use EQMOD the next time it is started.

Starry Night

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. Start the planetarium program
. Click the "Telescope" tab
. If necessary, expand the setup form
. Click the [Configure] button
. In the ASCOM "chooser" window that appears, select "EQMOD ASCOM Scope Driver"
. Click the [Connect] button
. When connected the EQMOD ASCOM driver window will appear.
. Verify that Starry Night and EQMOD agree upon settings for time/date/Latitude/Longitude.

StarCalc

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. Start the planetarium program
. Select Telescope | Choose menu item
. In the ASCOM "chooser" window that appears, select "EQMOD ASCOM Scope Driver"

. Select Telescope | Driver setup menu item. Complete appropriate details.
. Select Telescope | Connect EQMOD ASCOM driver menu item
. Select Telescope | Options menu item .
. Verify that StarCalc and EQMOD agree upon settings for time/date/Latitude/Longitude.

Using EQMOD with a Planetarium program (continued)

Stellarium

In order to integrate *Stellarium* with EQMOD, you will need to install both *Stellarium* and *StellariumScope*.

StellariumScope provides the necessary interface between *Stellarium* and the EQMOD. It is available at

http://www.welshdragoncomputing.ca/ (under the “Astronomy” menu item)

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. Full documentation is included within the *StellariumScope* program.
. Start *StellariumScope*. It can start *Stellarium* or you can start *Stellarium* yourself.
. Select the Scope Drive (typically *EQMOD Scope Driver* or *EQMOD ASCOM Simulator*).
. Click on “Connect” in StellariumScope.
. Select Configuration | Location menu item in Stellarium.
. Verify that *Stellarium* and EQMOD agree upon settings with respect to time/date/Latitude/Longitude.

A comment about CPU usage:

You should be aware that programs such as Stellarium that have the more realistic view of the sky use a greater amount of CPU processing on the computer. This may pose a problem if you have a slower computer or are running remote control operations that also need significant CPU processing.

You can reduce the impact upon CPU usage by minimizing the program when you don't need to see the display.

Using EQMOD with a Planetarium program (continued)

TheSky

I receive the following ASCOM Chooser message: Failed to load driver: object required.

If you get an error message: "failed to load driver: object required", this is a known problem of TheSky software (happened to many) but there is a fix for it as follows:

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. In windows select START/Run and type DCOMCNFG
. Click + sign next to Component Services
. Double click Component Services
. Double click Computers
. Double click My Computer
. Double click DCOM Config, may get a message or messages about wanting to record something....keep clicking 'no' to bypass these messages.
. Select "ASCOM Scope Driver Template" and right click (Hint: If you change the View to
7
“
List”, it may be easier to select the right one).
8
9
1
. Select "Properties"
. Change the Authentication Level from "Default" to "None"
0. Click Apply,
11. Click OK
1
2. Close "Component Services" window

Using a GPS module

The GPS module that is sold as an EQ mount accessory works well with EQMOD. It typically comes ready to connect to the hand controller with an adapter or directly to a USB port on your computer. There is a CD included with driver software for the computer.
Other GPS modules may also work.
When the GPS module is used with the handset it is set to binary mode. This mode will not work with your computer (or EQMOD). It is necessary to install the software application that comes with the GPS module. Once you have it working with the computer (it will require you to change the output format to “NMEA”), you can then close the application that came with the GPS module. The following instructions may be typical for your GPS application.
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. Connect the GPS module to your computer.
. Open the GPS application.
. Set the Com port (some experimentation may be necessary to find the correct port)
. Click on the View tab (fix the com port, if necessary).
. Click on the ==> to expand the window
. Click on the “Set Output Format” and choose NMEA.
. Click on [Send] button.
. Close down the GPS application.
Once you have EQMOD up and running,
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. Expand the EQMOD ASCOM Driver window by clicking the [Setup] button near the EQMOD ASCOM DRIVER title at the top of the EQMOD window.

2

. Click the [GPS] button in the “Site Information” panel.

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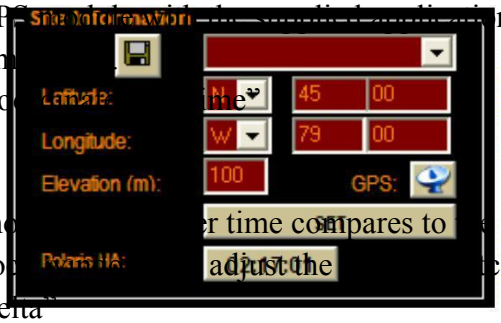
. In the GPS setup window, set &/or verify the com ports and speed (e.g. they should match the ones you used when you setup the GP n).

. Click the [Retrieve Coordinate and Tim

The button will change to “Sampling Co ime”



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. Observe the "Time Delta" line to see h r time compares to GPS time

. If appropriate, open your computer clo adjust the ch. See below for more information about the “Time Delta”

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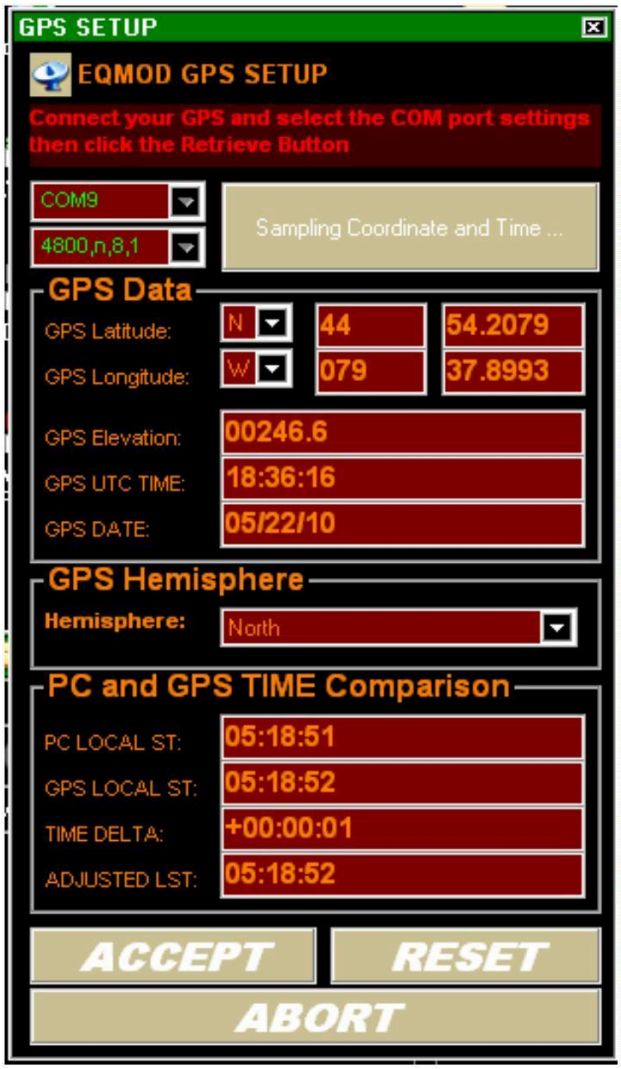
. Click the [Accept] button (in the GPS setup window)



About the Time Delta

The delta (offset) value is an important piece of the puzzle that synchronizes the whole setup from the GPS clock. In EQMOD, the PC clock is used to compute the Local Sidereal Time. However, the on-board PC time is not changed whenever a GPS receiver is used. The EQMOD driver gets the atomic time from the GPS receiver, it also reads the current PC time-of-day which is converted to UTC. The two values are then compared and the time delta (time discrepancy between PC and GPS) is then computed.

When the EQMOD driver computes the Local Sidereal Time, it reads the PC clock, applies an offset using the delta value, then derives the Local Sidereal Time. This is done without any adjustment on the on-board PC clock. In fact, you can actually remove the GPS receiver once it gets the delta and coordinate values. The driver will function on its own using the PC clock + the delta value as the time reference.

This process (using GPS) means that the time “drift” typical of most computers is not an issue. You could, of course, always correct the PC clock each time you start up the computer and the delta would then be 0. **Note: Most planetarium programs use the PC clock. It would be wise to have the PC clock close to the correct time (a very small delta value).**

Using the GPS on the Hand Controller

If you want to use the GPS module with your handset, you will have to use the GPS application program that you installed in your computer to set the output format back to binary.

Controlling the Mount

Using the Slew Controls

In the EQMOD ASCOM driver window you will find the “Slew Controls” panel. **Assuming that the mount is unparked**, clicking &/or holding the mouse down on one of the N/S/E/W buttons will move the mount in the appropriate direction.

You may need to select the RA or DEC reverse options to move the mount in the way you would expect.

You can drag the scale co[illegible] the mount responds to the direction buttons. You have a range of 0.1 to 800 x sidereal (so[illegible]iders give 0.1, 0.2, 0.3....0.9, 1,2,3....800). The most precise positioning is achieved at the sub-sidereal rates. Anyone wanting to manually guide should use those rates and per[illegible]others[illegible]d us[illegible]m fo[illegible] fine centering during alignment.

The [Stop] button will s[illegible]o track[illegible]s as wel[illegible] as GOTO slews. Stopping the mount will not affect alignment. S[illegible]m[illegible]a[illegible]ck rate button to restart tracking.

Using the Slew Controls (continued)

The extra icons at the bottom of the the slew controls provide some extra functionality.

Click this icon to jump to *EQTour* (assumes that *EQTour* has already been started). If *EQTour* is not already running, a file dialog will appear allowing you to browse to the location of *EQTour.exe*. Clicking on *EQTour* will start the program. A more detailed description appears later in this manual.

Click this icon to jump to *EQMosaic* (assumes that *EQMosaic* has already been started). If *EQMosaic* is not already running, a file dialog will appear allowing you to browse to the location of *EQMosaic.exe*. Clicking on *EQMosaic* will start the program. A more detailed description appears later in this manual.

Click and hold on this icon to initiate a spiral slew of the mount. Setting the slider will control whether it is a small or large spiral. Use this feature to help centre an object. A more detailed description appears later in this manual.

Using a Planetarium program to control mount

Once the planetarium program is connected to EQMOD (**and the mount is unparked**) you can select an object in the planetarium program and slew the mount to that object. The exact method varies from program to program. Possibilities:

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-
-

Right click the object and select GOTO or "slew to" in the popup menu
or

or
Double left click the object.
Press < Ctrl 1> or other defined key in Stellarium
There may be other possibilities depending upon the program. The mount will only slew correctly to the object if it has been carefully aligned on a near-by star or (preferably) with 3 or more stars.

Using a Gamepad/Joystick to control mount

Install the Gamepad/Joystick with the associated installation software.

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. Start up EQMOD in the usual fashion.

. There is an [Initialise] button in the expanded EQMOD window. It's located in the lower right under "Gamepad Configuration". You can use this [Initialise] button if the joystick disconnects.

. Typically the left joystick will control the slewing of the mount. You will also find you can move the joystick diagonally to move the mount in Dec and RA at the same time.

. Default buttons on Joystick/Game controller:

3

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-
-
-
-
-
-
-
-
-
-
-
-

1 spiral search
2 alignment cancel
3 alignment accept
4 unused
5 increase RA rate
6 increase Dec rate
7 decrease RA rate
8 decrease Dec rate
9 unused
10 start tracking sidereal
11 (press left Joystick down) Emergency Stop stops slews and tracking
12 unused
13 unused

Only one button can be assigned to a function so there can be only one emergency stop button.


RA Slew Rate -
DEC Slew Rate -
RA Slew Rate +
DEC Slew Rate +

Defining the Mapping of Buttons on a Gamepad/Joystick Controller

The Gamepad is sought out automatically if your Gamepad is present at start-up. If the Gamepad is not detected, try using the “Initialise” button in the “Gamepad Configuration” sub-panel.The user can define which Gamepad buttons map to which EQMOD_ASCOM functions. The following image shows the default settings.

OPERATION:

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. In EQMOD, click the [Setup] button (if necessary) to display the expanded EQMOD window.

. Open up the Gamepad configuration dialog via the [Configure] button on the main (expanded) EQMOD_ASCOM window (in the “Gamepad Configuration” sub-panel).

3

. In the “Gamepad Config
button **on your Game** that you wish to use. If you are
is not necessary to clea previous setting first.

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. To clear the button setti function, simply right click the current assignment.

. Click the [Clear All] bu to clear all assignments.

. Click the [Load defaults to load the default assignme

. After all changes have b click the [Assign Changes on the dialog will then close or click the [Can button to close without changing present assignments.

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. The same button can be assigned to more than one function and if this is the case any duplicates are highlighted as a warning. This allows you to combine RA and DEC rate adjustments to use only two buttons (increment and decrement) if you so desire.
. While the Gamepad configuration is in progress the Gamepad buttons no longer control the scope – **this includes any button currently defined for the emergency stop function**. On closing the configuration dialog control is returned to the Gamepad.
. A particular function can only be assigned to a single button and so there can now only be one button that performs *"Emergency Stop"*. However, as described above, one button can invoke more than one function (see 1. above).
. It is advisable to verify that button assignments perform as expected under simulation prior to using them to drive the mount. You should then verify (again) that the buttons drive the mount as expected.
. If on first run of EQMOD, the *joystick.ini* file does not exist, the code attempts to read each parameter and, upon failure, will fail assign default values. These default values are written to the *.ini* file and the file gets created as part of this process.
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. The read of mappings is performed on EQMOD main form load. This means the default behavior will be assigned without the need for any user configuration.
. Any buttons that form part of the default mapping that are not applicable to the actual controller being used (perhaps the controller has fewer buttons) will be ignored.
. If you wish to assign one or more buttons to select slew presets, you should read the section of the manual on slew presets.
. The function-button mappings are stored in a *joystick.ini* file in the
`C:\Documents and Settings\YourLoginName\Application Data\EQMOD`
folder. If you want to move your Gamepad mappings from one PC to another, copy this file.

Because of its location each windows account (if you login as a different user to your Windows computer) will have their own mapping file. You can edit the *joystick.ini* file with *NotePad* or some other text editor. This would enable you to change a single button code.

Note:

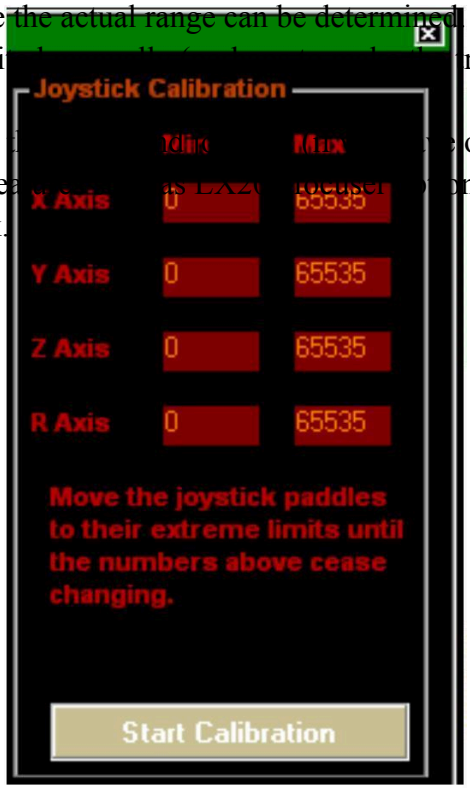
If you assign a button to the “Synchronize” function, you need to know that the button must be **pressed twice in close succession** in order to issue the “sync” command. You will hear a sound from the computer if the “sync” has been issued. You will also see an addition to the point list.

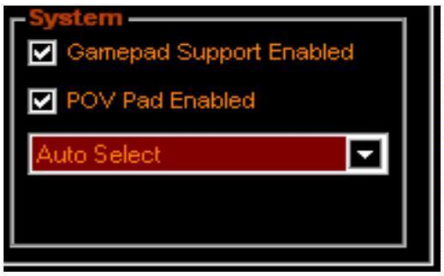
Calibrating the Joystick

Typically a joystick will send values of a minimum of 0 and a max of 65535. These are the limits that EQASCOM always used to apply internally. If Joysticks are auto calibrating or can be calibrated from their driver then these are the typical values.

Some game pads however don't quite seem to make it to the absolute min and max values (perhaps their centre position isn't set exactly at 32767 or perhaps their hardware doesn't have full 16 bit resolution, hence the calibration screen where the actual range can be determined. The data is stored in the joystick .ini file so the values could be edi rigger points well within the current limits).

The calibration routine also lets you calibrate one) i.e. Z and R (Rudder) axis. In future it's likely that other fe ns will be available on the game pad using the right hand joystick.




System
Gamepad Support Enabled
POV Pad Enabled
Auto Select

Using the slew pad and mouse to control mount

You can use a 3-button mouse to slew the mount using a special slew pad window.
Open up the slew pad window by click on the [Pad] button in the lower left of the slew controls.

-
-

You will probably want to have two mice.
You can adjust the size of the slew pad by dragging and dropping the borders so that it takes less of the available screen space.

Using the slew pad and mouse to control mount (continued)

- Use a 3-button mouse with the tracking ball removed for the slew control. You will only be using the buttons to control the mouse and you need the mouse to stay within the slew pad. Removing the trackball will mean you won't need to concerned about moving the mouse out of the slew pad area as you use it to slew the mount.
- Position the mouse within the slew pad area (with your regular mouse). Use the modified mouse to slew the mount.
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-
-

The left button is used for West & North
The right mouse button is used for East & South
The middle button toggles the modes of the left & right buttons.
If the middle button does not toggle the modes as expected, you may have to go into your windows mouse setup and assign the middle button to just "middle button". It may have been set to some other function such as "double click" or "help" or "minimize" etc.

If you have just one mouse:

1. Use the mouse to open the slew pad by clicking the [Pad] button.
2. Click anywhere within the slew pad (the middle is probably the safest in case you accidentally move the mouse while slewing the mount)
3. Use the mouse buttons to control the mount. Try to avoid moving the tracking ball so the screen mouse stays within the slew pad.

Assuming you have 2 mice:

1. Use your regular mouse to open the slew pad by clicking the [Pad] button.
2. Using the regular mouse, click anywhere within the slew pad.
3. Use the modified mouse to control the mount

Using a numeric Keypad to control mount

You can use the regular numeric keys on your regular keyboard. However, a more useful setup is a separate numeric USB keypad that is a frequent add-on for notebook computers. This allows you to hold the keypad in much the same way as you would have used the original hand controller.

Keypad information:

-
-

Slewing Functions via numeric keypad (USB Keypad, or Keyboard Keypad).

The keypad functions is only attached to the 'SLEWPAD' window. Just select the slew pad window and all key press commands will be recognized. You can reduce the size of the slew pad so that it does not hide any parts of the screen that you need to view.

You can slew 'diagonally' using the keypad:

Button 7: Slew North West
Button 8: Slew North
Button 9: Slew North East
Button 4: Slew West
Button 6: Slew West
Button 1: Slew South West
Button 2: Slew South
Button 3: Slew SouthEast
Left Arrow: Slew West
Right Arrow: Slew East
Up Arrow: Slew North
Down Arrow: Slew South
Button 5: EMERGENCY STOP/Disable Tracking
Button 0: Activate Sidereal Tracking

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Keypad Slew rates are based on the SLEWPAD Rate slider buttons

Slew Presets

EQMOD can use preset rates for slewing The rates are read from the *EQMOD.ini* file and are defined as multiples of sidereal rate (same as slider bars use). The presets apply the rates to both RA and DEC. The preset rates may be selected via the drop down list situated between the two rate sliders. A pair of Gamepad buttons could be assigned to increment and decrement the current preset number (*Increment Preset/Decrement Preset)* or you could set buttons to select specific presets (*Rate_1, Rate_2 etc.)*. Note that these Gamepad buttons are not assigned by default and you will have to do this via the Gamepad configuration dialog.

If the beep checkbox has been checked then each time a preset is changed via buttons EQMOD will issue a short "click". This is to provide some fee[illegible] relatively slow and fast changes can be missed (keep the button pressed [illegible] have no problems). When the first or last preset has been reached, further b[illegible] is [illegible] "beep" to let you know you've reached the min/max rate.

By default 4 preset rates are defined: sidereal x1, x8, x64 an[illegible]0. [illegible] can be can changed, and added to by editing the *.ini* file. The number of p[illegible] maximum of 10 by changing the *COUNT*. For example

```
[slewrates]
InitalPreset=1
rate_5=800
rate_4=400
rate_3=64
rate_2=2
rate_1=1
COUNT=5
```

Slew Presets (continued)

The value for *InitalPreset* determines which rate will be used as the default rate at startup. The software will only read in the number defined by *COUNT*. If *COUNT* is set to a number larger than there are presets, then the software will create the extra preset and assign a rate of 0 to them. Presets with a rate of 0 do not affect a change in slew rate.

EQMOD.ini can be found in:

```
C:\Documents and Settings\YourLoginAccount\Application Data\EQMOD
```

You may have to set your explorer to view hidden files.

Four additional functions (r*atebtn_1, ratebtn_2, ratebtn_3* and r*atebtn_4*) allow direct mapping of four slew rates presets to gamepad/Gamepad buttons. The mapping is defined in the *EQMOD.ini* file as follows.

```
[slewrates]
ratebtn_4=5
ratebtn_3=4
ratebtn_2=3
ratebtn_1=1
InitalPreset=1
rate_5=800
rate_4=400
rate_3=64
rate_2=2
rate_1=1
COUNT=5
```

A *ratebtn_x* (such as *ratebtn_2*) variable is assigned to a preset number *(*such as *rate_3)* rather than an explicit rate since there are only 4 rate buttons but there may be many more preset values. Typically, you will choose to assign 1, 2, 3 or 4 of the possible preset buttons. Default mappings are typically assigned on an initial run and use the first 4 rates presets. This means you can just use the Gamepad editor to assign buttons to the any one (or more) of the first 4 presets without needing to edit the *.ini* file.

Only if the defaults are not suitable, edit the *.ini* file to change the mapping in the following fashion:

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. In the Gamepad editor window assign a button of your choice to (say) *Rate Button 2*.

. Using Notepad, you set *ratebtn_2* to point at the appropriate rate setting variable (say) *rate_3*.

. Using Notepad, set the value of *rate_3* to the slew rate you wish.

In summary, the following shows how the button you have assigned points to preset slew rate of 400 x sideral.

```
Game controller button (you choose) -> ratebtn_3 -> 4 -> rate_4 -> 400
```

Note: The above example is not the default setting for the *.ini* file

Ways of Controlling Slew rate

There are three options for controlling slew rate:

1. Pure analogue variation via increment and decrement. RA and DEC (the RA Rate and DEC rate sliders in the slew controls sub-panel). Separate buttons can be assigned to the increment and decrement for DEC and RA (a total of 4 buttons. You could use just 2 buttons where the increment button increments bot RA and DEC. Similarly, one button could be assigned to decrement bot RA and DEC. or can be combined on to two buttons.

2.

3. Assign a button the increment the preset # and another button to decrement the preset #. RA and DEC rates are always linked when using presets.
. Assign individual buttons to each of the presets so you jump immediately to a particular preset. RA and DEC rates are linked

If you like to use lots of different slew rates then option 1 is probably the best. If you just use three or four rates then it may be more convenient to use option 3.

Using Spiral Search Feature

This feature is useful when the required object is not within the FOV.

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Click and hold the [Spiral] button. The mount will start a spiral outwards search until you release the [Spiral] button.

Alternatively press and hold button [1] on the game controller (unless you have defined another button for spiral search). Button [1] is spiral by defaul

Hint: Since EQMOD starts a new spiral search from the current location whenever you press and hold the [Spiral] button, you can optimize the slew to the object by uses successive spiral searches.

1

2

. Press and hold the [Spiral] button (or button [1] on the game controller).

. After the spiral has been generated for a number of cycles (getting closer and closer to the object), release the button when the spiral is on the side closest to the object.

3

4

. Press and hold the [Spiral] button (or button [1] on the game controller), starting a new spiral.

. Repeating the above sequence gives you a method of zeroing in on the object since each spiral starts off relatively small.

Notes:

1

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. The slider can be adjusted to control how much the mount slews on each leg of the spiral.

. The spiral search will always follow the current tracking state of the mount. That means you can implement the spiral slew with 'tracking on' and EQMOD will implement the slew with sidereal/Lunar/Polar/custom drift compensation.

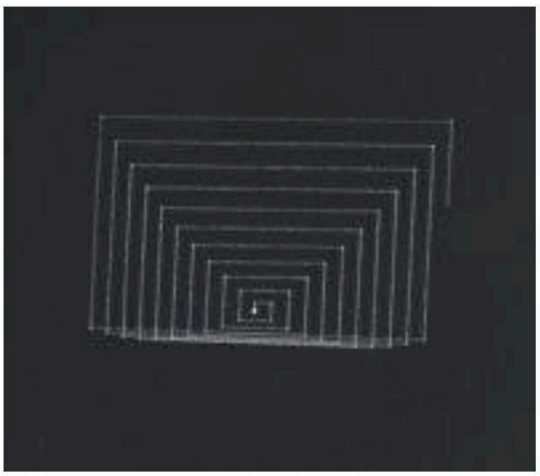
3

. EQMOD will not implement any compensation if the spiral slew is activated and the mount is not tracking.

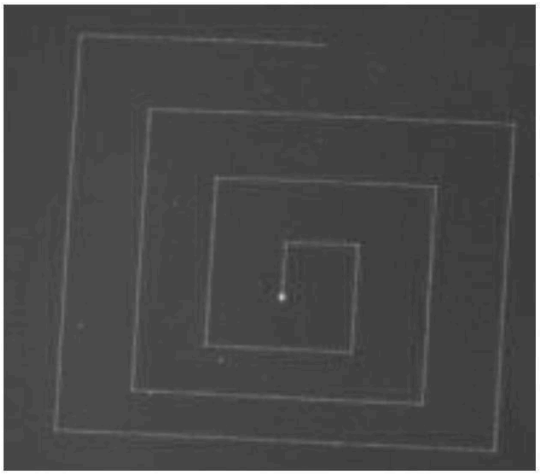
Using Spiral Search Feature

Here are sample slew patterns when there is no sidereal tracking and with sidereal tracking with small and large microstep settings. The images were provided by Andrew Wall using a Canon 400D on an EQ6 mount using version 109e.

This image used step size of 1029 with no tracking:

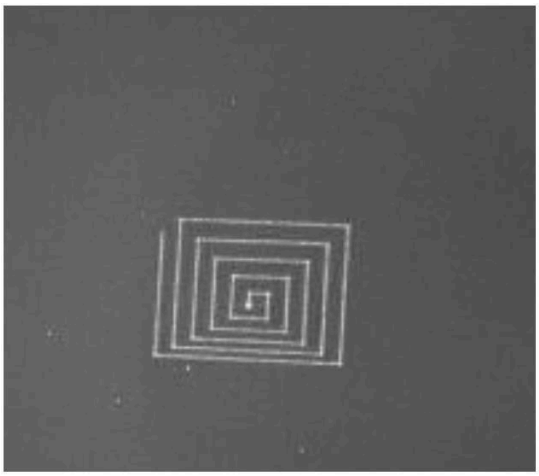


This image used step size 4000 with tracking:



Using Spiral Search Feature

This image used step size 1020 with tracking:

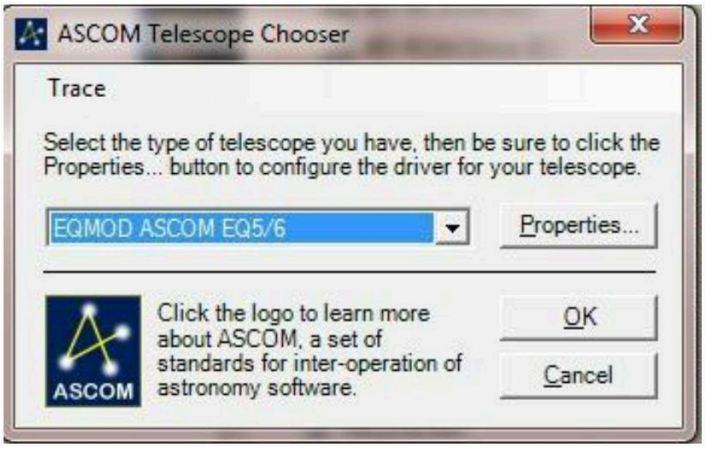


Auto Pier Flip Option

Given the concerns expressed at inclusion of auto-flip capability the auto flip support itself is dependent on an EQASCOM setup screen option (as presented when selecting properties from the ASCOM chooser).

In the “ASCOM Telescope Chooser” click the [Properties] button to display the ASCOM setup window shown below. You can also display this window by accessing:

Start | Programs | EQMOD | EQASCOM | Scripts | Setup EQASCOM



Auto Pier Flip Option

Only if this option is checked is the user able to set EQASCOM to perform automatic flips. Assuming this is the case the auto flip action itself can be enabled/disabled via Limits Setup form available from the main window.

Select the configure button:

from the Mount Limits panel on the main window:

then enable the option in the General Options panel:

If enabled the flip and the Enable Limits option is enabled, auto-flip is applied whenever the RA limits are reached (so not necessarily at the meridian). The PC will issue a short two tone beep sequence prior to initiating the flip to give you time **to clear the area, prepare catch falling eyepieces, cut any snagging cables and hit the emergency stop!**

Manual Goto

As of version v1.18m, a feature has been added that allows a manual entry of the RA/Dec.

1

. Right click on either the RA or Dec entry to display the manual Goto dialog

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. Enter/Modify the data entry in the manual Goto dialog and click the [GoTo] button

.

As of v1.19f you can store a position and recall it later. The stored value is only applicable until a new value is stored or EQMOD is restarted.

Note: The default is for JNOW coordinates. If you wish to enter J2000 coordinates, tick the J2000 box before clicking the [GOTO] button.

Mount Movement Strategies

EQASCOM provides two movement strategies.
Normal: RA and DEC move simultaneously to their target positions
Safe: This movement is used when moving from or to an Outside Limits position. The RA axis is first moved to the RA home position, the DEC axis then moves to its target position and finally the RA axis then moves to its target position. This is safer than the "Normal" slewing method because whilst entering/leaving the “Outside Limits” zone only the RA axis is moving and so the mount will take the same final approach to a given position irrespective of starting position.
If RA limits are applied then they will set the range over which will "normal" slewing will occur. Gotos/Parks/Unparks to/from positions outside of the limits will be implemented using a safe goto.
If RA limits are off then all movements from counter weight down (CW down) positions will be performed as simultaneous RA/DEC. Movements from counter weights up (CW UP) positions (i.e. where the mount has tracked over the meridian) are implemented using the Safe method.

Limits Not Applied

Start	Destination	Operation	Flipped Goto	Movement Type	Comment
CW Down	Anywhere	Goto/Park/ Unpark	No	Normal	
CW Up	Anywhere	Goto/Park/ Unpark	No	Safe	
Safe					
Mount may have tracked into a position where any DEC movement causes collision so safe moves are used.					
Anywhere	Anywhere	Goto	Yes		Flipped gotos can go to any target position – user must supervise and stop if collision is likely

Mount Movement Strategies (continued)

Limits Applied

Start	Destination	Operation	Flipped Limits Goto applied to Goto	Type	Movement	Comment
Within Limits	Within Limits	Goto	Yes or No	Yes or No	Normal	
Within Limits	Outside Limits	Goto	Yes	No	Normal	The flipped goto request is ignored and a standard goto is performed instead.
Anywhere	Outside Limits	Goto	Yes or No	NONE		Goto out of limit position can't be initiated.
Outside Limits	Anywhere	Goto	Yes or No	Yes		
			Yes or No	No	NONE	
Safe	Limit will prevent goto					
Outside Limits	Within Limits	Goto				
Within Limits	Within Limits	Park			N/A	
					N/A	
					N/A	
					N/A	
					N/A	
					N/A	
					N/A	
					N/A	
					N/A	
					Normal	
Safe		Unpark				
Outside Limits	Park	Unpark				

Within Limits Park
Unpark
Outside Limits Park
Unpark
Within
Limits
Outside
Limits
Safe
Outside
Limits
Safe

Using Forced Flip GoTo's

GoTo's and Mount flip

A GEM mount operates with the scope either on the west side of the mount or the east side. When you initiate a GOTO for an object east of the meridian, the mount will slew to the object with the counter-weights in the "down" position with the scope/camera on the west side of the mount. If you then initiate a slew to an object west of the meridian, the mount will reverse its position or "flip" so that the scope/camera is on the east side of the mount.

In the normal scheme of things a "flip" only occurs for GOTO's/slews as described above. If you select an object east of the meridian and the object crosses the meridian, the mount will not flip and will continue to track the object. With this situation, the mount will end up in the counter-weights up position. It also poses collision risks that are potentially different from the counter-weights down position so close monitoring of mount movements is essential. EQMOD has a feature that allows control of a "flip" in a non-standard way.

When would non-standard flip be appropriate.

Here are a couple of examples:

1. If your observing setup favours primarily west of the meridian with limited view of objects just east of the meridian and you would like to start tracking an object, east of, but close to the meridian.
2. If you use something like a SkyPOD observatory where the roof tends to block access to the Zenith and would like to position the mount so the scope/camera is offset from the roof.

In general, this flipped movement is really only to be attempted as a last resort. It is much better, if you can, to track through the meridian rather than used “Forced Flip GoTo's”. In addition, flipped gotos may not be as accurate as normal goto as the alignment model was not designed with them in mind. Fir this reason, the user must not create a model that includes a mixture of points added from normal and flipped positions.

It is important that anyone considering flipped gotos also reviews the meridian limit functionality and the associated movement strategies that EQASCOM applies. See the youtube presentations at http://www.youtube.com/watch?list=PLBB117AE85EB6BF04&v=TExsfjt8aro

Using Forced Flip GoTo's (continued)

How to use non-standard flip feature.

1
. You must be prepared to monitor the mount movements to avoid any collisions. This is always good practice even when this feature is not utilized but is particularly important when using the "Forced Flip GoTo".

2

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. Slew the mount so that the scope/camera is on the same side of the meridian as the object.
. Click the {Display} button (located just below the ASCOM logo) until the "Mount position" panel is displayed.

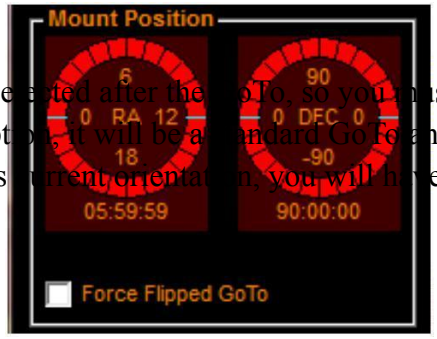
4
. Tick the "Force Flipped GoTo" option

5

6
. Initiate the GoTo for the object
. Fine tune the position with the slew controls

When the mount moves it will follow the strategy outlined in the Mount Movement Strategies topic.

Caution:



1
. The “Force Flipped GoTo” option will be deselected after the GoTo, so you must be careful with the next GoTo. If you don't reset the option, it will be a standard GoTo and may flip the mount. If you intend to keep the mount in its current orientation, you will have to reset the option each time before initiating a GoTo.

2

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. If you start with the scope/camera on the opposite side of the meridian to the object, the "Force Flipped GoTo" will flip the mount.
. The orientation of the mount using the “Force Flipped GoTo” poses significant collision hazards. Direct supervision of the mount is essential. ***Remote control of the mount is not recommended.***

Timed Park

It is possible to have the mount park after an elapsed time. This feature is independent of any park action that might be initiated by the user or the mount limits setting. If mount limits are enabled and a limit is reached the mount may park before the elapsed time occurs.

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. Unpark the mount and slew as appropriate

. Enter the number of “minutes until park” in the red text field

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. When ready, click the “Start Park Timer” icon

. The text field will turn green and will show the count down in minutes.

You can stop the time by clicking the “Start Park Timer” a 2nd time.

Alignment

EQASCOM Alignment Overview.

Summary:

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EQASCOM provides a pointing model using a list of calibrated points.
The number of points can vary from 1-1000.
The process of adding a point to the list is referred to as “Alignment” and involves moving the mount to a known location (typically a star) in the sky and adjusting the mount to centre this point in a high power reticule eyepiece (or camera image).

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The point remains as a fixed position In the sky with respect to the observer (i.e. it does not move with the related star). Using the same star one hour later would add a completely new point.

•

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Some means for slew control that can be used at the mount is required. A simple game pad is a good choice.
EQASCOM provides two alternate interfaces for alignment, one method uses a dialogue based from EQASCOM and the other uses ASCOM *syncs* using your planetarium program. The ASCOM sync method is highly recommended. However, if your chosen planetarium program cannot provide a mechanism for initiating a *“sync”*, you will have to use the EQASCOM dialogue method.

•

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To provide pointing/goto corrections EQASCOM applies a coordinate transformation algorithm using data from the alignment points list. There are two alternate transformation algorithms,“Nearest Point” and “3-Point+Nearest”.
If the “PierSide Points Only” checkbox is enabled, only those points on the same side of the meridian as the target point will be used.

Alignment via ASCOM Syncs

This method allows for an alignment list and pointing model to be built directly from any planetarium program that can issue ASCOM *slew* and *sync* commands.

The procedure is:

1

2

. Using the planetarium program, slew to a star

. At the mount, centre the star with a high power reticule eyepiece (or use a camera “bulls-eye”). This is best accomplished with a *game pad* but you can also use EQASCOM's nudge buttons / spiral search etc.

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. Using the planetarium program, issue a *'sync'* command on the target star. A new alignment point will be added.

. Repeat 1-3 for each alignment star.

With this approach, it is very easy to add new point should you feel *'goto'* performance is suffering in a particular area of the sky. Just *'goto'* a star, centre it and *'sync'*. If you use a '*game pad'* for slew control there is no need to open up EQASCOM.

Alignment via EQASCOM dialogue.

In this mode the user initiates alignment from EQASCOM.

The procedure is:

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. In EQASCOM initiate the Alignment dialogue by pressing the “Add Point(s)” button.

. In the planetarium initiate a slew to an alignment star.

. Centre the star using your game pad / EQASCOM Nudge controls using a high power reticule eyepiece / camera 'bulls-eye'.

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. In EQASCOM Press the [Accept] button.

. Repeat 2-4 for at least two further stars. In EQASCOM press the alignment dialogue [End] button when all stars are done.

You can add more points to the list at any time by calling up the Alignment dialogue

When operating in '*dialogue'* mode, alignment *syncs* received from the planetarium will result in entire pointing map being ‘shifted’ so it corresponds with the *sync* point .The map itself isn’t changed.

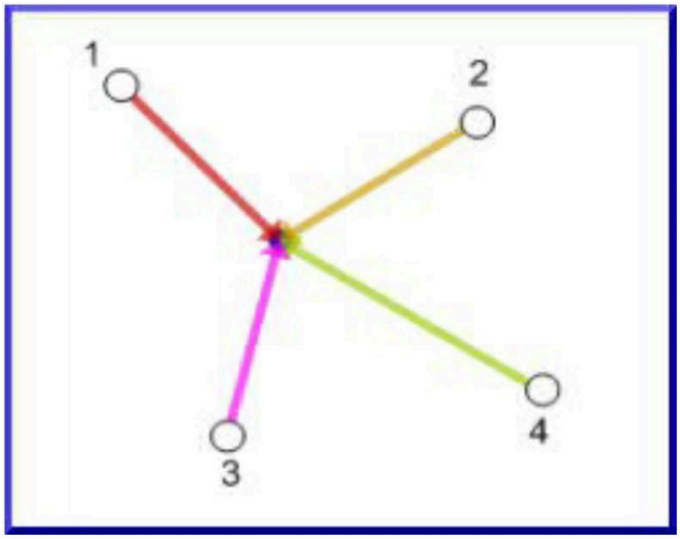
Transformation algorithms.

EQASCOM provides two pointing transformation algorithms, *3-Point+Nearest Point* and *Nearest Point*

Nearest Point Algorithm

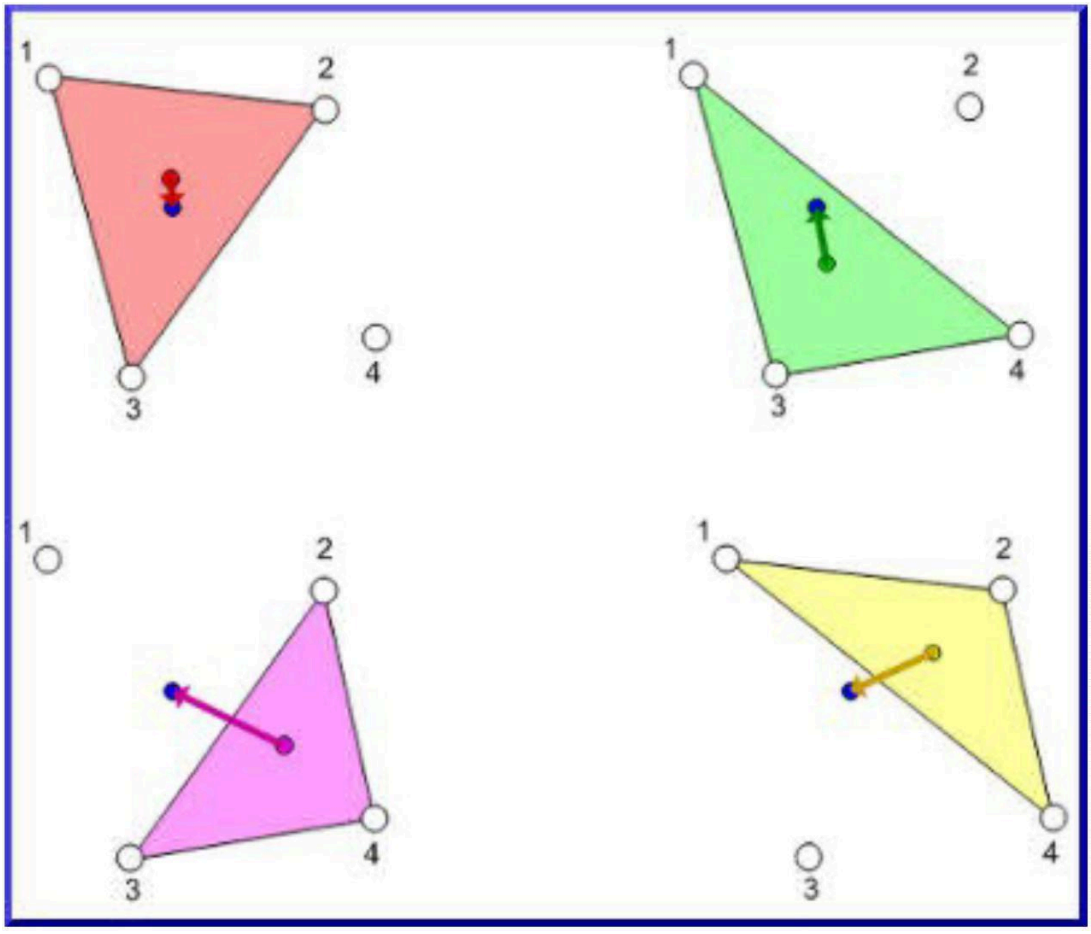
Nearest Point simply searches through the current alignment list to find the alignment point nearest to target position. Once the nearest star is found a transformation is performed based upon the data associated with that point.

Nearest-Point



-Point Algorithm

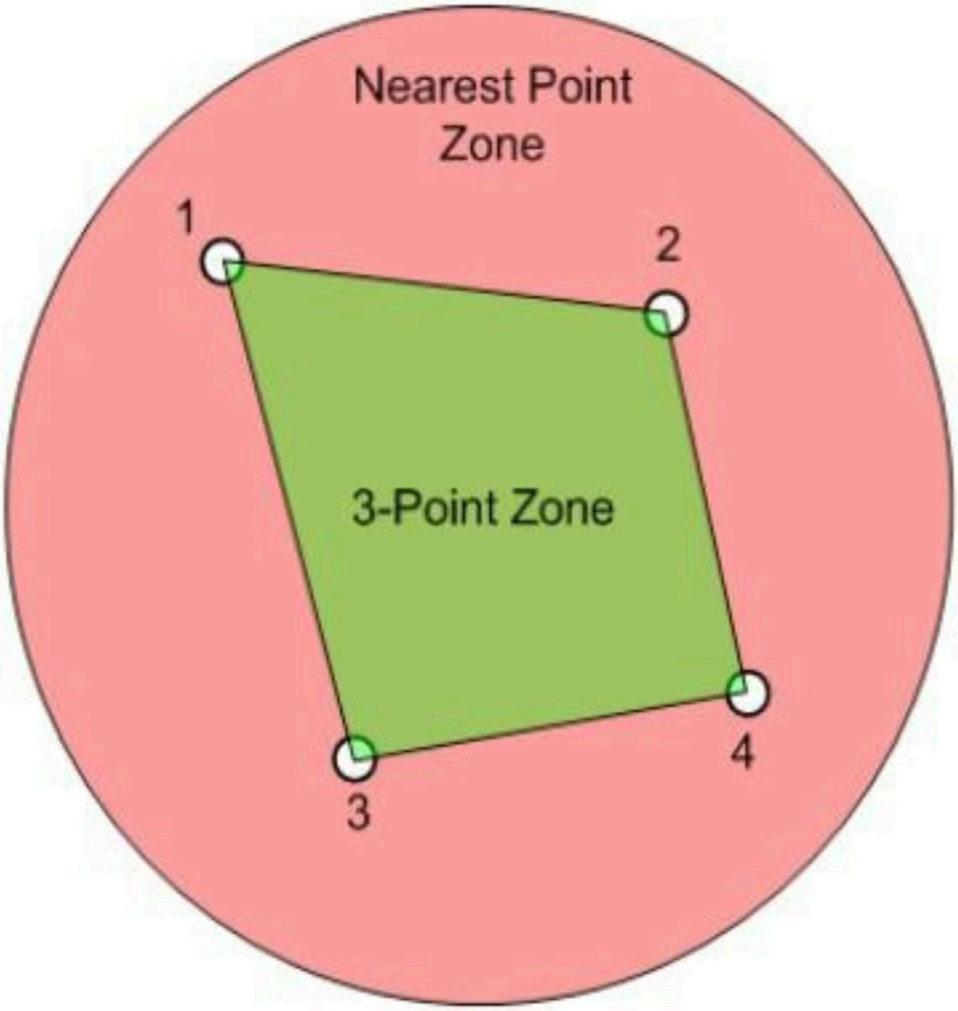
-Point iterates through all triangle combinations possible using the 50 nearest alignment points to
3
establish which triangle has its centre closest to the target position. The three alignment points that make up that triangle are then used for pointing correction. The diagram below illustrates this process. There are four points in the alignment list and as a result there are four possible alignment triangles. The centre of the triangle formed by alignment points 1,2 & 3 is the one used since the centre of this triangle is closest to the target of the slew (the blue dot).



-Point vs Nearest
The drawback with these triangle based transformations is that they are less accurate for targets falling outside the bounds of all possible triangles. To compensate for this the “Nearest Point” mechanism is automatically applied for these areas and so this method is referred to as 3-Point + Nearest.
Nearest Point is always applied if less than three points are present in the list.
PierSide Points Only
Another potential problem is where triangles span the meridian, particularly if you have a reflecting telescope where mirror flop many be significant. The “PierSide Points Only” checkbox will force using only points on the same side of the meridian as the target point in transformation calculations.

Nearest Point Zone

The following diagram (with 4 alignment points) shows the area of the sky (green) where the *3-point algorithm* will be used and the area of the sky (red) where the *nearest star algorithm* will be used. You should remember that the 4 points are fixed in the sky with respect to the observer and only coincide with the stars used at the time of the alignment. In theory, points 1 & 2 could actually be the same star at different times of the night.



Alignment FAQs

Q: My Synscan provides 1-Point, 2-Star and 3-Star alignment. What modes does EQASCOM provide?
A: EQASCOM provides MultiPoint Alignment. It's up to you how many alignment points you want to use. If you want the equivalent of “1-Point” then you simply clear the alignment data and add a single point to the alignment list.
Q: Can I change between Sync and Dialogue based alignment methods once an alignment list has been started?
A: Yes, you can change the alignment method/interface at any time.
Q: Can I switch between “Nearest Point” and “3-Point+Nearest” at any time.

A: Yes.

Leveling the Mount

Although it is not obvious, it turns out that precise leveling of the tripod/pier/mount is not all that important. Of course you want to have reasonable values here (there's little point in having your pier tilted way off vertical). However, any discrepancies are easily compensated for by the algorithms used in the N-Point alignment process.

A level mount can facilitate polar alignment because adjustments are made left, right up and down instead of at slight angles. Do not worry about leveling the mount with great precision.

What is important:

- good polar alignment (using the mounts polarscope will give results that are adequate for many cases. There are additional techniques that can improve on this setting if you have demanding imaging).
- A good home positioning of the mount in order to improve the accuracy of initial GOTO's to alignment stars. Even this is not absolutely essential if you recognize the alignment star and are prepared for a significant slew.

If you are doing only a 1-Point alignment, you may find that setting the home position and leveling is more critical.

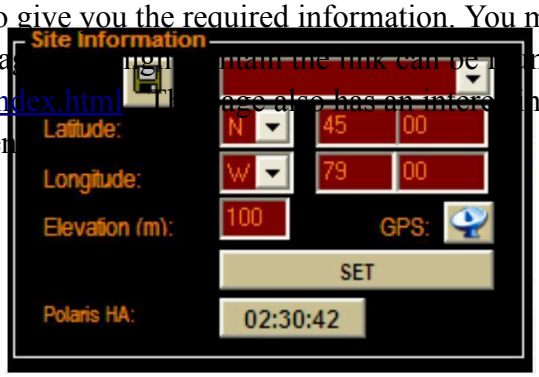
Polar Alignment

Polar alignment is the process of aligning the mount so that it points at the NCP (the North Celestial Pole) or the SCP (South Celestial Pole). This means that the axis of the mount will then be aligned parallel to the earth's axis. It should be noted that Polaris, although being accepted as the North Star, is not quite at the the NCP. For polar alignment in the northern hemisphere, it is necessary to offset the mount a fraction of a degree from Polaris.

An accurate polar alignment is essential for long exposure imaging. It will also have some effect on alignment. Mounts with a polarscope usually have a reticule that is visible as you look through the polarscope. The reticle will typically have a circle that is the correct distance from the NCP. Positioning the mount by adjusting the physical adjusting bolts so that Polaris appears on the circle will align the mount. It is important to know where on the circle to position Polaris. For some mounts the reticle lighting is so bright it may be hard to see Polaris. Try with the power off as there is no reason to have the mount powered up for polar alignment (except for the light on the reticle) although you can't turn off the power if you're using the motors to align the hole in the shaft for the polarscope (unless you are prepared to reset home position etc.)

The position of Polaris on the circle is described by its Hour Angle.

- The most recent version of the hand controller firmware will give you the hour angle of Polaris once the hand controller has been initialize with time/date location.
- EQMOD provides you with the current Hour Angle (*Polaris HA)*.
- Also many planetarium programs will also give you this information. In addition,a freeware program know as *PolarFinder.exe* will also give you the required information. You may have to search the internet for this program. One pa[illegible] ntain the link can be found http://arnholm.org/astro/polar_alignment/index.html [illegible]age also has an interesting description of the process of polar alignmen



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- Remember that the view of Polaris is usually inverted through the polarscope. The *PolarFinder.exe* program shows you the view you should expect to see with most polarscopes.

Count the hours in the hour angle CCW starting at the bottom of the clock as 24h/0h, remember that it there are 24 hours in the full circle (not 12).

many reticles have a small circle on the larger circle used for positioning Polaris. Set this small circle according to the hour angle.

EQASCOM PolarScope Alignment Tool

Important:

For the following procedure work properly, you must be sure the the reticule on the mount is correctly centred. The manufacturer's manual outlines the required procedure. (Typically you just centre the 'X' of the polarscope on a distant object (in daylight) and rotate the mount 180d. The object should stay centred under the 'X”. If not, use the appropriate set screws to move the reticle.)

The alignment of the reticle is not important (although the manual describes how to do it) as the following procedure works with the existing alignment of the reticle. In other words, it doesn't matter how the reticle is rotated on the axis. The only requirement is that it is centred. On the other hand, if you have equipment on the mount, you may wish to disassemble the polarscope and rotate the reticle so that the mount can be rotated into the required positions with the mounted equipment.

You also need 1.16b of EQMOD (or later) for this feature.

Initial Set-up Procedure:

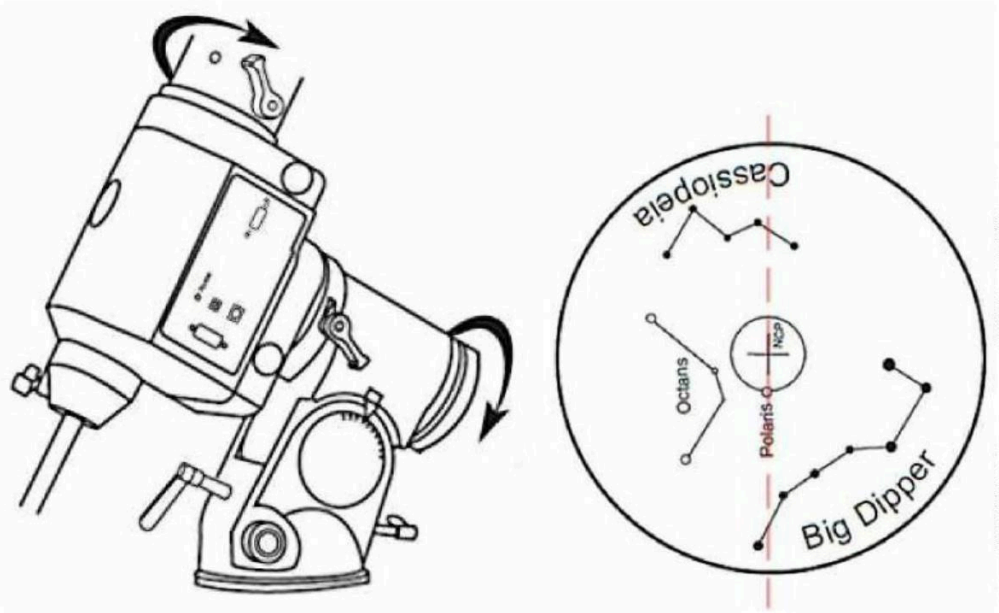
1. Set up the mount in the HOME position i.e. counterweight shaft down. You may want to mark this position on you mount in some way to ensure accurate and consistent setup between sessions. Some folks use bubble levels for this purpose. Rotate the Mount in RA and using a bubble level lock the clutch when the counterweight shaft is horizontal. Set the RA setting circle so that the indicator reads 0. Unlock and rotate the RA Axis until the setting circle reads 6 (i.e ¼ turn).
2.
3. Power up and connect to EQMOD.
4. Disable limits (if enabled). **Caution: If you have equipment mounted, you should be aware that the mount may move in a way that could cause the 'scope to hit the pier. Monitor the movement of the mount carefully. The following instructions assume there's no equipment attached to the mount.**
5. UNPARK.

5

. Use EQMOD slew controls to move the mount in DEC (so the polar scope has a clear view) and in RA to move the Pole Star marker to the “6 o'clock” position (straight down as viewed through the polarscope). (Note: You can use the 12 o'clock position if you wish).

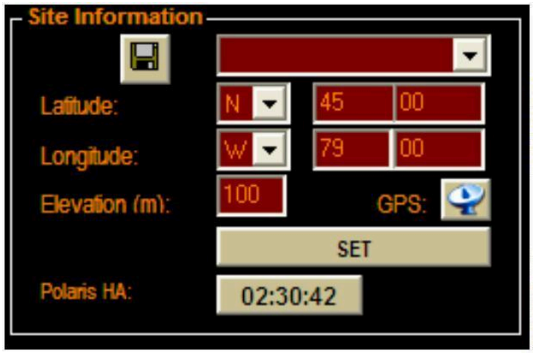
6. The easiest way to do this is to first adjust the mounts Alt/Az bolts to get the Pole Star centred in the reticule.

7. Now Adjust the mounts Altitude bolt until the Pole Star moves downwards (or upwards) to intercept the circle.



8. Now slew the mount in RA until the Pole Star indicator (the little circle) is superimposed over the Pole Star

9. Click on the Pole Star HA button (it's the button that shows Polaris HA time). To bring up the PolarScope View window. You will note the drop down that selects either 6 o'clock or 12 o'clock positions. Choose according to your setup.



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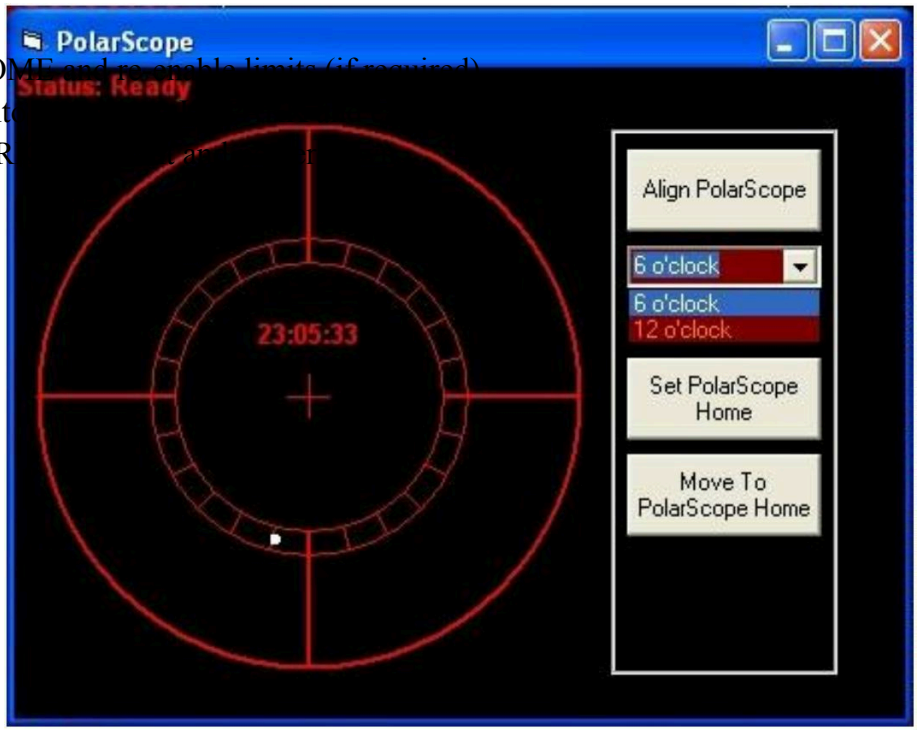
0. Click on the [Align PolarScope] button, which will cause the mount to slew in RA to correctly position the Pole Star marker. **Very Important: Monitor the movement of the mount to ensure there are no unexpected collisions.**

11. Click on the [Set PolarScope Home] button to record this position in the EQMOD parameter file.

12. Adjust the mount using the Alt and Az bolts so that the Pole Star is in the little circle. This completes polar alignment.



13. PARK the mount back to HOME and re-enable limits (if required)

14. Put the OTA, weights etc. ont

15. At the end of the session PAR

Subsequent Set-up Procedure:
Note: Any manual movement of the RA axis will invalidate a stored polar scope home position. In other words, you will need to reestablish the polar home position as outlined previously before you use the polarscope alignment tool.
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. Set up the mount in the HOME position i.e. weights down
. Power up and connect to EQMOD.
. Disable limits, UNPARK.
. Click on the [Move To PolarScope Home] button. The mount will slew in DEC so the polarscope can be used and in RA to place the Pole Star marker at the 6 o'clock position.
. Click on the [Align PolarScope] button. The mount will slew in RA to correctly position the Pole Star marker.
5

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. Adjust the mount using the Alt and Az bolts so that the Pole Star is in the little circle. This completes polar alignment.
7. PARK the mount back to HOME and re-enable limits if required.
8. Put the OTA, weights etc. onto the mount, UNPARK and carry out goto alignment as usual.
9. At the end of the session PARK the mount and power down.
Procedures without Park/Unpark.
For those folks who do not wish to use the PARK/UNPARK functionality of EQASCOM the polarscope alignment tool can still be used. There are two procedures you can use:
Procedure 1 (manual)
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. Set up the mount in the HOME position i.e. weights down.
. Power up and connect to EQMOD.
. Click on the Pole Star HA button. To bring up the PolarScope View window
. Move the mount in DEC so the polar scope can be used and in RA so the Pole Star marker corresponds to the same position as shown in the PolarScope View window.
. Adjust the mount using the Alt and Az bolts so that the Pole Star is in the little circle. This completes polar alignment.
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. Move the mount back to HOME.
. Put the OTA, weights etc. onto the mount, and carry out goto alignment as usual.

Procedure 2 (semi-automatic)

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. Set up the mount in the HOME position i.e. weights down.
. Power up and connect to EQMOD.
. Disable limits (if enabled)
. Move the mount in DEC so the polar scope can be used and in RA to move the Pole Star marker to the 6 o'clock position.

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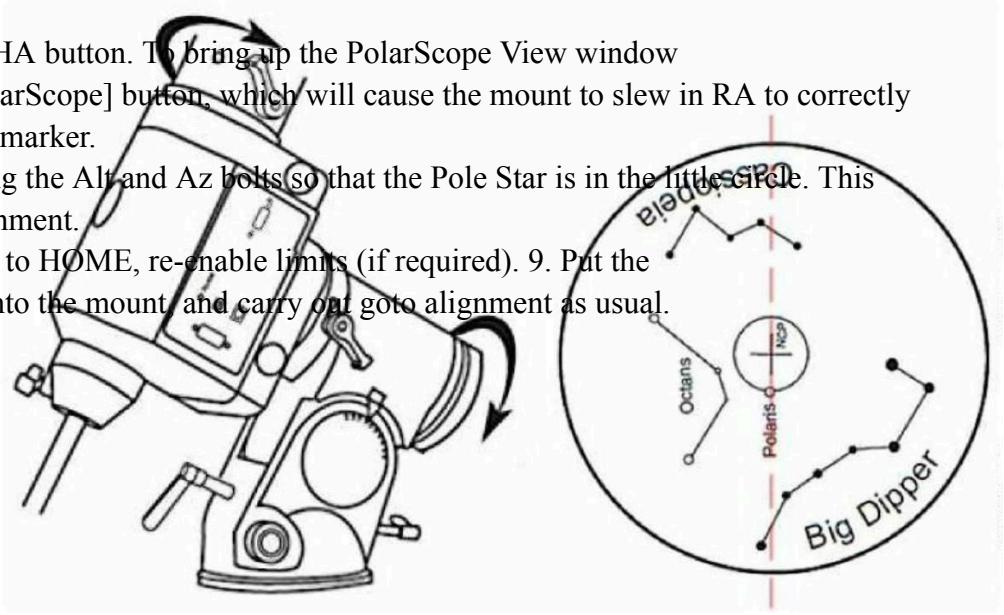
. Click on the Pole Star HA button. To bring up the PolarScope View window
. Click on the [Align PolarScope] button, which will cause the mount to slew in RA to correctly position the Pole Star marker.

7. Adjust the mount using the Alt and Az bolts so that the Pole Star is in the little circle. This completes polar alignment.

8. Move the mount back to HOME, re-enable limits (if required). 9. Put the OTA, weights etc. onto the mount, and carry out goto alignment as usual.



The EQMOD PROJECT

Southern Hemisphere Use

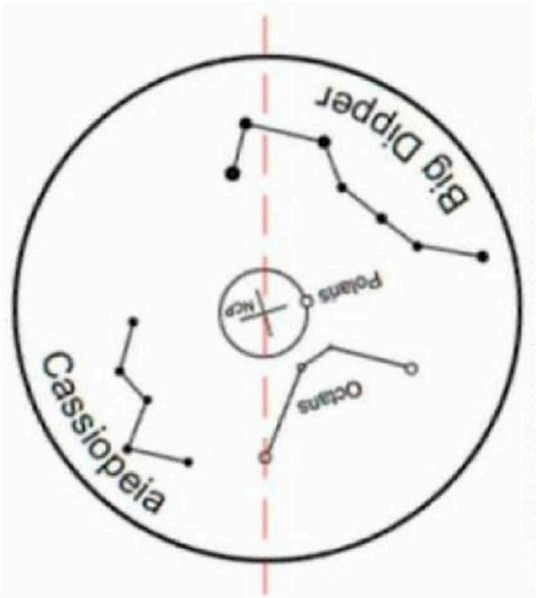
The right ascension coordinate of the pole star is read from the EQMOD.ini file (located in the %APPDATA%/EQMOD folder). Edit this file and you will find an entry as follows:

POLE_STAR_RA=2.5302

For Southern Hemisphere use you will need to change this value to correspond to one of the Octans stars that appear in the asterism shown on the polarscope reticule. The polarscope home position would then be when that star is in the “six o’clock” position.

For example using Chi Octans the ini file would be changed to POLE_STAR_RA=1 8.98

And the ”home “ position for the polarscope alignment tool would be:



Setting the Home position of the mount

The home position of the mount is the position where the telescope is pointing at the NCP (north celestial pole) or SCP(south celestial pole). This is accomplished by setting the mount with the balance (counter-weight) bar pointed downwards and the scope aimed north or south (as appropriate).

This is quite difficult to do with any real accuracy and it is not essential except that it helps with GOTO's for the alignment stars. Current versions of EQMOD store alignment data reducing the dependency on accurate home position for alignment GOTO's since the mount will be essentially already aligned at power up (although it may still need small adjustments).

Once the mount has been aligned the accuracy of the home position becomes irrelevant.

Technique 1 for setting the home position (from Mon)

To accurately set your mount to the Home position, you need a leveler (digital or bubble both work adequately).

1
. Position the counterweight shaft horizontally and level it using the bubble level on the counterweight shaft.
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. Set the RA setting circle to read 6 hours.
. Lock the RA setting circle.
. While the counterweight shaft is in the horizontal position, level the DEC side (dovetail and scope) horizontally using the leveler on the dovetail (or on the telescope).
. Move your DEC setting circle to read the exact degrees as indicated on your mount's altitude indicator (your site's altitude). Choose the DEC degree setting such when you move the scope to 0 Degrees DEC circle (cw shaft still in horizontal position), end of tube should move up).
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. Lock the DEC setting circle.
. Set the mount to the RA Home Position by moving the RA shaft until it points to 0 Hours. (counterweights should now be pointing down).
. Set the mount to the DEC Home Position by moving the DEC shaft until the DEC setting circle reads 0 degrees.
. Scope should be pointing at NCP/SCP (North Celestial Pole/South Celestial Pole) at this point.
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Once you have found this position, you may be able to find places on the mount that are level so that you can reset the mount, if necessary, without repeating the above procedure.

Technique 2 for refining the home position

This particular method may or may not work for you. You may just want to experiment with it. The major difficulty may be the subtle movements of the mount that are required while it is unclamped. It is certainly difficult compared to slewing under fine motor control but is no more difficult for most installations than the initial setting of the home position.

Assumptions:

- You're using a fixed pier installation... although this technique might be useful for portable installations if you have to re-align during the observing session.
- You have a good polar alignment
- When the scope is unclamped and moved it does not move the ring counters.
- Alignment does not change the setting of the home position with respect to the ring counter
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Procedure:

1. set the mount in the home position by eye to the best of your abilities. (no need to use technique 1).
2. Start alignment and slew to first alignment star (chances are it won't be in the FOV).
3. Unclamp the telescope and use your finder to align on the star. Moving the scope manually in small increments is difficult but get as close as you can. You might actually be able to get the alignment star onto the CCD or within the FOV of the main scope.
4. Clamp the scope.
5. Continue with 1-Point or N-Point alignment procedures.
6. Typically future power up first alignments will be much closer to the FOV than rough home positioning of the mount.

To prove out the adjustment:

1. Park the scope.
2. Unpark the scope.
3. Start alignment (you should find that the first alignment star comes very close to your FOV).

What is N-Point Alignment?

EQMOD driver supports the N-Point Alignment algorithm.

N-Point basically is a mount stepper coordinate to sky coordinate affine/taki matrix transformation process. The driver internally plots the sky using a minimum of three alignment points (anchor points) as reference points. Pointing accuracy is increased by simply adding more anchor points on different parts of the sky automatically compensating for any mount alignment errors (polar, cone, etc.) yielding more accurate pointing.

Think of the coordinate space of the mount+EQMOD as a rubber sheet with the star database marked on its surface. You place the rubber sheet on top of a star map (your sky) and align the stars on the sheet with the ones on the map. You then lock the sheet with push pins on top of the map. The push pins are now your “anchor points” or “alignment stars” in the real world. To align the markings on the rubber sheet with respect to the catalog points on the map means stretching/ rotating/ scaling specific areas of the sheet and locking them to the star map using the anchor points (push pins).

The affine/taki matrix coordinate transformation routine is actually the one implementing the “stretching/rotating/scaling” functions and needs at least three points as anchor points to define the process.

When you have aligned on more than 3 points, the EQMOD driver dynamically selects 3 anchor points or alignment points from the list of anchor points (N-Point) to apply in the coordinate transformation during a GOTO process.

Accuracy is best within the bounds of the 3 anchor points and degrades dramatically (due the centering errors) as it goes outside the three points. However, if the stars are centered dead-on, even the GOTO's outside the area of the three anchor points should be accurate.

It is best to use points in the area where you most likely to do your GOTO's. If you imagine one big triangle formed by the 3 points, GOTO's will be most accurate within the triangle area.

Other Information about N-Point alignment

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avoid syncing or aligning on stars at the meridian itself as the driver will block such operation. At least 5 degrees away from the meridian is recommended. If the star is too close to the meridian, alignment will be aborted and a message displayed.

in theory, the driver can handle up to 1000 alignment points

you can add additional points to the alignment data. This works really well when you need more accurate pointing for a hard to find object. Adding a near-by star to the N-Point set greatly improves the local pointing accuracy.

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alignment points should be separated as far as possible in the area of the sky you plan to observe.

alignment points can be distributed on both side of the meridian, however, most observers will probably set the “PierSide Points Only” to avoid issues with inaccuracies caused as the mount crosses the meridian. This means that only points on the object side of the mount are used.

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the [Map] button displays a screen with graphical information about N-Point alignment points

Nearest Point is treated as a list of one star alignments with the point nearest to your target being used to correct the pointing.

N-Point+Nearest Point is the best of both. If your target falls within an alignment point triangle it will use N-Point, if it outside the available triangles it uses: Nearest Point.

N-Point Alignment Using SYNC (recommended alignment method)

This is the recommended method of setting up alignment for planetarium programs with a SYNC function

User Settings

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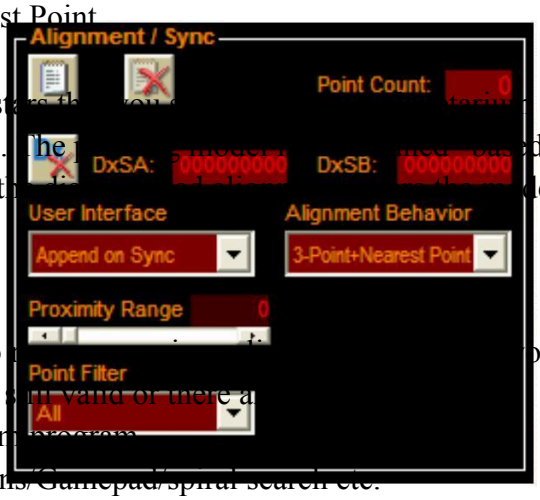
User Interface = Append on Sync [Add Point(s)] button will no longer be displayed.
Alignment Behavior = 3-Point + Nearest Point



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With "Append on Sync" selected, any st program will be added to the N-Point alignment data. The d upon the additional points added. This is unlike t del is simply shifted to match the new point.

Essentially the steps are:

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. Click the [Clear Align Data] button to uld not be necessary if the existing data was still valid or there a

. Execute a GOTO using the planetarium program

. Centre the object using the slew buttons/Gamepad/spiral search etc.

. Select the SYNC option within the planetarium program (this is quite often invoked by right clicking the object but other methods may be required) or **double click** the gamepad button that you have assigned to sync.

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. The point is added to the pointing model.

. Repeat steps 2 to 5 until sufficient points have been added.

If less than 3 points are added, the driver will operate in the “Nearest Point” mode. As soon as 3 (or more points) are added to the pointing model, the driver operates in the “3-point + Nearest Point” mode. You can choose to use “Nearest Point” for all slews by selecting this option in the “Alignment Behavior” drop down. Generally speaking, your best choice is to use the “3-point + Nearest Point” option that lets the driver switch to “Nearest Point” only when necessary.

Special SYNC methods

Special Instructions for Stellarium:

In order to accomplish a SYNC with Stellarium use the <Ctrl 1> keystroke to activate the Stellariumscope window (old Stellariumscope) and select the appropriate button.

With the more recent Stellariumscope use the <Ctrl 2> keystroke or the keystroke that you have defined for SYNC.

Special Instructions for HNSKY:

In order to accomplish a SYNC with HNSKY

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. Right click the object (this centres it on the screen).

. Left click the object to perform a GOTO.

. Click the icon that “Matches the telescope's coordinates to the center of the window”. It is the icon just below the planetarium menu and to the right of the “hand” STOP icon.

One Point Alignment

Some users of EQMOD find that alignment on a single star is sufficient... particularly if used with a permanent installation.

Assumptions:

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you have carefully polar aligned the mount.
you are not concerned about precise GOTO's.
there is minimal cone error.
the mount is reasonably level.

Procedure

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. Clicking the [Clear Align Data] button.
. Add a single point by either the “Append on Sync” method or the “Dialog based” method.

The driver will operate in the “Nearest point” mode no matter what “Alignment Behavior” has been selected.

Dialog Based Alignment (old alignment method)

Procedure

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. Unpark the mount.

. Make sure that you have selected the "Dialog Based" option in the User Interface.

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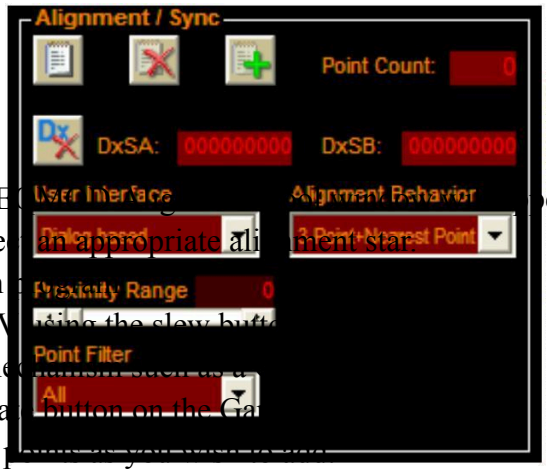

. Click the [Add Point(s)] button. The E ear.

. Using your planetarium program, sele an appropriate ali ment star.

. GOTO that star using the planetarium

. Accurately centre the star in your FOV

Alignment Tool window (or other me

. Click the [Accept] button or appropria button on the Ga

. Repeat steps 4 through 7 for as many p

0. Click the [End] button in the Alignment Tool window.

8

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If you wish to repeat the alignment process or you wish to add additional points, simply click the [Add Point(s)] button.

You can also switch “User Interface” to “Append on Sync” and add additional points using the SYNC method.

Question:

Q.

A.

Why is the [Add Point(s)] button not visible?

You didn't select the “Dialog based” option in the User Interface drop-down.

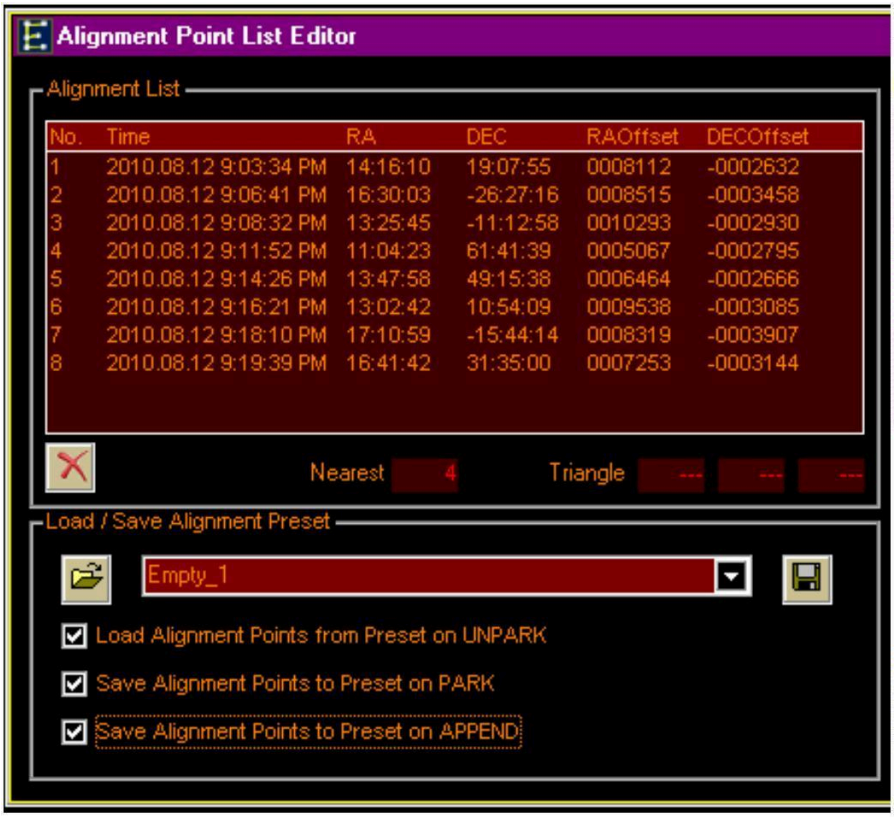
Alignment Points List Editor

It may be desirable to delete one or more points from the points that have been used for alignment without completely resetting all the alignment data or you may simply want to verify the alignment for the alignment that you have used for alignment.

Clicking the [Point List] button on the setup screen will open up the “Alignment Point List Editor” window. The editor displays all of the current points that have been used for alignment. If the editor window is already open, you should close and re-open the editor in order to display the current alignment information.

If the alignment appears faulty, you can click the [Delete Point] button to remove it from the list. If the number of alignment objects drops below 3, EQMOD will revert to “Nearest Point” mode.

Note: A method of bookmarking objects is made possible by an add on application called EQTour. This method allows objects to be named. It is documented later in this document.



Saving N-Point Alignment Data

Procedure for saving data:

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. Perform N-Point alignment as usual.
. Open the “Alignment Point List Editor” window by clicking on [Point List] button.

. Click on the preset drop down list and select a preset.
. Click on the preset name to rename it
. Click the [Save] button to save the alignment data. (There is also an option “Save Alignment Points to Preset on PARK”.)

Procedure for loading data:

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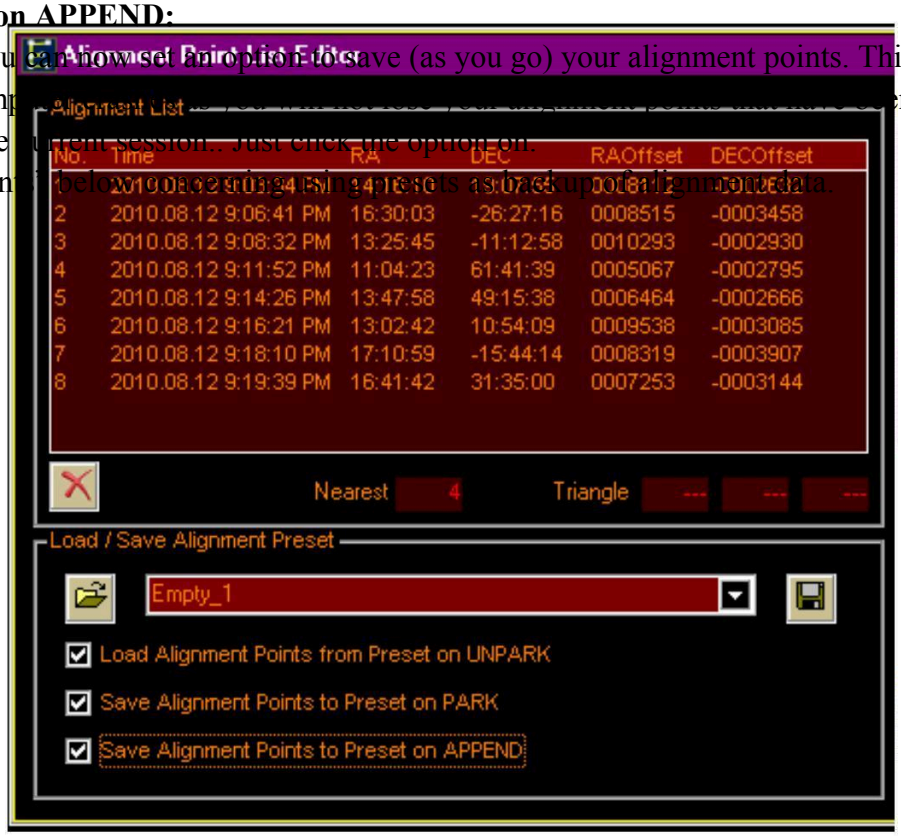
. Click on [Point List] button
. Select the preset you want to load
. Click the [Load] button – new alignment is applied immediately. (There is also an option “Load Alignment Points from Preset on UNPARK”.)

Procedure for saving on APPEND:

As of version 1.22g, you can now set an option to save (as you go) your alignment points. This helps in the case of comp[illegible] have been created in the current session.. Just click the option on.
See the “Other Comments” below on using presets as backup of alignment data.



Automatic Saving and Loading of Alignment data

In the “Alignment Point List Editor” window there are 3 check box items. You can select any of the options.

You can choose to automatically save the data when you park the mount. This is an excellent option for those of us who forget that the alignment data will not be saved unless you do save it manually or use this option. **You should know, however, that if you use the automatic save option, the alignment data will be saved in the currently selected preset and it will replace the previous contents.** See the "Other Comments" below about keeping copies of your "good" alignment data as a backup..

You can choose to automatically load the alignment data from a previous session when you unpark the mount. In most cases, this is probably what you want. Starting a new evening session, automatically loading up your previously stored alignment points means your 'scope will probably be able to centre on objects with the same accuracy as the previous session immediately with no further alignment required.

You can chose to automatically save each alignment point as it is appended in the current session rather than waiting for the park option or the manual save event.

However, you may wish to “goto”several objects and tweak the positioning followed by a “synch”. If you have the “Synch behaviour” set to “Append on Sync” the new synchronization will be added to the star list. If you then determine that each of the synchronizations for the current session need significant adjustment (you decide what's significant) from the GOTO position, you may want to delete alignments that have been stored from previous sessions. Simply click on the star alignment data line and click the [Delete Point] button.

Other comments about Saving and Loading of Alignment data

It's always a good idea to use at least two presets particularly if you use the save on park option. This is probably the most common application of using the star list presets. Use one as a backup of a known 'good' set. The other would be the current working set. Using duplicates is also quite handy if you when editing your alignment sets as well as it effectively gives you an undo if you accidentally remove the wrong star/point. It can be useful when playing with the polar alignment where you align on a quite a few stars either side of the meridian and then pick those that give you the best 'matching' triangles and delete the rest.

To save an alignment set as a duplicate, first load it then switch the preset and click the [Save] button. You can then select another preset and click the [Save] button again creating as many backups as you wish.

Different presets can be used to store different alignment datasets based upon the following:

Presets may be useful for observatory mounts where, for example, preset 1 uses one set of N-Point data, preset 2 uses a different set of N-Point data.

Perhaps preset 1 is a set of N-Point data gathered at the north-eastern side of the observatory while preset 2 is a set of points on the western side. Preset 3 could be a combination. Preset 4 could be the entire sky. Preset 5 could be just three points, and so on.

If we consider for example mount/scope/dovetail flexures induced due to extra equipment mounted on the scope in the data gathering, preset 1 could be settings for DSLR body camera (or bigger camera) setup and preset 2 could be settings for a "small camera" such as webcam. It may not be advisable to maintain a single N-Point database if the user keeps on swapping/replacing the hardware options mounted on the scope due to the different flexure mechanics induced by these add-ons (which is also different depending on where the scope is pointed at). Each (from a high accuracy standard) should have a dedicated N-Point database.

Strategies for Recovering Lost Alignments

There is nothing so frustrating as losing mount alignment in the middle of an observing session! Your mount can lose alignment for any number of reasons.

It should be noted that a computer crash where the mount remains powered up should not cause a loss of alignment so long as you have saved your currently created alignment points. The option to save alignment point data as you append points is currently available in the points editor as of v1.22g.

Simply:

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. reboot the computer

. restart planetarium/EQMOD etc

. EQMOD will update itself from the current position of the mount.

. restore your backed up points

During an observing session a loss of alignment is most probably due to:

•

•

a loss of power to the mount

an unexpected movement of the mount when bumped and the clamps are not tight.

Your mount can also lose alignment at the end of an observing session due to:

•

improper parking

Recovering Lost Alignment

You can, of course, simply start over with a new alignment. The following technique(s) provide a more sophisticated approach to the problem with very good accuracy.

Assumptions:

•

•

the mount has been aligned (preferably with at least 3 points).

The mount has been previously successfully parked to an accurately reproduced location. The recommended park location for this process is the horizontal one measured with a good digital level (i.e. both the telescope and the weight bar are horizontal). Even if you do not usually use this position for regular parking, you should consider defining it for this process of easily and accurately restoring alignment.

•

you have saved alignment points preferably from the current session. Previously saved alignment points would restore you to the start of the current session.

The EQMOD PROJECT
Recovering Lost Alignment

Steps:

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. Park the mount to the user defined horizontal position. **Unclamp the mount first since the mount may move to an unexpected position.**

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. Clamp the mount in the horizontal position. (best guess... no precision required)

. Make sure the “Unpark Mode”

. Unpark.

. Make sure the mount is not trac ng.

. Using your level and the slew c

. Click the [Resync Encoders] bu

8

9

. Start tracking.

. Restore alignment data

You will find this method gives remarkable accuracy with a minimum of lost time. It's probably a good idea to give it a practice run so you can use it quickly and easily when necessity arises.

Points List And Pointing Accuracy

If you create a list of alignment stars using an eyepiece and later create alignments with a CCD you should probably keep the alignments in separate lists. Generally speaking CCD centered stars have an accuracy higher than those manually centered using an eyepiece. It is OK to mix them but the ones centered by the eyepiece (depending on the way it was centered) would slightly 'degrade' the overall accuracy.

If you are planning to populate the list using a CCD camera as a centering tool, make sure the camera is not moved during the entire alignment process.

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•

If you are planning to keep the list for a long period of time, the following points must be considered.

The list is heavily "time-accurate" dependent. There is a small amount of variance with regards to the PC Time (where all timing data is based) over a specific time period. Any timing "skew" on the PC clock would degrade the accuracy of the entire list after some time period. To overcome this, your PC has to be synchronized always with a more accurate clock prior to populating the Star list. This is where the GPS will come in. With a GPS device on EQMOD, the time data is "normalized" based on a common reference time (the atomic clock). Now assuming you have already a list of stars centered/populated on a GPS-Synchronized PC, the accuracy of the list will still degrade over a time period from the last GPS synchronization, to regain back the accuracy, simply re-synch the PC again using the GPS.

•

The accuracy of the points list is also dependent on the mechanical configuration and inherent flexure of the mount (specially the heavy ones). You lose the accuracy of the list if you;

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•

•

•

moved the mount to some other location.
you loosened the RA and DEC clutches.
you removed or replaced the scope.
something in the scope has moved such as re-collimating your optics (mirror shifts), or changing the focuser tube, etc.

•

added or removed an accessory to the entire assembly (the added weight would contribute to flexure).

Detailed description of how alignments are processed

As explained before, you can actually use the same star all over again in populating the N-Point table as it traverses across the sky.

What N-Point basically does is it converts all RA and DEC coordinate values into stepper values and uses the stepper values themselves in the transformation process. If we use the equatorial coordinates in the transformation, we need to utilize a third parameter which is the time of measurement. Including time data in the transformation actually complicates the conversion.

In this case, the time data is only used during the equatorial to stepper conversion and the converted stepper values are the ones stored in the N-Point table. The time component is not stored (although we store them for window display reasons).

The good thing about this method is that the same RA/DEC Equatorial coordinates of sky object which is fixed have different stepper values as it traverses across the sky after a given time period. Since we are using the stepper values in the transformation process, we can actually align on the same object again on a different time and use the generated stepper motor values as a separate N-Point entry.

The Stepper values are actually ALT/AZ coordinates in nature in which you can "map" a stepper count value (RAx, DECy) as a fixed point ALT/AZ coordinate in the sky.

N-Point Data processing uses several different different components:

Download a jpg image here:

http://www.welshdragoncomputing.ca/eqmod/images/N_StarDataFlowDiagram.jpg

Equatorial Coordinates to Stepper Motor Counter value converter

This converts the RA/DEC coordinates to its equivalent stepper value using the current time as the 3rd parameter in the conversion. This means you will get different results as you execute this function on the same RA/DEC values as the time parameters vary. Also take note that the nutation is also accounted here.

Polar to Cartesian.

The stepper coordinates are not linear and are spherical/circular in nature. In this case we need to convert them from a vector based coordinate representation to Cartesian to allow us to transform them using TAKI or AFFINE Matrix conversion.

If you remove this module from the system, computations will be more complicated as you will have to introduce the vector coordinates within the affine/taki matrix. This was actually the original approach of the the TAKI.bas routines where a matrix cell has sine and cosine functions in them.

The EQMOD PROJECT

AFFINE / TAKI Coordinate Transformation Module

(This was explained a lot on various threads on the news group).

Use matrix conversion/computations for coordinate transformation. It accounts for the 3 basic transformation operations; rotation, shift, magnification/reduction

Cartesian to Polar

Reverse computations from Cartesian back to Polar

Stepper Motor Counter values to Equatorial Coordinates converter

(as explained)

Referring to the legend, it shows colored boxes that represent operations performed within the N-Point module;

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ALIGNMENT

GOTO

Current Scope Position COORDINATE DISPLAY and ASCOM Coordinate Presentation

The yellow colored boxes/arrows represent the data flow during a goto execution. The green ones are those used to obtain the current position of the telescope. The Light Blue ones are those used during the alignment process.

The diagram also shows the effect of using the same star all over again as an alignment data. As the star moves across the sky, you can actually create a separate N-Point entry when you align on the same star after (say) 2 hours of movement. That point where the star is located is converted to stepper values; Eqmod simply gets the current stepper count (Measured) and The Catalog Stars supposed to be stepper count at time(t) or time of measurement. These four values (ra stepper catalog, ra stepper measured, dec stepper catalog, dec stepper measured) are stored in the N-Point table. The 2nd measurement which is already located at a different position can now be used as one of the Affine anchor point of the transformation triangle.

Other Information About Alignment

Should the mount be tracking while aligning?

Yes, the mount should be tracking, although the only difference is that it's easier to centre a star at high magnification (if you weren't tracking the star would drift out of the FOV pretty quickly). When you SYNC or click [Accept] button, EQMOD uses the current ring counter stepper values and that has nothing to do with tracking being on.

Do I have to complete the alignment of a star quickly?

There should be no concern about the time it takes you to slew the alignment star to the middle of your FOV.

Measurements are made right after the SYNC or [Accept] align button is clicked. It is not a problem if it takes a long time to zero-in (center) on the alignment object. Once the SYNC or [Accept] button at the alignment window is clicked, EQMOD will read the current stepper values of the mount (RA and DEC) and compute what the stepper values should be on the catalog object at this precise moment based on the Local Sidereal Time (LST).

These four values (mount RA ring counter, mount DEC ring counter, catalog computed RA ring counter, catalog computed DEC ring counter) are then stored as a N-Point entry in the N-Point in-memory database.

Parking the Mount

Before powering down the mount, it is desirable to return the mount to a known position (a park position).

If you have set some mount RA limits, parking the mount properly before power down is essential in order to record the limits for the next power up. It will also be important for restoration of stored alignment data.

You have basically 2 options for parking:

-
-

the home position

a customized position very useful for installations where a roof of an observatory would not clear the telescope upon close-up. A common customized park position is with the balance/counter-weight bar horizontal and the telescope itself horizontal.

Note:

You should park only if the alignment is complete. Do not park an unaligned scope or you will be unparking using invalid data creating an invalid alignment table.

Background information about parking and bootup

EQMOD gets the equatorial coordinate values (RA and Dec) from the mount itself. If you disconnect the driver while maintaining power to the mount and then re-activate the EQMOD driver, it will continue to operate based on the RA and Dec values stored in the mount's stepper controller. This means that even if you shutdown the PC but leave the mount in a tracking state and then reconnect EQMOD, it will continue to display and report the correct RA and Dec values based on the current position of the mount.

The setup will revert to a home position only if you remove and re-apply the power to the mount. When EQMOD reconnects it will know if the mount was reset or was left in a tracking state.

To allow continuity of operation after a power recycle, the mount has to be parked at a known position (either the home position or a custom park position). When the mount is parked the last RA and Dec values are recorded. Upon mount power up, EQMOD restores the RA and Dec values to the mount. This works successfully based on the assumption that the worm gears remain at the same position as when the mount was shutdown.

Assuming the mount is parked at the end of a session and unpark is performed on mount bootup, and assuming the N-Point data is saved and restored, GOTO's will remain accurate even if you use the last N-Point list. Sync data will also remain correct and accurate. Of course, the PC time and coordinate values need to be accurate. Using a GS module to set the correct time in your computer clock as well as EQMOD will make restores of stored N-Point data work correctly.

Recovering from Invalid Park Data

If you have a mount setup with invalid park data, you can get a fresh start by the following procedure:

(You will know that you have invalid RA/DEC park ring counter values if you execute a "Park to Home" and mount does not end up at the home position)

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. Unpark Scope from EQMOD driver.
. Shutdown EQMOD **then** power down the mount. **Don't** use park for this step.

The above steps will reset park settings of EQMOD.

Now do the following:

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. Loosen Clutch and manually position mount at home position.
. Run your planetarium program if not already running.
. Check the Latitude/Longitude/Hemisphere settings of your planetarium program.
. Confirm PC time.
. Check the planetarium time and date (remember to check daylight saving, if applicable).
. Connect to the mount (this activates EQMOD). EQMOD should start in an "unparked state" with the Dec And Az set at values for the home position.
. Check the EQMOD Latitude/Longitude/Hemisphere settings. The Alt value in the EQMOD window should correspond to your Latitude.

7
8
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. Perform 1-Point or N-Point alignment.
. GOTO's should be accurate at this point.

EQASCOM Mount Limits

Mount Limits provide a way to restrict mount movement perhaps to correspond to a physical horizon or to help protect equipment from possible pier collisions. It is important to understand that limit detection is performed within the EQASCOM driver and not by the mount motor controller itself. In common with all other PC based mount control applications, if you intend to leave the mount unattended you should carefully consider the potential risks to your equipment that may be caused by Windows crashes, restarts, or application failures and/or hardware failures.

Limit detection is optional and can be enabled/disabled via the associated check box.

EQASCOM provides detection of limit conditions for both the meridian and horizon. The meridian limits dictate how far the mount is allowed to track past the meridian and it is recommended that Meridian limits are always defined when horizon detection is desired.

Operations that are subject to limit detection are:

-
- Tracking
Gotos

Operations to which limits not applied are

-
-
- Park
Unpark & Goto
Manual slews initiated by the EQASCOM direction pad or external gamepad

When a limit condition is detected the following actions are performed

-
-
-

Both RA and DEC motors are stopped

Tracking is stopped.

The Mount position display will alternately flash "LIMIT" and the current coords.

-

If desired the mount can be automatically moved to a park position on limit detection.

These actions are continually re-applied until such time as the limit condition no longer applies.

To remove the mount from the "limited" state use the direction pad or gamepad to slew the scope away from the limit point or execute a Park operation.

Limits Configuration

Meridian Limits.

These limits apply when the scope has moved past the meridian (usually through tracking) and has been a part of EQASCOM since V1 .07. By default the limit is set to trigger when the RA axis is horizontal but most folks will want to allow some degree of tracking past the meridian.
To set the limits simply slew the scope to the limit position and click the “add” button. You will need to do this for both East and West sides of the pier.
As these limits use encoder positions they can only be applied properly if the mount is parked and unparked. On start-up the default ‘horizontal’ limits are applied and on unparking any user specified limits are restored.
The default ‘horizontal’ limit can be restored by pressing the [defaults] button. Meridian limits can be removed altogether by pressing the [delete] button.

Horizon Limits.

This detects when the mount is pointing below a specified horizon profile. By default a horizon is applied of Alt= 0 degrees.
There are three ways to create a horizon profile.
1
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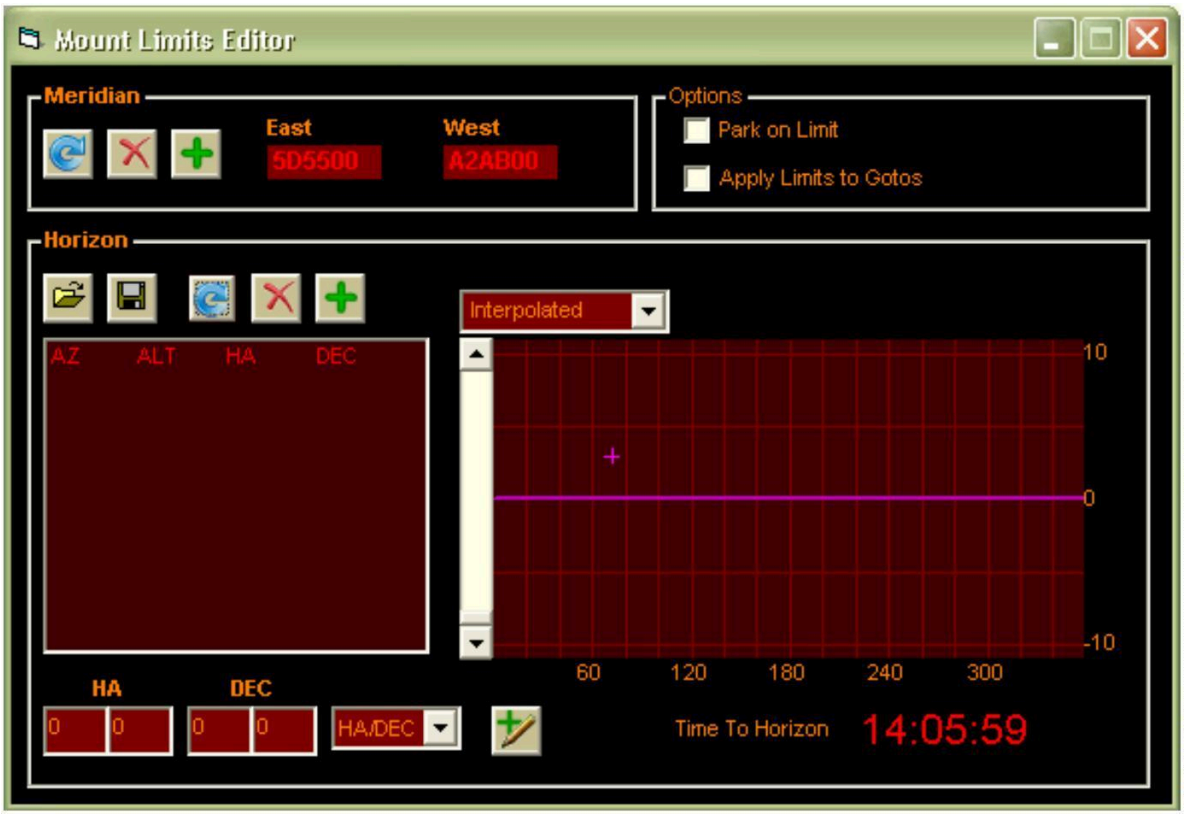
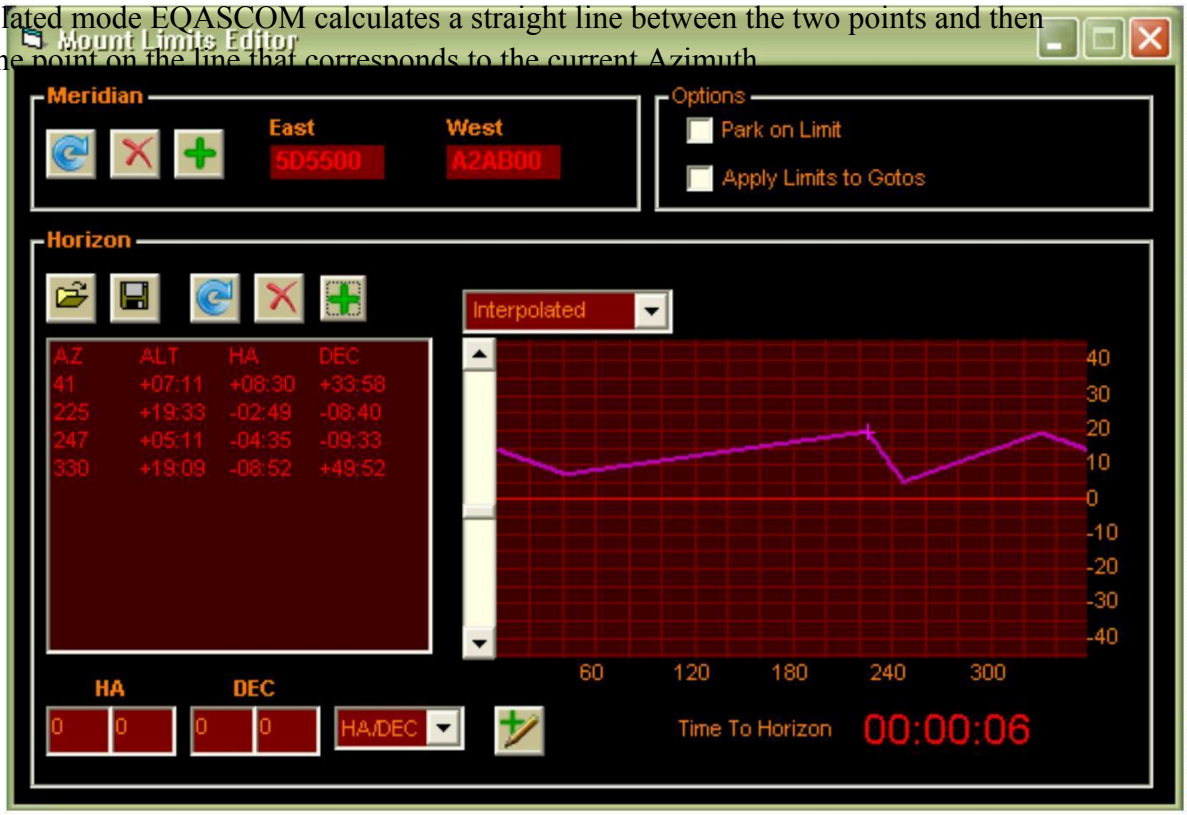
. Slew the scope along your horizon using the “add” button to add points.
. Manually enter points, either in Az/Alt or HA/DEC (i.e. useful if reading setting circles).
. Edit a text file with your horizon points (in Alt/Az)
The horizon profile is stored in a text file that is the same format as CDC’s horizon file. This allows both applications to share the same file if you wish.
EQASCOM provides a plot of the current profile and the mounts current position is marked with a cross. Points can be individually deleted if required. The [defaults] button removes all points restoring the Alt=0 horizon.

Adding a single point will give a 360 degree horizon at the associated Altitude
As you add more points the horizon profile is built.



There are two algorithms that determine how EQASCOM uses the points list to calculate an Altitude limit.

Using Interpolated mode EQASCOM calculates a straight line between the two points and then establishing the point on the line that corresponds to the current Azimuth.



Using “Greatest Alt” mode EQACOM finds the two points on either side of the scopes current Azimuth and uses the one that has the greatest Altitude.

Limits File Load/Save & Startup

On startup EQASCOM will attempt to reload the last opened horizon definition file (the filename was stored in the EQMOD.ini file). To make any changes permanent then you must save the file otherwise they will apply only for the current EQASCOM session.

Time to Horizon

The time it will take the scope to reach the current horizon is display. If the mount is at a position such that it will never “set” then --:--:-- is displayed.

Options

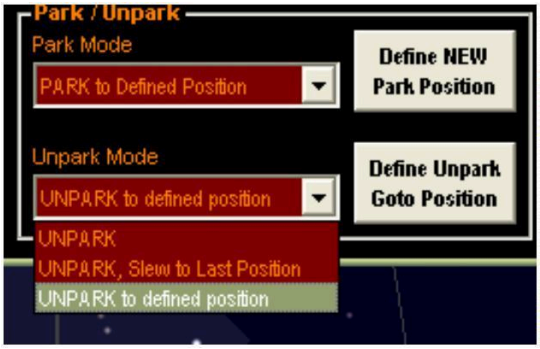
If “Park on Limit” is checked the mount will automatically Park (using the currently selected park mode) when a limit is reached.

If “Apply Limits to Gotos” is checked the Limit detection is active during a goto slew. This may be inconvenient if your slew path crosses a visual obstruction when moving from one above horizon point to another as shown below.

However if the horizon file represents physical mount movement obstructions you will want to ensure this option is checked.

Limits Park and Unpark.

As mentioned previously Park operations are excluded from limit detection so the Park position can be below the horizon limits. A new Unpark mode has been added, “Unpark to defined position” which allows the scope to be moved to a predefined above horizon start position on unpark .



Saving the ini files

Check the EQMOD files section for the following application: EQMOD_Toolbox.exe

(http://tech.groups.yahoo.com/group/EQMOD/files/A EQMOD Release/EQASCOM/)

Other EQMOD Settings

RA Reverse and Dec Reverse

These 2 options allow you to reverse the function of the associated slew control.

“PierSide Points Only” radio button (enabled by default).

In previous versions this was labelled as"Local to Pier".

When enabled, only alignment point on the target side of the meridian are used. If disabled, a 3-point cross-meridian is allowed. This function should be enabled if the setup has severe cone errors or mirror flop is an issue.

Always on top option

This option controls whether the EQMOD window stays visible when you click on another program such as your planetarium program. If it is not selected, the EQMOD will disappear when you click other programs. This is helpful if you're working with a smaller screen. You can always cause the window to reappear use the [Alt-Tab] keystrokes or clicking the appropriate reference in the task bar at the bottom of the screen.

Color option

The [Color] button allows the change of the various default colors. It also allows the change in the message font size although increasing the font size causes messages to be partially displayed since, with a larger font, the message will not fit into the message window.

Alignment Behavior – Nearest Point

The alignment points will be treated as "localized" points. The number beside the “PierSide Points Only” shows which alignment point is currently being used.

Alignment Behavior – 3-Point + Nearest Point

If at least 3 alignment points have been setup and the destination object lies within a triangle formed by 3 alignment points, calculations will be based upon those 3 points... otherwise the nearest point will be used.

Sounds

Click the [Sounds] button to open the “Set Sounds” window. You can choose default Windows sounds or customized sounds using .wav files. Use the drop down to select.

You can enable/disable Beeps/Button Clicks/Alarms by using the appropriate check box. If you make changes use the [OK] button.

Sounds

Click the [Sounds] button to open the “Set Sounds” window.

You can choose default Windows sounds or customized sounds using .wav files. Use the drop down to select.

You can enable/disable Beeps/Button Clicks/Alarms by using the appropriate check box. If you make changes use the [OK] button.

The EQMOD PROJECT

Using the EQMOD simulator

It is important to distinguish between the ASCOM simulators and the EQMOD simulator. When you use the EQMOD simulator you are not using the ASCOM simulator. In fact, ASCOM “thinks” that you are working with a "live" mount!

Installing the EQMOD simulator

The simulator version of EQMOD is installed at the same time as the regular driver version in all current versions (see the installation instructions earlier in this manual). Some earlier version needed a file called *mschrt20.ocx* but this is no longer needed.

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. When you connect from your planetarium program select *"EQMOD ASCOM Simulator"* .

. The first time you try to use the simulator driver you may find that the [OK] button in the ASCOM Chooser dialog is not enabled. In that case, select the [Properties] button. Fill in:

Port

Baud

Timeout

Retry

Values don't matter. Then the [OK] button will be enabled.

```
. When connected to the simulator version, an additional window appears
  displaying shaft position.
```

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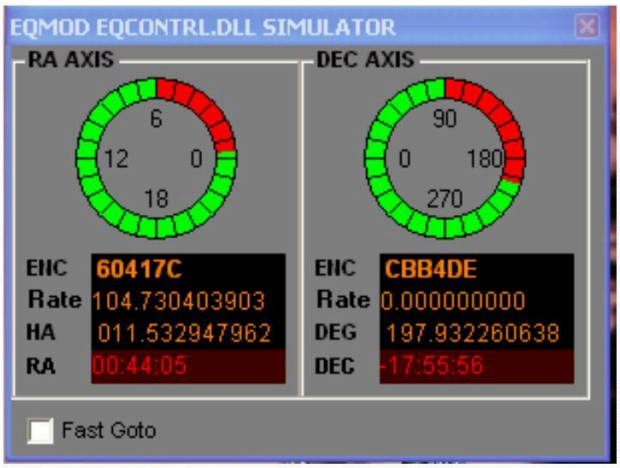
. You will find that setting the "Fast Goto" option will speed up the simulator slews. (See the following images).



Guiding

Guiding control of the mount can be accomplished in 2 different ways. The guiding signals can be sent to the dedicated ST-4 port on the mount or they can be sent to the regular control port on the mount.

ST-4 Port and ST-4 Autoguider port rate

For the ST-4 port, the signal could come directly from the guide camera (if the camera supports that option) or the signal could come from a separate port on the computer using a relay or electronic switch box.

If user intends to use the ST4 based Autoguider port found at the faceplate of the mount's stepper controller, the "Autoguider Port Rate" sets the correction applied on the RA and DEC motors if any of the four ST4 lines (RA+ RA- DEC+ DEC-) are activated. Possible values are x1.0, x0.75, x0.50, x0.25 of the Sidereal rate.

ASCOM pulse guide settings

For guiding through the regular control port of the mount, the guiding signal uses the same cabling as the signals used for slewing and GOTO's.

Other than ST4 type of autoguiding, EQMOD also provides the "PulseGuide" Method where the correction commands are fed directly through ASCOM. A pulseguide message contains two parameters, the direction and the duration. The Pulseguide message currently does not contain any Guide Rate settings. The correction rate has to be provided by the user by means of two "slider bars" at the EQMOD setup window. Each bar specifies the speed of the RA and Dec motor during the course of the pulseguide correction. The Duration parameter (specified in terms of milliseconds) determines the duration to which the correction speed is applied. Once the duration of the correction expires, the RA speed is restored to the sidereal rate speed (or in DEC where the motor is stopped)

The pulseguide speed rate can be set between x0.1 to x0.9 of the sidereal rate at increments of 0.1 independently on each motor (RA or Dec).

The "Duration Override" option allows the user instead of the autoguiding application to dictate a fixed duration correction.

See further information about EQDIR and pulseguiding in the miscellaneous facts section.

Custom track rate

Other then the standard Lunar, Solar, and Sidereal rate, the user can specify the speed of each motor (RA or DEC) using the Custom Track rate facility. This option is provided at the Custom Track rate portion on the EQMOD driver setup window wherein the user will simply enter the rate in terms of arcseconds/second and then click on the [Execute] button. EQMOD will apply the rate on the two motors right after the [Execute] click. The Default value you see on the RA entry is actually the RA rate in sidereal. Clicking on the [Execute] button using the default RA rate value (15.04157) puts the mount in sidereal Tracking mode.

The EQMOD PROJECT

Periodic Error (EQ)

EQMOD VS-PEC: Q&A (Author: Chris Shillito)

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. Documentation for EQMOD VS-PEC can be found on the Yahoo tech group here:
http://tech.groups.yahoo.com/group/EQMOD/files/Documentation/
. Also:
http://tech.groups.yahoo.com/group/EQMOD/files/A EQMOD Release/EQPEC/

Q What is Periodic Error?

A: Periodic Error (PE) is movement in a mount caused by imperfections in the gear train resulting in a very slight 'wobble' about the axis being driven. The most significant contribution to PE is the worm to worm gear transfer. PE can be reduced by mechanical improvements but it cannot be removed altogether, it is an inherent feature of a worm drive.

Q: What is VS-PEC

A: VS-PEC is **V**ariable **S**peed **P**eriodic **E**rror **C**orrection. This is a technique developed for the EQMOD project that varies the mount tracking speed to compensate for Periodic Error. This differs from PEC as applied by the SYNSCAN hand controller which uses constant speed corrections of varying duration.

Q: What are the benefits of using VS-PEC?

A: VS-PEC basically provides an improvement in tracking performance. Typically this is an advantage when using the mount for astrophotography.

Q: How much improvement will I see with VS-PEC?

A: Its difficult to give absolute figures because every mount differs in its periodic error. PEC is most effective if the mount periodic error varies smoothly and is consistent in amplitude over many cycles. If the periodic error appears erratic then you should first consider mechanical adjustments.

Q: What is the advantage over auto-guiding?

A: A lot depends on the image scale you chose to image at and the magnitude of Periodic Error that your mount exhibits. For instance with VS-PEC it may be possible to reduce the periodic error movement of the mount to a level where for a given exposure time the movement experienced is smaller than the resolution of your imaging system. In this case VS-PEC has an advantage of not requiring a separate autoguider thereby saving weight, less processing
load, less cables etc.

Q: Can ST4 AutoGuiding and VS-PEC be run simultaneously?

A: It is not recommended to use VS-PEC in combination with ST4 guiding it is likely that this will lead to overcorrection. No tests have been performed to verify this, so if you do try it let us know your results.

Q: Can ASCOM PulseGuiding and VS-PEC be run simultaneously?

A: Yes. EQMOD VS-PEC is designed to work alongside pulse guiding and can actually improve guiding performance when tracking on fainter guide stars.

EQMOD VS-PEC: Q&A (continued)

Q: What do I need to record PE?

A: A star, an imaging device and a capture program. The simplest approach is to use the EQMOD perecorder application and a Webcam.

Q: What is pereccorder and why should I use it?

A: perecorder is an application written specifically for the capture of PE data for use by EQASCOM's VS-PEC. It provides automatic calibration to automatically determine the resolution of your imaging system and integrates closely with EQASCOM to record not only the Periodic Error, but also the associated stepper motor position. Perecorder is the most accurate means of capturing PE data for EQASCOM.

Q: What imaging devices does perecorder support?

A: Currently perecorder only supports webcams.

Q: I don't own a webcam, how can I record my PE?

A: If K3CCDTools or PHD supports your imaging device then there is a way to import log file data into PECPrep. This process is slightly more involved than using perecorder.

Q: How long does it take to record PE?

A: For an EQ6 type mount you really need to record at least 40 minutes of data. For an EQ5 mount 55 minutes of data. With brighter stars you can record PE during dusk or periods if during poor seeing when other observation is impractical (the smoothing process is able to remove seeing and wind disturbances in the recorded signal).

Q: How often would I need to record/process PE?

A: You might need to re-record your PE if you change the loading of the mount, or if you fail to park the mount (there are means to resynchronise manually if this happens but re-recording may be the simpler option).

Q: How do I analyse my PE and create a PEC Curve for EQASCOM?

A: Use PECPrep. PECPrep has been written specifically for this purpose and contains a number of analysis and manipulation tools.

Q: What's the difference between a PE Curve and a PEC Curve?

A: There isn't a big difference but the PE Curve is the raw response of your mount, whilst the PEC curve is the data formatted for EQASCOM to apply corrections to the mount.

Q: Where is the VS-PEC data held?

A: VS-PEC data is stored in a text file on your PC and loaded by the EQASCOM driver. EQASCOM uses the file to send rate change commands to the mount. Whilst the mount may continue to track at sidereal rate when EQASCOM has been disconnected, it cannot track using VS-PEC.

FAQs - File Locations

What ini files should I move if I reinstall on another computer?

In addition to the eqmod.ini file there is an align.ini file that contains any saved alignment models and joystick.ini that contains your gamepad configuration.
There are separate files for both EQASCOM and the simulator. The EQASCOM files are found in %appdata%/eqmod and simulator fiules are in %appdata%/eqmod_sim.
The other EQMOD software applications (EQTour, EQMOSAIC, EQTOur, PECPREP, EQMODLX, EQNotify) also create their own .ini files that are stored in the %appdata%/eqmod directory.

Sync file location

If you manually save your data, or have it automatically save on park or append then you will find it written to a "preset" within the align.ini file (a text file). To find align.ini just type %appdata%/eqmod into a windows file explorer address bar.

Location of .ini files

The .ini file is typically stored in directory (folder):
\Documents and Settings\USERNAME\Application Data\EQMOD
USERNAME is your windows login username). The Application Data folder has hidden attributes .
This means you might not be able to see the folder. Set your explorer options to show hidden files.
You can also just enter
%
appdata%\eqmod
in a windows explorer address bar, or
appdata%\eqmod_sim
%
for the simulator ini's.
There are several .ini files.
ALIGN.ini
EQMOD.ini
EQMOSAIC.ini
EQTOUR.ini
JOYSTICK.ini

FAQs - Parking

Does Alignment alter the home or park position?

Alignment does not alter the home or park position as the driver uses hard coded park positions which is not affected by any alignment/sync data. This applies to all the park positions including user defined park positions.

I parked to an object but when I unparked it did not return to the object.

When you park it is to a fixed position in the sky not an object (even though the object is at that location). Even if you park and unpark within a short period of time, you would find that the object will have moved from the park position that you defined. A Goto should find the object fairly accurately unless a significant time has passed and the object is no longer within the area of sky that you have “calibrated”.

How do I reset the “Park to Home” position?

If you have a mount setup with invalid park data, you can get a fresh start by the following procedure: (You will know that you have invalid RA/DEC park ring counter values if you execute a "Park to Home" and mount does not end up at the home position)

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. Unpark Scope using the EQMOD driver.

. Shutdown EQMOD **then** power down the mount. **Don't** use park for this step.

. Position the mount in the home position.

. Power up mount

. Start EQMOD & connect to mount.

The above steps will reset park settings of EQMOD.

I forgot to park the mount before I shut the computer. What can I do?

As long as the mount is still powered, you can re-connect EQMOD and the ring counter data will remain intact. The ring counters are being maintained by the stepper board. You will lose the ring counter data only if you remove power from the mount without parking it.

FAQs - Parking

Can you stop a slew without parking?

There are two stop buttons on the EQASCOM user interface.

The stop button one in the centre of the slew pad is an "emergency stop" and will park the mount mount at the current position. This prevents the client that initiated the slew from re-issuing slew should it detect it hasn't completed (or indeed other clients from issuing other movements). Most ASCOM client applications will not automatically unpark and so using the emergency stop will require user intervention (i.e. unpark) before and further movement is possible.

The Stop button in the tracking section will not only stop the mount tracking but will also halt slews (without the park).

Do EQMOD and HC (hand controller) use the same method of parking?

Both EQMOD and HC use the same method of parking.

In HC mode, the mount initializes the ring counter values and assumes the home position (the same position manually pointed by the user to NCP upon power up). EQMOD also uses the same position as the home position. User also has to manually point the mount to the home position which is also NCP.

The only condition for the usage to be interchangeable (EQMOD vs HC) is to position the worm gear to the same spot where it was found at power up prior to shutting down and this is through the park to home position found both on the HC and the EQMOD driver.

However, if you use EQMOD's user-defined park position (the HC doesn't have this feature in some versions), and then attempt to use the HC after, user will have to disengage the clutch and manually point by hand the mount back to the home position. This disengaging the clutch alone will invalidate any alignment/PEC data on the EQMOD side.

In short, to be able to use both method (HC and EQMOD) interchangeably and at the same time preserve the alignment data, you need to use only the park-to-home feature and not EQMOD's custom park-to-user-define-position.

You can use EQMOD's custom park-to-user-define-position only if you use EQMOD entirely for all mount operations.

FAQs - Parking

What does Synchronous Park do?

A Synchronous Park is how the ASCOM "standard" requires that parking should be performed. The client application issues a park command to the driver which only returns control back to the client once the park has completed. For some reason ASCOM lacks an Asynchronous parking method although oddly enough it does provide both synchronous and asynchronous methods for gotos.

An asynchronous park provides a better overall control implementation as control is returned immediately to the client whilst parking is performed. This allows the client to be able to monitor and if needs be, interrupt the mount whilst parking is in progress. Traditionally EQASCOM has therefore implemented parks as asynchronous operations and this does not appear to cause issues with most clients. However, you can force synchronous behavior via the setup screen checkbox if you believe a particular client requires it.

Alignment will only be preserved between sessions if you save it and then load it again. There are options to do this manually or automatically on park/unpark.

FAQs - Alignment

How do you pick a good star for 1-Point alignment.

Assuming that the mount is polar aligned and there is minimal cone error, choose any star from eastern or western side at least 45 degrees from the ground.

If you click the [Stop] button do you lose alignment?

No, it will not lose alignment. Position computation is time based. If you stop tracking and re-initiate tracking 30mins later, the driver will simply compute the new position and apply the GOTO.

If the mount stops because an RA limit has been reached, does it lose alignment?

No, it will not lose alignment. (see the reference to the [Stop] button above). Simply move the mount away from the limit using slew controls and restart tracking.

Clear sync data vs Clear align data

To remove **all** pointing correction you must clear both the alignment data and sync data.

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Clear align data deletes all your current alignment points.

Clear Sync data removes any sync shift that is currently active. When operating in "dialog mode" for alignment, a sync will act to shift the entire model rather than add a new point. Once assigned a sync shift will be applied to the pointing model irrespective of whether "append on sync" or "dialog" mode is subsequently used. You can tell if there is a sync shift active as the DXSA and/or the DXSB values will be non zero.

Note: Alignment points can be created by append on sync, dialog mode or a mixture of both.

Does unclamping and moving mount move ring counters?

Unclamping will not move the ring counters. However you will lose alignment if you loosen the RA/DEC clutches. This can be fixed by:

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initiating a GOTO to a bright object (assuming the 3-Point data is still active)

manually centering the object through the scope eyepiece FOV after the GOTO by loosening the RA/DEC clutch and pushing the tube to bright object's position.

Why a GOTO on a previously aligned object might not work after 6 hours.

When you "append on sync" all that happens is a new alignment point is added to the model - the model isn't shifted at all (so a true "sync" in the traditional sense hasn't really been performed). Only when in "dialog mode" is a received ASCOM sync used to shift the model. If you always operate in "append" mode then the likelihood is that no sync shift would have been present.

It is important to appreciate that the pointing transformations are applied not only in moving to goto targets but also whenever EQASCOM updates its reported position. In light of this is really no surprise that after 6 hours of tracking the EQASCOM position /reticule has drifted off your initially aligned object.

If initially you added three alignment points around an object, your goto would have had a three point transformation applied to it to take you accurately to the object. So long as the object remains in the triangle the position reported by EQASCOM will be subject to the same 3Point transformation. As soon as the object drifts outside of the alignment triangle, EQASCOM will switch to using a Nearest Point transformation for it's reported position. When you're six hours away and over the meridian EQASCOM will still be trying to apply that nearest Point transformation even though the point is a long long way away. If you have the "Pierside points only" option checked then once you cross the meridian you will loose all correction as there are no points defined on the current side.

FAQs -Tracking & Guiding

My mount stopped tracking.

When I click a tracking icon it flashes briefly and still stays at “not tracking”. What is the probable cause?

One of the RA limits that have been set in EQMOD has probably been reached.

Solutions:

1. Try slewing the mount away from the pier a little and then click the tracking button. You will probably find that it will now track.
2. Expand to the full setup window by clicking the [Setup >>>>] button. You can then change the limits by clicking the [No Limit] button (Caution: the mount is not protected from moving into the pier.).
3. Slew the mount to the position you want to define as a limit and click the [Set Current RA] button. You would also want to repeat the procedure with the mount flipped to the other side as well. You use the same [Set Current RA] button.

Tracking/Imaging Past Meridian

The ability to track past the meridian depends on the telescope and where it is pointed. A short telescope can track quite a way past the meridian before it runs into the mount. A long telescope can't track as far. A telescope pointed near the celestial equator can track farther past the meridian than a telescope pointed near the zenith. The Orion Atlas doesn't have safety stops built in. The EQASCOM driver lets you set safety limits.

Auto Meridian Flip and Overall Limits Setting

When the Auto Meridian Flip is checked, does it work if the overall Limits setting is not checked ?

It is the RA limits (meridian limits) that define the point at which the mount will perform an automatic flip. If limits are off then the RA limits are not applied and so there will be no automatic flip whilst tracking and automatic flips will only occur during gotos.

What connection should I use for guiding?

It is entirely up to you how you wish to guide. One option is to have PHD send ASCOM pulse guide commands to EQASCOM which in turn will apply the necessary corrections using the serial link. EQASCOM has a number of parameters that control how pulseguiding is applied and includes a pulseguide monitor display to help diagnose and correct problems.

Alternatively you can have PHD control the mount via ST4 (assuming you have a guide camera with an ST-4 output or a GPUSB/relay box) in which case EQASCOM plays no active part other than providing a means to set the mounts ST-4 guide rate.

Please note that if using the very latest version of EQASCOM (V1.25c) you need to select your preferred guiding method form the EQASCOM setup screen (EQASCOM will then customise the runtime user interface accordingly).

FAQs - Miscellaneous

RA offset Diff and DEC offset Diff

Q:

If I start an alignment and goto a star and accept (without any adjustment) the position, the DEC offset is always 0 (as expected) but the RA offset is not 0.

Mon: That is the difference in microsteps from the computed ra/dec ring counter values of the alignment star goto using the ra/dec equatorial catalog coordinates and the ring counters that is read on the simulator. Ideally the discrepancy should be less than 50 if you are using the physical mount (crystal based counter) than the simulator (pc based sidereal counter).

EQMOD Connection Issues

Q: When I try connecting my planetarium program to EQMOD the connection fails. If I attempt to connect to a non-existent serial port (say, COM9), the EQMOD config window pops up very briefly and disappears. When I attempt to connect to the correct port (verified through Windows XP's HW manager), the window pops up, but only displays its outline... hangs there for some time and then disappears. What's happening.

A: When you see the EQASCOM "ghost" interface appearing, it means that EQASCOM has found a valid COM port and is trying (in vain) to contact the mount. When you try with an invalid com port EQASCOM quickly detects this so can close much quicker (no comms timeouts or retries etc). So, it would appear that you do not have a com connection to the mount or you have not used the correct port settings... typically 9600, 8-1-N, no flow control.

How do you use the function "Drift Compensation"

Drift compensation is needed for the motor control boards V1.06 or later. For some reason these boards do not track accurately when issued the same commands as earlier boards and so this additional parameter was introduced. There is a "driftmeter" application

http://tech.groups.yahoo.com/group/EQMOD/files/A EQMOD Release/EQASCOM/RA Drift Meter/

that allows you to measure any tracking drift but others have found that for V1.06 boards a figure of 3 is required, for earlier & later boards set the compensation to 0.

The tracking must be stopped and restarted for the compensation value to take effect. This is because the compensation is applied directly to the message used to start tracking.

What is the purpose of the “Auto RA Sync” setting?

The Auto RA Sync check box (located in the “Drift Compensation” panel)is actually rather important . If checked then EQASCOM will periodically resynch its position based upon a poll of the the motor position. If Left unchecked then such a resynch only occurs on slew completion and, while the mount is tracking, EQASCOM calculates its own 'emulated' position.

If you want to test for RA drift then you must have the Auto RA Sync check box checked. You are advised to always leave the Auto RA Sync box checked.

There was once a theory that polling the mount for motor position could itself lead to a tracking error and this why the option to remove polling by via the checkbox was added. In fact this polling/tracking problem is likely just a red herring with the real problem being the drift associated with V1.06 boards.

This option has to do with how EQASCOM determines the stepper motor positions while tracking. If it is unchecked EQASCOM simply estimates the position based upon the last known position (as read following a slew or goto) and the elapsed time. With the option checked EQASCOM will regularly poll the mount for the current position and between polls estimate the position.

How do I determine the board version in my mount?

Once EQMOD has been connected to the mount click the [Display +] button located just below the ASCOM logo. The message centre will appear. Clicking the [Display +] button repeatedly cycles through several displays but you want the message centre for the version information.

The information displayed may be something like

EQ Modded Mount found at COM1: 9600
Mount Version : 000601 DLL Version: 000204

The mount version is displayed in reversed order. In the above example the mount version is 1.06.00

GPS time question and Daylight Saving (Summer Time)

The PC's clock may advance but the underlying windows UTC time is not adjusted when you move into daylight saving or summer time. EQASCOM only ever uses the PC's UTC time + any GPS delta correction. Irrespective of any GMT/BST changes EQASCOM and the GPS will continue to work in UTC.

What does camera aligned orthogonally mean?

"orthogonally" is the adverb from the root verb "orthogonal". http://m.dictionary.com/d/?q=orthogonal&o=0&l=dir

The camera should be aligned such that mount movement in RA should result in an image shift to the left/right along row of sensor pixels whereas mount movement in DEC should result in an up/down image shift along a column of sensor pixels.

The DxSA/DxSB data fields

These data fields display the offset data in stepper steps for the SYNC Command. They show the discrepancy from the current stepper value computed Catalog coordinates (planetarium database coordinates converted to Stepper data) vs the one that was read currently on the stepper motors.

Miscellaneous Facts

Typical Configurations

In this hobby there are virtually an infinite number of combinations of equipment. This is certainly true for guiding. The examples listed here come from working installations and may be useful in setting up your specific equipment environment.

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Example #1

Equipment:

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Skywatcher EQ-6
Shoestring Astronomy (http://www.store.shoestringastronomy.com/products_eq.htm)EQDIR
"retired" desktop computer (Windows XP (tm) SP2) with Logitech game pad
CCD-Labs (http://www.ccd-labs.com/Qseries/qguide.htm) Q-Guide Camera
William Optics (http://www.williamoptics.com/)ZenithStar ED 80 (scope used for guiding)

The EQ-6 is connected to an EQDIR module and then connected via **a straight through cable** to the computer's RS232 port.

The EQDIR module could be located at the computer end of the cable. However, you should note that the inputs at the telescope motor control board are at 5vdc peak levels. RS232 uses plus or minus voltages generally in the 9 volt range (18 volts) plus or minus. It is a better solution to have the EQDIR adapter at the scope end of a long cable run, than at the computer. This reduces the possibility of electronic signals being induced into a 5 volt signal line and propagated to the controller board, sending potentially damaging movement signals to the mount. The RS232 interface was developed to avoid this issue. With the EQDIR module at the mount the communication between the EQDIR module and the computer uses RS232 voltage levels.

Software:

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PHD guiding (http://www.stark-labs.com/)
Stellarium with StellariumScope

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The Q-Guide camera is connected:

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to a computer USB port
directly to the mount ST4 port (straight through cable)
no other connection to the computer is required

PHD guiding is configured with the mount "on camera" using the Q-Guide camera.

Exposure times are typically 1s. Other PHD settings are default settings.

Any one of the various planetarium programs are connected directly to EQMOD

HNSKY/CdC/SN/StarCalc/StellariumScope ---> EQMOD

Maxim --> EQMOD

EQTour --> EQMOD

EQMosaic --> EQMOD
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Typical Configurations (continued)

Example #2

Equipment:

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EQ6 Pro
Homemade EQDIR adapter
USB Powered Hub
5m USB Active extension cable
HugePine USB-RS232 converter
2m RS232 Extension cable
Rumblepad II wireless gamepad.
Desktop PC (Windows XP Pro™ SP2)
PC PSU providing 12V supply to Mount & 5V supply to USB Hub
B&W Philips Vesta Pro LX modified webcam for guiding
EQ6 is connected as follows:
EQ6 -> RS232 extension cable -> EQDIR module -> RS232-USB converter ->
USB hub -> 5m USB Active extension cable -> PC.
Software:

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Cartes du Ceil Version 3 beta 0.1.2 - planetarium
K3CCDTools 3.4.7.1078 – capture/drift analysis/ guiding
PHD guiding (http://www.stark-labs.com/) - guiding
EQTour – for alignment star list
EQMosaic – for CCD targeting/framing and mosaics.

Functioning of [Synch As] and 1-Point vs n-Point

Q:

This is an interesting feature since it provides a method of moving from 1-point to N-point without clearing the previous alignment data. Is there any reason, that the [N-point] button is locked out after a 1-point align? Unless you use the "sync" option, the only way to move from 1

-point to N-point is to clear alignment data (or uses the [Sync As] option).

Mon: Thats precisely the reason, to force the user to clear the data for a new set of alignment points.

Q:

Couldn't the first star (the 1-point alignment star) count as the first of the 3 sync/alignment stars?

Mon: Currently EQMOD uses a different alignment routine for the 1-point and the N-point. The 1-Point simply uses an offset value implementation on the stepper motors which is entirely different from the N-point approach. Because of this, they cannot share the data.

Also, this option was done so that EQMOD would have a simple default mode to use upon startup.

Q:

If I've done a 1-point align and then turn on [Append as] and then sync on stars do I move into N-point alignment. The message window seems to imply this.

Mon: Yes. However you need at least three SYNC commands to activate the N-point alignment. If there are only 1 or 2 SYNC commands (while append as is activated), EQMOD will continue to function in 1-point align. If you get the SYNC at the 3rd star, EQMOD will automatically function in N-point alignment mode and will use the 1st three SYNC stars as the 3-Star alignment data.

A detailed description of how EQMOD gets the equatorial coordinates

Author: Mon

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. Read the RA and DEC Stepper ring counter values from the stepper board

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Values are 32BIT Hexadecimal Ring counter values
Ring counter center value is 0x800000
A single increment (decrement) of the counter corresponds to 0.144 arcsecond of mount movement on each axis

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. Get the PC Local Time and the site's Latitude, Longitude, Elevation

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data provided by the user or the GPS module and is fed to the EQMOD driver
data stored in the windows registry

. Compute for the Local Sidereal Time/date based on the PC Local Time, Site Coordinate data, and the RA ring counter value

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. Get the Hour Angle based on the LST and date and other factors such as obliquity and nutation.

. Get the DECLINATION equatorial coordinate based on DEC motor ring counter value

. Compute for RIGHT ASCENSION equatorial coordinate based on the Local Sidereal Time and Hour angle, RA coordinate and PIER status

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Notice that the Right Ascension is also dependent on the DEC motor. The Right Ascension values change when the DEC motor moves to the other side of the pier.

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. Publish the values on the display and on the upper application layers such as the Planetarium application

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. Repeat from Step 1

As you can see, the values are still based on the RA and Dec motor ring counter values (Step 1). Even if the EQMOD driver is shutdown and restarted and as long as the power is not removed from the mount, you will be able to continue the operation without starting from the home position.

EQMOD Goto Accuracy – Explained (Author: Mon)

The key to GOTO accuracy is basically a two step method;

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. Alignment of the mount with respect to a series of reference point on the sky (alignment stars)

. Properly Positioning the RA and DEC stepper motor after the GOTO slew to the correct location.

Step 1 is achieved by the N-Point alignment.

You can still achieve accurate GOTO's even with a 1-Point if the mount is properly polar aligned and have minimal cone errors (we can still overcome cone errors on a 1 star align by choosing stars on the same meridian side on both the alignment and the GOTO). If the final position crosses the meridian opposite where the 1-Point alignment is, then you need to do a SYNC first to overcome cone errors on the opposite side.

Step 2 has already been achieved within the EQMOD

It is achieved using the GOTO function codes and through the "Iterative Goto" implementation. Achieving the correct stepper position both for RA and DEC at the same time compensating for the earth's movement and the time the GOTO was implemented were the keys for an accurate iterative GOTO function.

The "iterative GOTO" uses the following two control lines found at the 'EQMATH.bas' source code;

```
NUM_SLEW_RETRIES As Long = 5retries
gRA_Allowed_diff As Double = 10
```

It says that Goto should not stop until you get within 10 microsteps of the desired position (10 *

0

.144arcsecond) or roughly 1 arcsecond. To achieve this you need to at least perform an iterative GOTO retry. Iteration will stop if more than 5 attempts. I have observed that most GOTO's on this mount stops at the 2nd or 3rd iteration. You will notice this on your mount as stepper "clicks" / "bursts" after a GOTO operation and as "Slew Retry" messages on the EQMOD window.

```
CoordSlew: RA[ 06:00:03 ] DEC[ +44:57:00 ]
SlewRetry[ 4]: Diff at : 1444 Target is: < 10
Goto Slew Complete. Diff at 2
```

Using the sample EQMOD message above, without iteration, GOTO will stop at 1444 microsteps of discrepancy (.144arcsec/microstep = 207 arcseconds). A slew retry has brought the mount only at 2 microsteps discrepancy. With good alignment, a 2 microstep discrepancy should put the object dead center on the FOV.

The driver has to impose a 5 retry limit to avoid any indefinite oscillations in the iteration process. If you get more than 1 arcsecond of stepper positioning error visually on the FOV, then the problem is NOT on the stepper position but on the mount alignment (polar/cone/etc).

Value of using a GPS device

Author: Mon

As long as you have the time and location data consistent and accurate on every imaging or observation session, and as long the alignment data is intact, whether the data came from the GPS or manually entered, you will be able to achieve accurate GOTO's.

Although you can manually define the coordinates and time-of-day of your mount on your hand controller or on the PC (when using EQMOD), having a GPS device handy would allow things be done automatically for you. The location data may be fixed but the time component will not be as you are required to make sure that the time is accurate as the mount driver computes for the Local Sidereal Time (LST) based on the local time. The position of the stepper motor based on the requested RA/DEC Goto coordinates are computed based on the current Local Sidereal Time value.

Any electronic device (Notebook, PC, Watch, Clock, HC, etc) that maintain the current time will not be always accurate. You will have to sync it on a regular basis from a common timing system which can be found on GPS devices which are synced from an Atomic Clock passed to all GPS satellites.

A GPS would come in handy for mounts that are permanently located on a certain location (observatory, fixed pier, etc.). As you park and unpark your mount, the RA shaft position is usually memorized and the absolute position is computed based on your longitude and latitude coordinates and the current time-of-day / Local Sidereal Time.

With the GPS, the "continuity" of your mount "state of accuracy" is achieved. This means the data from any "alignment" operation/calibration done on a previous day can still be re-used on the current day and the days to come as you will be using the same coordinate data and the sky will still be "synced" with the RA shaft because of the atomic time.

If there are inherent discrepancies introduced on the time alone, that means you have to perform the same 1-Point, 2-star, 3-star, N-Point alignment every night for you to be able to maintain the accuracy on any GOTO operation.

In the EQMOD program code, the GPS data (time and coordinates) is processed even to the seconds/arcseconds portion in order to be able to compute in 0.144 arcsecond accuracy of the stepper motor position,

For mounts "on the go" or mounts that don't have a fixed location, the latitude and longitude coordinate and time-of-day data is usually important on the first alignment star GOTO coming from the initial home position. In the absence of an alignment data, the driver usually uses a "0" offset alignment. To "estimate" the position of the 1st, 2nd, and 3rd alignment star, it has to rely on these latitude/longitude/time-of-day data. This means, the centering process of any alignment operation would be better if your latitude/longitude/time of day are accurate. The GPS info would be helpful for this.

Some of you might ask are we still close to accurate GOTO's even without access to a GPS data. The answer lies on the different "offsets" applied on your goto coordinates. These offset data were derived from the alignment and star centering/calibration operation. The errors from the your latitude/longitude/time-of-day data are easily compensated by the star alignment operation.
However the accuracy may not be constant on all parts of the sky if you introduce errors on your coordinates as the accuracy will vary depending on which part of the sky your scope is pointed at. (unless you have access to an N-Point alignment). Usually the correction offset only applies to a certain part of the sky. (This where the N-Point and SYNC operation becomes handy). This happens as the mount firmware attempts to compute in a spherical coordinate system the location of the sky object. If your latitude/longitude data is not accurate, the virtual sphere which your mount firmware maintains to which your local sky is part of it will be a little "skewed" on certain sky locations.
At the end of the day, you get to minimize these errors and spare the mount from compensating these errors by simply using a GPS device.
Most mounts usually provide arcminute accuracy. However, with good command on programming, mathematical mechanics and depending on the capability and quality of the hardware itself, it is always possible to increase the accuracy towards the arcseconds level.

The advantage of using pulseguide with EQDIR

Author: Mon

The old hand controller (HC) will not work as it doesn't have Pulseguide support. On the ASCOM-talk yahoo groups, I suggested that the Celestron's ASCOM driver be changed to support a "timer" based simultaneous axis pulseguide. An updated Celestron driver was released last month to support the ability of PHD to implement pulseguide directly to the Syncscan controller.

However, it should be noted, that the EQDIR option should be more accurate due to less delays induced on the serial interface since the pulseguide commands are directly fed to the mount's stepper board controller. This should provide the ability to have better subpixel autoguiding

Without the EQDIR option (using the hand controller) there are two "cascaded" serial interface delays (very critical to mount's reaction time to the pulseguide corrections). One delay comes from the serial connection between the PC and the hand controller (HC). The other delay comes from the connection from the HC to the mount. Since Celestron's Pulseguide commands protocol is entirely different from the Mount's Stepper protocol, the HC does some sort of command translation. This adds to the delay. Pulseguide will be successful using this option (PC->HC->mount), however the accuracy in terms of subpixel guiding would be less.

Problems

Game Controllers

If your game controller is not responding as expected, look for the [Mode] button on the controller. This button switches most game controllers from analog to digital modes. The digital mode should work correctly.

Tracking past Meridian

Q: I would like to be able to set my mount to keep tracking a few degrees past the meridian before any limits are set. Tracking appears to stop right at the meridian which can be quite frustrating when imaging. Is there a setting for this?

A: That is the "RA LIMIT" at the EQMOD setup window. Just click on the [RESET] button. A "0" value disables the RA Limiter function.

Glossary

Affine

There are many detailed mathematical descriptions of affine/taki transformations (check http://en.wikipedia.org/wiki/Affine_transformation for example). The simplest description is to say that it is a mathematical method of calculating the differences between the actual "sky" positions and the mount position. Basically it is used to tell the mount where it has to move in order to GOTO the required object. It uses the star catalog data from your planetarium program and the alignment data from the alignment process you completed at startup.

Encoders (Ring Counter)

This documentation sometimes refers to the “encoders” in the mount. Strictly speaking, the mount doesn't have Optical Encoders, instead, the mount uses 32 bit ring counters to keep track of the stepper motor position. The more appropriate term to describe the stepper motor counters would be "RA position counter" or "DEC position counter"instead of "encoder" (or just "RA or DEC counter").

Home

The home position of the mount is the position where the telescope is pointing at the NCP (north celestial pole) or the SCP (south celestial pole). This is accomplished by setting the mount with the balance (counter-weight) bar point downwards and the scope point north or south.

Park

Before powering down the mount, the mount should be returned to a park position. This position could be the same as the Home position. However, it is possible to define another position for the park position that might be preferable for special installations such as a permanent pier in a roll-off roof observatory. Parking the mount before shutdown means that the mount has a known place to start when power is returned and the mount is "unparked". Recent versions of EQMOD allow several park positions to be defined so that mount could be (for instance) parked in a position suitable for maintenance.

POTH

POTH is part of the ASCOM software. Although you must use the ASCOM software itself, POTH is an add on feature to allow several programs to control the mount and other hardware at the same time using the same cable. POTH is no longer needed with EQASCOM.

Accessories Used with EQMOD

The accessories most commonly used with EQMOD are:

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a Gamepad/Joystick
a USB to serial converter
an add-on numeric keypad
A source of specific hardware models and brands that work and do not work can be found on the EQMOD Yahoo site under files or database.

Resources

The best place to find supporting resources is the Yahoo special interest group

http://tech.groups.yahoo.com/group/EQMOD

Within that group, you will find a very responsive and supportive group of individuals willing to provide answers to questions that might not have been covered in this manual. Please remember to search the manual and news group before posing questions that might have already been covered.
As part of the Yahoo interest group there are additional resources accessed from the following links.

http://tech.groups.yahoo.com/group/EQMOD/links

http://tech.groups.yahoo.com/group/EQMOD/files/

http://tech.groups.yahoo.com/group/EQMOD/database

http://tech.ph.groups.yahoo.com/group/EQMOD/photos

Additional link:
http://eq-mod.sourceforge.net/index.htm

Add on Software

There are a number of additional applications that have been written specifically to work with EQMOD. These applications use the ASCOM interface and so may also work with other ASCOM compliant telescope drivers. This manual focuses on their use with EQMOD.

Note: ***None of these applications are required for using EQMOD.*** They simply add additional (and useful) functionality. It is recommended that you install and use EQMOD without these applications. Once you have EQMOD fully functional and you are completely familiar with its use you may wish to try the “add on” applications.

EQASCOM_Run

EQASCOM_Run is a very basic ASCOM client intended to provide a permanent client for EQASCOM thereby ensuring the EQASCOM continues to run even it other more complex client apps such as guiding/planetarium are closed (or crash). Those with dedicated mount control PCs may wish to add EQASCOM_Run to the startup menu and leave it to windows to terminate on close down. Those without dedicated PCs may also opt to use EQASCOM_Run but may want to initiate it manually.
It can be all too easy to accidentally shut down the EQASCOM interface by closing the last connected client application. The mount itself is unaffected by EQASCOM closure and will continue tracking allowing you to re-start a client app. EQASCOM will then pick up where you left off. However during the "down period" any active limit protection will have been compromised. You also lose unsaved alignment data etc.

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When running EQASCOM_Run will repeatedly attempt to evoke EQASCOM and connect to the mount every three seconds (if not already connected).

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EQASCOM_Run will start minimised to the desktop and will not be show in the taskbar.
If EQASCOM_Run can is closed via its close button / or menu item it will issue a prompt requiring confirmation.

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If EQASCOM_Run is "restored" form its mimimised state then there is a menu item that allows access to EQASCOMs setup screen.
EQASCOM currently has no configuration options and so contains a literal reference to the ASCOM ID of the EQASCOM driver. There is no current way to use it to run the EQASCOM simulator other by changing and rebuilding the source code.

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The self installer program will add a start button entry for EQASCOM_Run.
EQASCOM will be closed without prompt on windows shutdown or if ended via the task manager.

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EQASCOM_Run can only be shutdown either by windows closing or after confirming a closure prompt.
If you set it to run automatically on windows start-up, it will then keep looking for the mount. Once it finds the mount, it will connect automatically and the EQASCOM UI will appear. It is not necessary to close EQASCOM run explicitly. Just let windows do that when it shuts down. In this way, you can open and close other clients without any concerns about accidentally shutting down EQASCOM.
An alternative way to get EQASCOM to run permanently is to use the "start EQASCOM" script that ships with EQASCOM. This efficiently tricks EQASCOM by changing its client count to think there is already a client present. If started this way the only way to stop EQASCOM is via the "Kill" script let windows do it on shutdown (or via the task manager).
Strictly speaking the script approach is a violation of ASCOM compliance which requires that drivers should not run standalone. EQASCOM_Run on the other hand is a legitimate ASCOM implementation.
The latest versions can be found in the files folder at
http://tech.groups.yahoo.com/group/EQMOD/files/A%20EQMOD%20Release/EQASCOM_RUN/

EQMOD Mosaic

EQMOD Mosaic is an ASCOM Client Application that integrates with EQMOD.

Note: ***You do not need to install EQMOD Mosaic in order to use EQMOD.***

EQMOD Mosaic is used to facilitate creating mosaics of large objects. The program creates a grid of RA and DEC coordinate points so that the mount can be moved in a systematic manner as the mosaic images are accumulated.

The latest versions can be found in the files folder at

http://tech.groups.yahoo.com/group/EQMOD/files/A%20EQMOD%20Release/EQMosaic/

The file will have a name such as:

```
EQMOD_MOSAIC_V112.exe
```

where the version number in the above example is 112. The version you should download will probably have a later version number.

Assumptions:

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. You have setup ASCOM
. You have setup EQMOD (although EQMosaic can be used with other ASCOM drivers).

ASCOM Server Connection

Connection must be made to an ASCOM telescope driver and this is achieved via the [Connect] Button. If no connection has previously been made then the ASCOM “Chooser” dialog is shown, otherwise connection is established to the server currently set as the current default. The default server is set via the [Choose Scope] button on the extended window. EQMosaic can be set to automatically connect to the current ‘default’ASCOM server on start up. Typically you will choose "EQMOD ASCOM Scope Driver".

Download EQMOD Mosaic

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. Download the latest version into an appropriate folder from:
http://tech.groups.yahoo.com/group/EQMOD/files/A%20EQMOD%20Release/EQMosaic/
. Run the file. It will typically create a sub-folder with the project files. For non-developers the
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exe file is the only file of interest.

Basic Operation of EQMOD Mosaic

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. Double click the file *EQMOD_MOSAIC.exe* . Depending upon your computer setup the *.exe* extension may not be visible.

. Start your planetarium program (optional) and connect to EQMOD in the “ASCOM Telescope Chooser” dialog. EQMOD will start up.

. In the EQMOD Mosaic window, click the [Connect] button. EQMOD Mosaic will then connect to an ASCOM driver. If none has previously been selected then the “ASCOM Telescope Chooser” dialog will appear. On successful connection the center cell of the mosaic grid is automatically synchronized with the scopes position and will appear highlighted.

. Use your planetarium program or the EQMOD slew controls (Gamepad etc.) in EQMOD to move to the object of interest.

. Double click a new grid position (or [Spiral] button) to slew the mount a precise amount for each subsequent image. When the scope finishes slewing the target grid cell will be highlighted and the grid cell label will be displayed (if option enabled).

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. If at any point you wish to resynchronize the grid center with the current scope position, click the [Get Position] button. The grid will be reset and position F6 (row F, column 6) and will appear highlighted.

Summary of Using Mosaic

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. Startup Mosaic and Planetarium program.

. If auto-connection hasn't been enabled press [Connect].

. Find object, slew to it.

. Verify current FOV and overlap settings are giving reasonable slews by using Mosaic to move in RA, then DEC visually noting features in the overlap zones.

. Frame the Mosaic by performing a Mosaic slew to the 'edges' of your subject, adjust using manual slews (Gamepad, keypad etc.).

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. **Mosaic** slew to first grid of your mosaic and start imaging.

. **Mosaic** slew to next grid, image - repeat till done.

Using the [Spiral] button in EQMOD Mosaic

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. The first click of the [Spiral] button initializes the spiral slew

. Subsequent button clicks slew the scope in a “circular” pattern of grid positions

. When all grid positions have been covered the process starts again. Provided your target is roughly circular/square and doesn't span the meridian during your imaging session, this provides a simple one button approach to mosaic building.

Note: The [Spiral] button only becomes active once a scope is connected its position read. Also the Spiral] and [Slew] buttons are disabled until the slew is complete.

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Mosaic can also be used as a spiral search where it is necessary to pause to take an exposure. This works well for finding dim targets where you need a long exposure image.

EQMOD Mosaic Settings

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. To change the default settings of EQMOD Mosaic, click the [> > >] button.

. In this extended window, you can set the frame size that corresponds to your imaging setup. This setting only needs to be approximate although it should typically be equal or smaller than the actual camera image size. The frame size is used by the grid navigator to calculate the amount of slew.

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. There is a drop down that allows you to save and recall the frame sizes

. There is a setting to allow you to specify the amount of overlap between frames.

. There is an option to warn you if the slew will cause a mount flip.

. There is an option to automatically connect to the default ASCOM driver on program start.

. There is an option to keep EQMOD Mosaic on top of all other desktop applications.

. The current default ASCOM driver is displayed and there is a [Choose Scope] button that allows a different default driver to be selected (perhaps a driver other than EQMOD).

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. You can save and load sessions.

Setting the Framesize Default in EQMOD Mosaic

Q: I am using a 6" Schmidt Newton F/5 with a (modified) Canon 350D, my FOV is about 2 x 1 degrees.

However currently the maximum framesize is 60 arcmin (1 degree). Is it possible to make the framesize bigger than 60 arcmin, say 150 x 150 arcmin?

Chris: Yes it is possible to increase the maximum frame size but you'll need to do a little bit of text editing. First make sure the mosaic program isn't running then find the EQMOSAIC.ini file. Under XP it can be found in ....

C:\Documents and Settings\USERNAME\Application Data\EQMOD

where USERNAME is your windows username.

(You should also see an EQMOD.ini file in this directory if you're using the latest version of EQMOD.)

Note that the Application Data folder has the hidden attribute set so you may have to make sure your file explorer is showing hidden files. If you open EQMOSAIC.ini file you'll see some lines like

```
DEC_MAX_FOV=60
RA_MAX_FOV=60
```

You can set new values as required but obviously the bigger numbers you use the less resolution you have on the slider's that change the FOV in the mosaic program itself - so you may find yourself having to use the [nudge] buttons rather than the sliders to get an 'exact' value.

EQMosaic and Meridian Flips

If the Meridian flip warning option has be enabled, Mosaic will issue a warning if it thinks the next slew is on the opposite side of the meridian from last slew position. Mosaic itself doesn't make the mount flip, the driver actually controls the flip. The mount may not actually flip when you click the [OK] button because, in the time it takes you to make the decision, the target position may have drifted back to the mounts current side.

When doing a mosaic of an item that starts spanning the meridian, a recommendation would be to start on the western side and move through the grid by doing columns of common RA. In this way you spend the maximum amount of time at the same RA. If the second column is on the other side of the meridian when you start, then by by the time you've finished imaging the the first column, the second column may well have drifted across the meridian and so no flip would be needed.

If you do get the meridian flip warning in mosaic you can always cancel the slew, wait a short until the object moves onto the current side of the meridian.

Mosaic Sessions

It is possible to save and load sessions. Up to 10 separate sessions may be saved and recalled. The following information is saved as part of a session definition.

```
RA field of view
DEC field of view
RA overlap
DEC overlap
RA & DEC coordinates of grid centre.
X,Y grid coordinates of Cell to be slewed to.
Status of all grid cells.
```

On session load the grid will be restored to the condition it was in on saving and a slew is initiated to place the scope at the last slew position. RA and DEC skip values are recalculated using the current coordinates.

This feature makes for easier mosaic compilation when imaging spans a number of observing sessions as the mosaic program is able to pick up from the exact point it was previously saved.

Notes about EQMOD Mosaic

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. Grid navigation is accomplished via mouse clicks.

. The settings for EQMOD Mosaic are stored in a file *EQMOSAIC.ini* in folder:

```
c:\Documents and Settings\YourLoginName\Application Data\EQMOD
```

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. The [Get Position] button synchronises the grid to your scope. The object does not have to be in view when you [Get Position] - when you slew the grid moves with you where ever you go. Key to mosaic operation is to realize the difference between 'external' slews (planetarium, tour, Gamepad) and Mosaic slews. External slews will move the entire grid around, Mosaic slew move within the grid.

. **Tracking:** EQMOD Mosaic can only control the scope to accurately cover an area of sky if the mount is tracking. The tracking status is checked whenever the [Get Position] button is pressed and/or at completion of a slew. If the mount is found not to be tracking then a warning message is displayed in the message center and an attempt is then made to start tracking. If this fails a

“

Scope will not track” message is displayed.

. **Non-sidereal tracking:** Imaging the Sun and particularly the Moon needs special consideration Mosaic places a grid on the celestial sphere but objects such as the Sun and Moon move across that grid with time i.e. move at a nonsidereal rate. Mosaic incorporates an algorithm that will automatically compensate for this provided the mount is able to track the objects accurately . Currently EQMOD only does solar and lunar tracking in RA - the Moon & Sun both move in declination as well so over time will slip over mosaic grid. Clearly these are bright objects and imaging times will not be extended so the effect should be negligible unless there are long pauses between image captures.

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. Prior to initiating a slew Mosaic, checks the scopes current position (both RA and DEC) and subtracts the position it thinks the scope should be at (i.e. the position used for the last slew). This gives a drift compensation in RA and DEC that is then applied to the grid centre coordinates, from which all other grid cell coords are calculated.

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. If you use Mosaic session save/restore and your imaging target is the Moon, the initial session restore slew is unlikely to get you to the right place as the Moon will have moved on across the sky. The session save/load feature is really only practical for Deep Space Mosaics.

. Before starting your Mosaic sequence of images, you can adjust the alignment of the grid over

your object by using the scopes slew controls.

For example: Whilst imaging the moon, try centering the moon and click the [Get Position] button to lock the grid in place. Then double click around the grid to find the frames the will constitute the boundaries of the mosaic. If any frames on the edge have an unacceptably small amount of moon in them, simply use the telescope slew controls to get more of the moon in the cell and the drift compensation code will automatically move the grid centre to compensate. Then check that the other extremity is satisfactory. This way, you can ensure that you capture the object with the minimum number of images.

About Mosaic FOV settings:

deg,54 min x 1 deg,34mins is 174 arcmins x 94 arcmins

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The field of view needed is that of your imaging device when applied to your scope. Obviously there are a wide range of FOVs we need to cover when you consider the various options folks have in terms of scopes, barlows, reducers, CCDs, webcams, DSLRs, SLRs etc. You don't have to be deadly accurate with setting the FOV values just err on the 'smaller' side and all that will happen is the mosaic will be slightly more overlapped.

For an imaging device at prime focus the FOV dimensions may be calculated as follows:

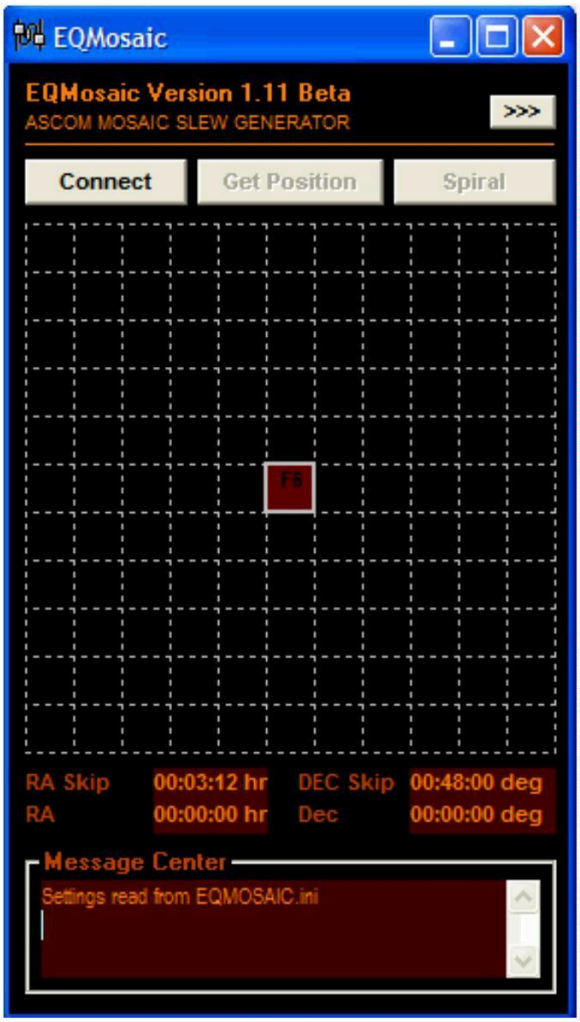
```
FOV (arcmins) = 3.438 * ChipDimension / FocalLength
```

Where ChipDimension and FocalLength are in mm. FocalLength should take into account magnification effect of any barlows/reducers in the imaging setup.

Note that the mosaic program assumes your imaging device's FOV is aligned in RA and DEC - so movement in RA moves stars horizontally across the image - adjusting the frame overlap should compensate for small errors in alignment.

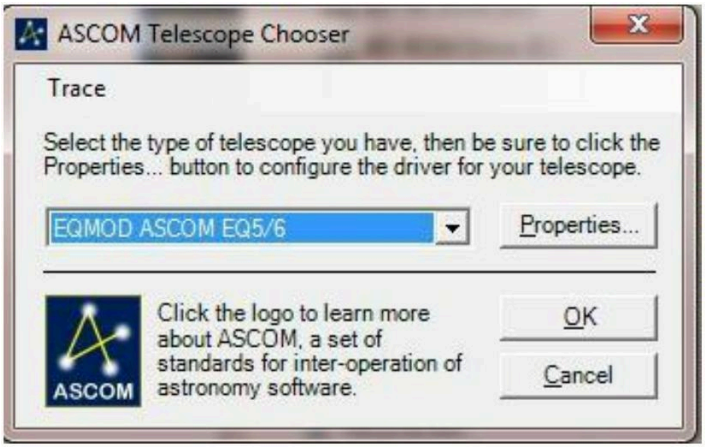
EQMOD Mosaic – Interface Images

This is the start up window of EQMOD Mosaic. Click the [Connect] button to connect to the mount.
(see below about auto-connect option)

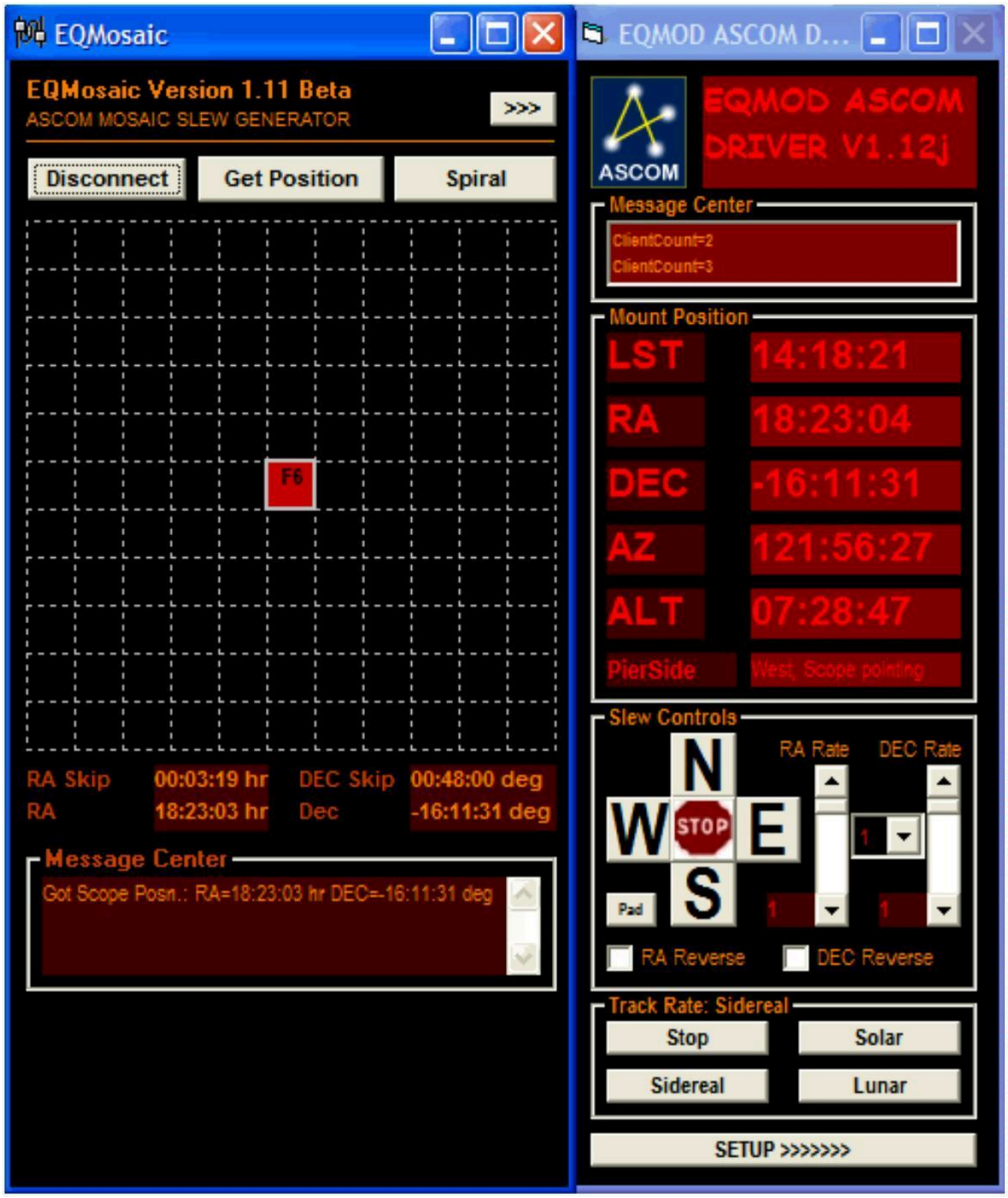


The ASCOM Telescope Chooser appears.

Select [EQMOD ASCOM EQ5/6] and click the [OK] button. If you have set the “Auto-connect” option, Mosaic will attempt to connect to the last driver that you have used. In this case the [Connect] button will be replaced with a [Disconnect] button.



EQMOD will activate.



In order to set EQMOD Mosaic options, click the [> > >] button. Here you can

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adjust the frame size and overlap.
save several different combinations by using the “Presets” drop-down
save and loa
The other options are:

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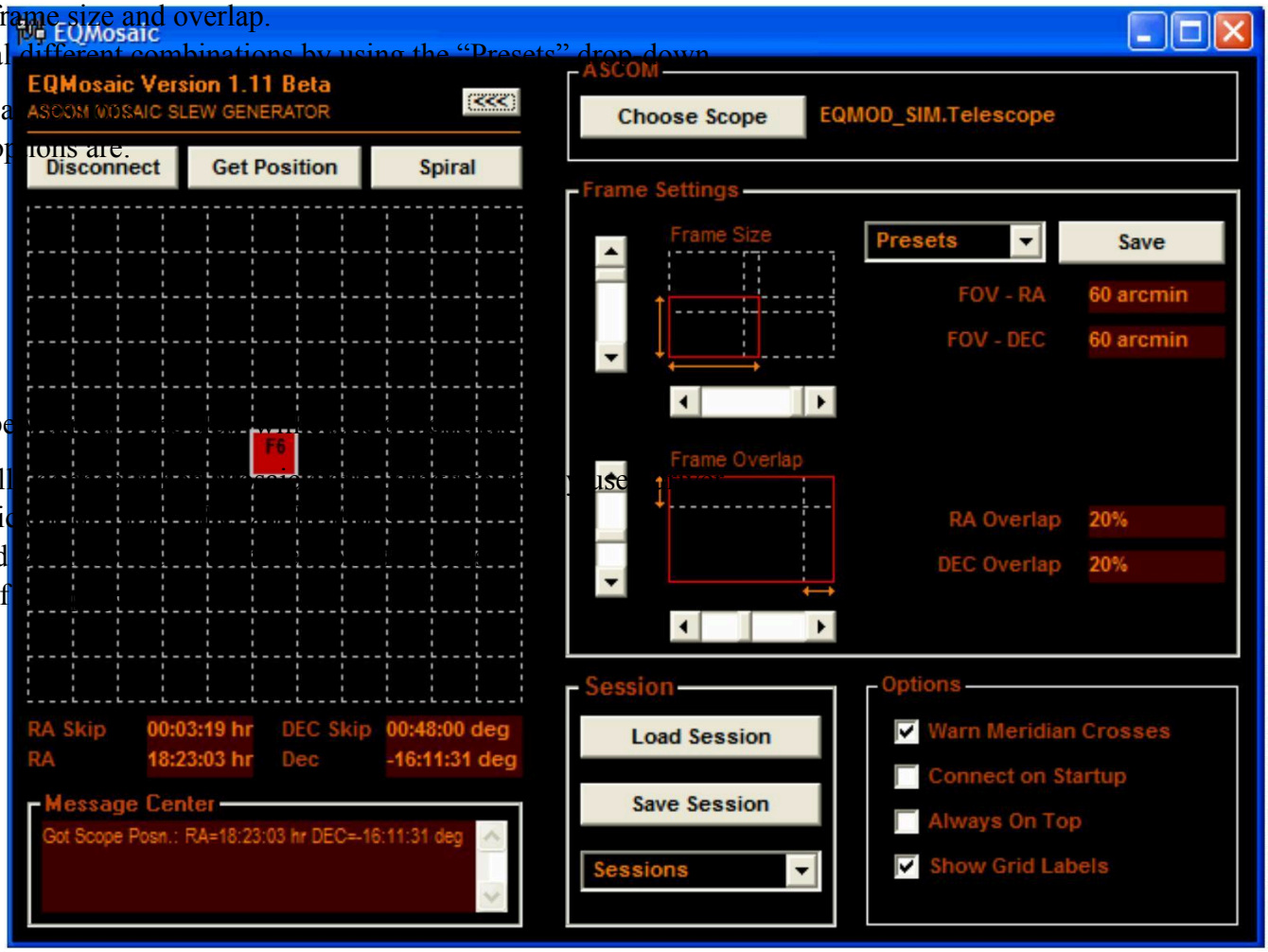
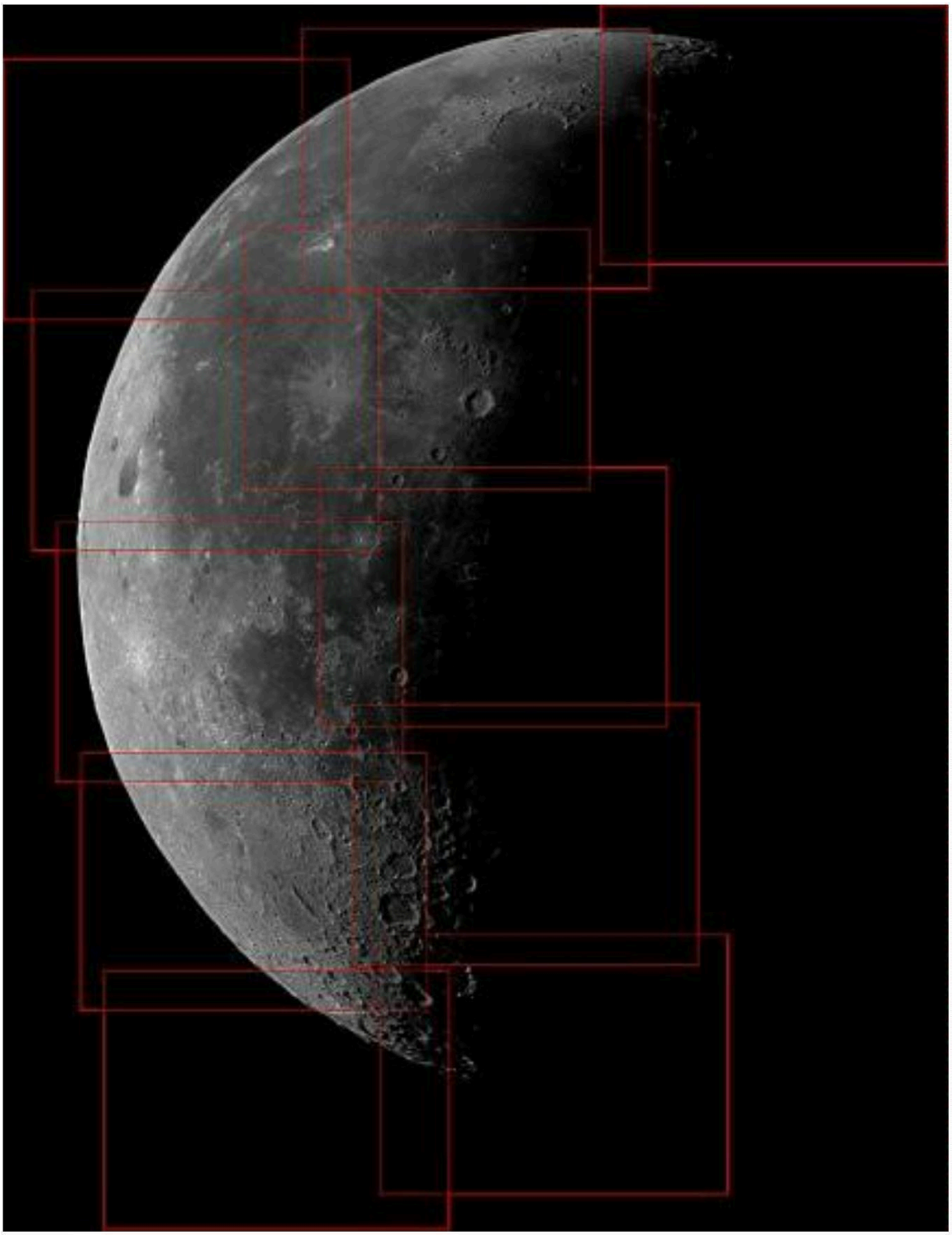
choose to be
automaticall use
keep Mosaic
display grid



EQMOD Mosaic – Moon Images

The staggered nature of the grids shows the effect of not having the camera RA aligned and that despite this, given sufficient overlap, an acceptable mosaic can still be achieved (each frame being overlapped by six other frames rather than 4 for optimal alignment)



EQTour

Introduction

EQTour is an ASCOM Client Application that integrates with EQMOD.

Note: ***You do not need to install EQTour in order to use EQMOD.***

EQTour is a lightweight, small footprint application that provides users with the capability to create their own Sky Tours of objects. This may prove to be useful as a “bookmarking” facility during or spanning observing session when objects need to be regularly revisited. By using *EQTour* in combination with Planetarium software and the EQMOD simulator, it is easy to build up lists of sky locations for later observation/demonstration sessions.

The latest versions can be found in the files folder at

http://tech.groups.yahoo.com/group/EQMOD/files/A%20EQMOD%20Release/EQTour/

The file will have a name such as:

EQTOUR_V112_Setup.exe

where the version number in the above example is 1.12. The version you download may have a later version number.

Assumptions:

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. You have setup ASCOM
. You have setup EQMOD (although EQTour can be used with other ASCOM drivers).

Downloading EQTour

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. Download the latest version into an appropriate folder.
. Run the file. It will typically create a sub-folder with the project files. For non-developers the
.
exe file is the only file of interest. You may receive warnings about an unknown publisher.

ASCOM Server Connection

Connection must be made to an ASCOM telescope driver and this is achieved via the [Connect] Button. If no connection has previously been made then the ASCOM “Chooser” dialog is shown, otherwise connection is established to the server currently set as the current default. The default server is set via the [Choose Scope] button on the extended window. *EQTour* can be set to automatically connect to the current ‘default’ASCOM server on start up. Typically you will choose "EQMOD ASCOM Scope Driver".

EQTour - Tours & Object lists

On start-up *EQTour* automatically scans its install directory and populates a drop down list of available Tours. Each Tour simply consists of a list of sky objects. Several samples have been included as part of the installation - these have not been fully verified as to accuracy but should give a fair selection of Northern and Southern hemisphere objects.

The *MyTour.lst* file is provided as an empty tour which effectively replaces the bookmark feature of earlier *EQTour* versions (See below for adding Object entries).

Select a Tour via a drop down list. Changing the tour will generate a list of objects in the Tour object window that are currently above the horizon. Note that object list can only be populated when an ASCOM connection has been established (via the [Connect] button) as the application must read Local Sidereal Time and Observing Site coordinates from the scope driver in order to determine which objects are visible.

The list of currently visible objects is not dynamically updated but can be refreshed at any time by clicking the [Refresh] button. Right clicking the mouse on the list of tour objects will expand/contract the list display.

The Horizon Altitude limit can be adjusted via a slider control. This feature allows the currently selected tour to be filtered by altitude – very useful finding which objects are currently around zenith (and therefore ripe for imaging) or for excluding objects in the murk of the true horizon.

EQTour - Slewing to an Object

Clicking on a Tour Object Item will result in the "Object Position" settings being changed to those associated with the object. Double clicking will slew the scope to the object position. If an object has passed below the horizon its coordinates will be displayed in RED and slews for that object will be disabled.

EQTour - Adding and Deleting Object entries

Objects can be added to the current Tour Object List. Usually you would add objects to the *MyTour* list.

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. Start EQTour and connect to the EQMOD interface.
. Start your planetarium program and connect to the EQMOD interface.
. Using your planetarium program, slew to the object to be added.
. In EQTour, click the [Add] button.
. Enter an appropriate description (typically the name and some supplemental information). Press the [Enter] key on your keyboard in order to record the description. The list will be refreshed and the new entry will appear.

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. If an empty description is entered then the process is aborted.
. If desired, the user can manually set the target RA/DEC coordinates by clicking and entering new values.

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. Objects are removed from the current list by first selecting them then pressing the [Delete] button.

EQTour - Tour Files

Tour definitions are stored in text files (*.lst) located in the same directory as *EQTour.exe* These files can be freely edited (in notepad for example) to add new entries. The format is as follows :

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a first line with !J2000, if the tour file contains J2000 coordinates that require precession and nutation to be applied by EQTOUR.

•

•

lines starting with a semi-colon or hash (#) are comment lines
Object definition take the form of RA; DEC; Name & description (typically the name and a reference to the constellation where the object can be found).

•

RA and Dec are decimal representations in Hours and Degrees respectively.
If you don't require all of the sample Tour files either delete them, rename them *.sav, or move them to another directory. Note that the program needs at least one list file to provide any useful functionality!

More on the EQTOUR !J2000 option

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This is the typical situation for the sample .lst files provided with the EQTOUR installation. The coords stored in these files are based on J2000. The assumption is that your planetarium program (or other software) will be sending EQMOD JNOW coords.

If you add objects to a list you should be aware whether the coords provided by your planetarium program are JNOW or J2000. If you are adding to a list setup with the !J2000 setting and you add a JNOW set of coords EQMOD will incorrectly adjust the JNOW.
If your favorite planetarium issues gotos based upon J2000 coordinates it would make sense to remove the !J2000 from tour files. The planetarium and EQTour would then both issue J2000 based gotos. Correction to JNOW would occur as an inherent part of a EQASCOMs n-point alignment model. The key is that it doesn't matter which coordinate system you use so long as all applications are set to the same system.

Additional Notes about EQTour

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. The additional settings are visible only if you click the [> > >] button.
. The additional settings has an option to set the horizon altitude. Setting this value above
degrees will hide objects from the tour list below that level.
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. Right clicking the object list will expand or reduce the display... revealing or hiding the
controls.
. The settings for EQTour are stored in a file *EQTOUR.ini* in folder:
C:\Documents and Settings\YourLoginAccountName\Application Data\EQMOD

Language Customization for EQMOD and EQMosaic and EQTour

EQMOD and *EQTOUR* and *EQMOSAIC* support the use of language specific *dlls* where all language specific text is held.
Developers wishing only to translate these products now can do so by creating a separate language *dll* without the need to modify the main body of code.
The code works as follows:
On start-up the applications determine you language automatically from your PC's locale settings. They then attempt to load a *dll* named EQMODxx.dll/*EQTOURxx.dll* / *EQMOSxx.dll* - where xx is an abbreviated form of your language i.e. en=English fr=French etc.
If a suitably named *dll* cannot be English is used by default (an English *dll* need not be present for this).
For testing purposes the language *dll* used can be overridden by editing the *LANG_DLL* entry in the application *ini* file and assigning a filename.
Each time the application requires text data it attempts to retrieve it from the language *dll*. If the particular text doesn't exist, then the English text will be used instead. In this way, if for some reason translated *dlls* lag behind the current English version all that will happen is that English text will appear where new text has been added.
Included in the zips are VB projects for creating the language *dlls*. To start a new translation do the following
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2
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. Copy and rename one of the exiting projects
. Copy the *EN.res* file from the main project parent directory.
. Edit the string table of the resource file as needed
. Build the *dll* , making sure its named according to the convention mentioned earlier.
. Copy the new *dll* to the parent directory.
An alternative method would be to copy and rename an existing dll and use a resource editing program (there are many free ones available) to edit the dll directly. Note that ideally translated text should be of equivalent length as the original English to ensure it will fit in the space allocated for buttons, labels, etc.

Summary of recently added EQASCOM functions as of v1.22g.

EQASCOM setup screen

Some of the following settings need access to the EQASCOM setup screen

Programs | EQMOD |EQASCOM |Scripts | Setup EQASCOM

Max slew rate (introduced with V1.21e)

Provided the "Show Advanced Settings" option has been checked on the EQASCOM setup screen the user now has the option to limit the slew rate of Gotos and Parks/Unparks.

The way this works is that rather than telling the mount to goto a specific position, EQASCOM now just sets it moving in the appropriate direction. It then monitors the mounts position until it has passed the desired target position and then issues a normal goto. Because the mount is close to the intended target the slew is implemented at a slow rate by the mount.

Please note that there are potential control issues in operating in this way. Whilst the standard goto method will always stop when reaching the target position, this alternate method will only stop upon instruction by EQASCOM. So if communications are lost it is possible that the mount will slew continuously. It is therefore not advised to use this feature when operating the mount remotely.

This function was introduced at the request of those in extremely cold climates where the standard high speed slews were becoming inaccurate.

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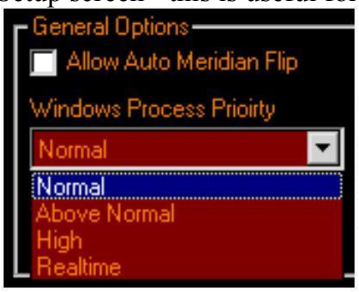
Windows process priority (introduced with V1.21e)

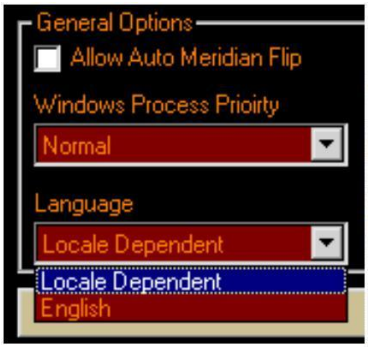
The EQASCOM setup screen now allows the user to define the windows process priority at which EQASCOM will run.

EQASCOM by default runs at Normal priority but if experience problems when running in combination with other applications (particularly comms failures etc.) then try increasing the priority. Be aware that a priority level of "Realtime" is used by windows for handling mice and the keyboard etc. and increasing EQASCOM up to that level may affect the responsiveness of those devices.

Override language to English (introduced with V1.22a)

Language can now be overridden to English from via Setup screen - this is useful for investigating language dependent issues.

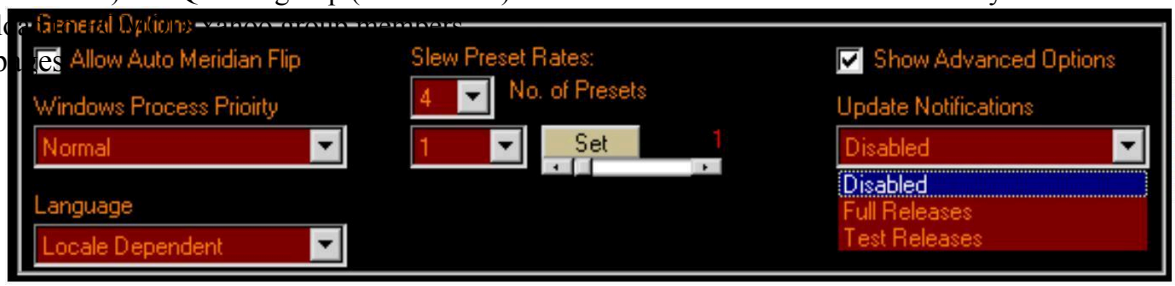




Update checking and notification (introduced with V1.22a)

EQASCOM can, provided an internet connection is available, check for updates. This is configured via the EQASCOM setup screen and you can opt to be notified of Full Releases, Test Releases (full releases are always initially released as test releases) or you can of course disable the feature completely (which is the default).
On startup EQASCOM will then check for the latest versions and should a newer one be available then an "

Updates" button will appear on the main screen. Hovering over button with the mouse should show the latest version number.
Pressing the "updates" button will then open up the default browser and will navigate either to sourceforge download page (full releases) or EQMOD group (test releases). Please note that "Test Releases" are only available for downl



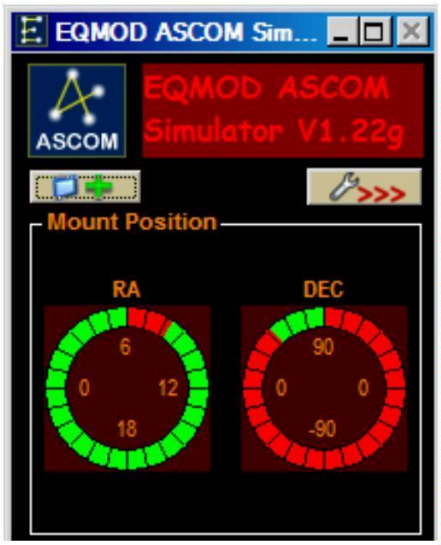
Multiple Goto Bookmarks (introduced with V1.22e)

Rather than just a single bookmark you can now add as many as you like. The bookmarked positions now appear in a list, clicking on the list will recall a position. Please note that these "bookmarks" are currently not saved so will be lost on EQASCOM closure.

Goto Bookmarks might be useful for navigating to and from “focus stars” or for doing stellar comparisons etc. Those wanting a more sophisticated bookmark facility might consider using the EQTOUR application (which has a quick launch facility from the EQASCOM UI)

Mount Position dials (introduced with V1.22f)

The position of RA and DEC axis is shown using two dials. When at the home position (i.e. pointing to the pole) the dials will read RA=6, DEC= 90 and you can imagine yourself standing behind the mount looking to the pole. If the mount is slewed west the RA dial will move to the left. If the mount is slewed North DEC dial will move to the right.



Save Alignment preset on append (introduced with V1.22g)

If the “Save alignment Points to Preset on APPEND” option is checked then every time a new point is added to the pointing model (whether via sync or dialog based alignment) then the current alignment list is saved to the active reset.

This might be particularly useful for those setting up afresh each night as it ensures that in the event of accidental EQASCOM closure, PC crash or PC power failure the alignment is not lost and can be reloaded when EQASCOM is subsequently restarted.

Summary of Recent Changes since v1.12k

EQASCOM_V125c

Support added for NMEA ZDA message (time & date).

EQASCOM_V125b

Last GPS baud rate in the dropdown now comes from ini file so user can override to their own custom rates.

Fix to park timer which would unpark the mount if while active it detected the mount was currently parked.

EQASCOM_V125a

Guiding type now set via setup screen.

Main interface only displays guiding params for the guiding type being used.

Guide rates can now be written via ASCOM for both ST-4 and Pulseguiding.

EQASCOM_V124g

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Screen position remembered.

EQASCOM_V124f

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Fix to Southern Hemisphere alignment editor plot.

Sigma Octans added to pole star list.

Fix to EQTOUR/EQMOSAIC launcher when no files defined.

EQASCOM_V124e

Fix to Meridian limits - if cleared defaults were applied on restart.

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EQASCOM_V124d

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Fix to proximity limit initialisation

Removal of code that restricts mount characteristics to previously "known" synta types.

EQASCOM_V124c

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Setup Option to allow ASCOM clients to change site settings.

Bug fix to handle exception when changing active screen whilst maximised.

EQASCOM_V124b

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Correction to polar scope precession view

New slew controls only display mode.

EQASCOM_V124a

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Option to show Polaris precession added to polar scope tool.

Ra/Dec reverse sound assignments

Park timer added.

Change to Side of Pier calculations in line with ASCOM's latest documentation

EQASCOM_V123t

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fix to move axis in southern hemisphere (where rate change is small!)

Updated custom mount definitions to include more belt drive mods.

EQASCOM_V123s

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Sound definitions added for Game pad lock and monitor toggle.

Emergency stop given precedence when game pad lock on.

EQASCOM_V123r

Fix to parking from easterly position when using custom go to speeds (mount didn't stop at park position)

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EQASCOM_V123q

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Range checking on site coords - error prompt displayed if out of range.

Screen saver/monitor power toggle button added to gamepad control

Gamepad lock toggle button added to gamepad control

EQASCOM_V123p

Further Bug fix associated with V1.23n changes.

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EQASCOM_V123n

Bug fix for EQ3, EQ5 upgrade mounts (introduced with V1.23k). Meridian position was being assigned EQ6Pro/HEQ5 defaults.

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EQASCOM_V123m

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Change to app launching (EQTOUR, EQMOSAIC, TonighSky) to allow restoration form a minimised state.
Fix to flipped goto when flipping from a counterweights up position with limits off (was using limit position rather then horizontal as RA pivot point)
Popup menu to change display

EQASCOM_V123k

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Change to safe goto's when limits are on - if moving from an out of limit position the goto with first move to the limit position in RA only before completing the move to target (previously moves were made via home position).

EQASCOM_V123j

Change to "safe" gotos when limits are off and moving from a CW up position - slews/parks are routed via median position rather than home position.

EQASCOM_V123i

Listbox added to Setup form slew preset definition. Bug fix to exception caused when undefined rate is applied.

EQASCOM_V123h

Choice of pole stars now offered via drop down list
Setting of Polarscope home position now prompts for confirmation.
Bug fix to prevent POV buttons from closing alignment dialogue.

EQASCOM_V123g

More fixes to southern hemisphere polar scope alignment.

EQASCOM_V123f

Fix to "crash" if rate preset selected via gamepad button is greater than the number of presets currently defined.
Updated Romainian translation dll
Manual Sync script added to install
Read of GuideRates via ASCOM now supported (for pulse guide).
Changes to polar scope alignment to handle southern hemisphere use.

EQASCOM_V123e

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Fix to bug in "safe slew" code that change home park position.
Extra error handling in setup dialog
Gamepad Monitor app now allows manual selection if more than one gamepad is installed.
Updated Dutch translation dll

EQASCOM_V123d

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Fix to ensure multi part slews are aborted when parking
Fix to ensure parks are only ever initiated if the mount is unparked - exception is park to current which can interrupt a parking mount.

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Fix to ensure unparks are only ever initiated if the mount is parked.
Fix to ensure Flipped goto state/checkbox is cleared on park (for the case where a goto doesn't complete).

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Fix to update the Park status display on emergency stop (previously mount would park but no indication was given)
Fix to RA Limit ini file initialisation. If RA limits were not defined (i.e. first use) the EAST and WEST limit were written with the same default value. Now correct defaults are assigned.
Number of parks/unparks uncreased to 10
Change to prevent undefined parks or unparks from being selected.
Flashing Limit display now indicates which type of limits are triggered (Horizon or Meridian).
Meridian limits suppressed during CW up type slews.

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EQMOD_ASCOM_V123c

Parked status now flashes in the main coordinate area when parked.

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Emergency Stop (slew controls and Gamepad) now performs a park to current. (tracking stop just stops motors)

Park from CW up positions now always implemented as a RA slew to the RA home followed by a slew in declination only to Park declination followed by a final slew in RA to the PARK RA.

Slews from CW up positions with limits off now always implemented as a slew in RA to the RA home followed by a slew in declination only to target declination followed by a final iterative slew in RA to the target RA.

Fix to AutoRASync ini file initialisation - previously defaulted to off rather than on for clean installs

Position dials added to Park/Unpark definition dialog allowing the user to verify the current definitions.

Toolbox:- View ini file added.

EQMOD_ASCOM_V123b

Fix to sync too big bug which whilst rejecting the sync would apply it as a fixed offset.

Slews to CW up targets now always implemented as a slew in RA to the RA home followed by a slew in declination only to target declination followed by a final iterative slew in RA to the target RA.

Fix to custom tracking for southern hemisphere RA track rates - previously RA axis motion was reversed requiring the entry of "negative" rates.

Fix for EQ5 type bug (invalid stepcount error) introduced with previous version.

Fix to bug that reset alignment preset name on point append.

EQMOD_ASCOM_V123a

Graphical display of RA limits on main UI and limits editor

Addition of one shot Counter Weights Up goto - allows a forced flip provided the end position is within defined limits.

Dead Man's Switch added as a gamepad option. Releasing whilst slewing will immediately park the mount to the current position.

EQMOD_ASCOM_V122j

Updated French dll/Updated Italian

Toolbox fix - allow disconnect on connection fail.

PEC fix - switched to wrong display on PEC load

Polar Scope home - start position (clock position) now saved along with mount position

EQASCOM_RUN - now starts in system tray

Gamepad monitor added to install

GPS NMEA trace added - right click on GPS data frame to show left click to hide.

EQMOD_ASCOM_V122i

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Setup Form and Custom Mount translation support (extra strings added)
Updated Dutch dll

EQMOD_ASCOM_V122h

Simulator form, minimise added. Now starts minimised latitude and longitude site details now has seconds entry box.
New COM interface added to allow reading of the dec axis position (0-360 degrees rather than 0+-90)

EQMOD_ASCOM_V122g

Save Alignment Points to Preset on APPEND option added.

EQMOD_ASCOM_V122f

Further changes to simulator display.
Axis position dials added to main display.

EQMOD_ASCOM_V122e

Fix to simulator RA display.
Goto screen (right click on the main display RA/DEC coords) now provides a bookmarked positions list replacing the previous single bookmark.

EQMOD_ASCOM_V122d

Fix to custom rate calculations for EQ5 type mounts.

EQMOD_ASCOM_V122c

Backlash range increased upto 200ms max
Mount param debug.

EQMOD_ASCOM_V122b

Slew rate Limit dropdown replaced with slider control.

EQMOD_ASCOM_V122a

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Fix to solar and lunar "sound" labels
Fix to Italian language translation that affected joystick config parsing
Ability to override language to English (setup screen)
Update checking and notification.

EQMOD_ASCOM_V121e

Max slew rate feature introduced (requires evaluation)
Ability to increase windows process priority

EQMOD_ASCOM_V121d

Clear sync, Define Park and Resynch encoder text buttons replaced with graphics
Italian language dll

EQMOD_ASCOM_V121c

Graphical button backgrounds set to icon background colour.
ASCOM option for synchronous parking - May be important if your client application expects
EQASCOM to "block" until the mount is parked (ASCOM standard method).
Initialisation errors are now displayed on the main mount status display.
Points List, Clear Alignment and Add Point buttons replaced with graphical buttons.
Rate changes can now be made on the fly whilst manually slewing.

EQMOD_ASCOM_V121b

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current Sitename now stored in ini file
eqascom_run - error handling improved and polling suspended during shutdown prompt.
Fix to custom mount RA/DEC dropdown initialisation.

EQMOD_ASCOM_V121a

Custom Mount tracking offset added to ini file - allows users to apply a larger offset than is available via drift compensation.
Custom mount setup dialog added (accessed from button on setup screen)
Graphical buttons replacing text - cleaner interface
Gamepad setup accessible from setup screen.
Toolbox ini file move between simulator and EQASCOM
GPS option added to setup screen.
Site presets added to setup screen.

EQMOD_ASCOM_V120k

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Fix to PC beep on rate preset change (long beep on max/min preset had been lost)

EQMOD_ASCOM_V120j

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Message and ASCOM file logs now use a two file approach to prevent massive logs. Each file contains
000 logs.

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New and updated language dlls.

EQMOD_ASCOM_V120i

Declination backlash compensation for pulse guide.

EQMOD_ASCOM_V120h

ASCOM PulseGuide command now will have no effect on E/W directions if not tracking. Previously there was a bug that meant the requested pulse never completed.

EQMOD_ASCOM_V120g

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o'clock and 9 o'clock starting positions added to polar alignment.

Gamepad button assignment option added for Polar Scope alignment

Alignment sounds (Accept, Cancel End)

Polar Scope Alignment sounds.

EQMOD_ASCOM_V120f

Goto initiation sound option.

fix to align dialog slew button layout.

Optimisation of goto handling.

EQMOD_ASCOM_V120e

More sounds (tracking and unpark).

PoleStar Hour Angle no uses J2000 coords and applies precession.

EQMOD_ASCOM_V120d

Greater sound control for folks who like to have their mount's speak to them.

EQMOD_ASCOM_V120c

Minor fix to slew resolution ini default , V1.20b set this to 0 by mistake. V1.20c will automatically fix existing ini files to the correct default of 10.

EQMOD_ASCOM_V120b

Advanced" checkbox added to setup form - When checked various "advanced controls on the

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EQASCOM UI are made visible

Auto RA sync is now only displayed when operating in "advanced mode"

New option for 3-star "Closest Points" or "Best Center" This is an advanced feature.

New "point filter" dropdown - "All", "PierSide Only" and "Local Quadrant"

Number of Slew iterations is now read from the ini file.

Slew termination resolution no read from ini file

Pulseguide enable / disable via ASCOM commandstring.

Fix to manual Horizon entry.

EQMOD_ASCOM_V120a

Improvement to Alignment pierside implementation.

Minor improvements to alignment map display.

EQMOD_ASCOM_V119g

Change to slew release code to put back to V119a state - some problems reported with sidereal not restarting.

EQMOD_ASCOM_V119f

Fix to simulator - was terminating slews early due to rA tracking stopping DEC motor.

Store and Recall functions added to goto form.

EQMOD_ASCOM_V119e

Fix gamepad slew south - didn't work when assigned to button rather than POV.

EQMOD_ASCOM_V119d

Goto form placed "on top" when opened.

Search option added to setup form to auto-detect com port (when connected to mount).

EQMOD_ASCOM_V119c

Optimisation of slew release for sub-sidereal speeds.

EQMOD_ASCOM_V119b

Icons added to dialogs

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Bug fix to drift compensation value which was reset if comms failure stopped EQASCOM initialising

Fix to slews (southern hemisphere and sub-sidereal)

Addition to game pad configuration to allow the device to be explicitly selected rather than using automatic detection.

Preparatory work for wider mount support.

EQMOD_ASCOM_V119a

New "proximity range" parameter as part of N-Point Alignment. Existing points within range of a new point are automatically removed from the points list.

Slew Rates now include pulse guide rates for sub sidereal rate movement.

Setup form not includes ability to define Slew preset rates

Fix to E, NE and SE slews when at x1 rate.

EQMOD_ASCOM_V118m

Fix to sync handling and POV controls (POV buttons were initiating syncs)

Goto function added (right click RA/DEC display)

EQMOD_ASCOM_V118l

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Fix to Westward slew commands when reversed.

Fix to allows NW and SW slews to take into account tracking.

EQMOD_ASCOM_V118k

POV disable option now applies during game pad configuration.

EQMOD_ASCOM_V118j

Slew pad rates linked to main interface rate sliders - so if main sliders change so do slew pad rates.

EQMOD_ASCOM_V118i

Pulseguide logging always active.

Bug fix to POV handling

EQMOD_ASCOM_V118h

Slew pad keyboard handling. Rate preset change via + and -, *=spiral search.

Game pad handling - POV (D-PAD) buttons now capable of individual assignment

Pulse guide monitors now wrap around - cursor added to show current position.

Fix to limit detection during slews (limits were always applied regardless of the limit on slew option)

EQMOD_ASCOM_V118g

Minor change to point transformation map display of mount position.

CommandString interfaces added for reading and writing PulseGuide rates

CommandString interfaces added for reading and writing ST4 Guide rates

Exception handling improvements to GPS serial communications (may help will dodgy drivers!).

EQMOD_ASCOM_V118f

Fix to points list delete (would delete even if list was empty)

Wider range of GPS baud rates supported

Re-write of command string parsing

EQMOD_ASCOM_V118e

Goto Star hidden from Point editor (button and menu)

Code speed efficiency improved on alignment list searches

Fix to reading of ASCOM RightAscensionRate property.

EQMOD_ASCOM_V118d

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Key handling for points list selection changes

ini file handling - bug fix to handle very large ini files.

Transformation map now "draws as it goes" so folks can see the progress (important for large points lists)

EQMOD_ASCOM_V118c

Points editor now automatically refreshes list if alignment point count changes.

Points editor is sizable

EQMOD_ASCOM_V118b

Time to Meridian limit added

Rework of points list display to use tabs

alignment map moved to Points Editor - many improvements

EQMOD_ASCOM_V118a

Alignment Save now crops data to alignment point count. Previously "unused" entries could remain in the ini file (they caused no harm, but were confusing)

Park status is now written to the ini whenever the mount unparks. Previously "unparks" were only written on closure which meant that in event of a PC crash the an "unparked" mount could appear as parked on subsequent restart (thereby loosing PEC sync).

Sync button added to game pad handling

Rework to provide support for early binding.

EQMOD_ASCOM_V117f

Bug fix to ASCOM Pulseguide enable - was associated with exception disable state.

EQMOD_ASCOM_V117e

Simulator fixes & improvements

Custom rate - rates up to 12000 arc secs / sec allowed.

Fixes to on the fly rate change behaviour - motors were stopping if moving from slow to fast rates.

Log message center to file.

Option to disable ASCOM exceptions.

This version was withdrawn and replaced with v117f

EQMOD_ASCOM_V117d

Fix to loading of custom mount parameters

EQMOD_ASCOM_V117c

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Resynch Encoders button added.

EQASCOM_toolbox included in the install

EQMOD_ASCOM_V117b

Fix to simulator read of motor positions - wrap arounds were not simulated and out of range values were returned.

EQMOD_ASCOM_V117a

Correction of default used for Polaris RA.

POV disable option added to allow ASCOMPAD to control focuser using those buttons.

Affine Taki+Polar checkbox hidden

Alignment process simplified.

EQMOD_ASCOM_V116k

New ASCOM interfaces to initiate the various park/unpark modes

Fix to button decoding when using Spanish/Dutch land dlls

Disabling of Polar Alignment measurement pending completion - enable ini file (POLAR_ALIGNMENT=1)

Fix to store N-Point Alignment mode (nearest didn't previously save)

Preparatory work for goto slew rate option - not active yet though.

PEC debug options slightly modified.

Fix to simulator sidereal rate.

Optional GPS initializer string (via ini file key GPS_INITSTRING)

Alternate 12 o'clock start position for polarscope alignment.

N- Point alignment option removed from user interface (N-Point+nearest is better)

EQMOD_ASCOM_V116j

Sound config options added. WAVfile alternative to beep.

EQMOD_ASCOM_BETA_V116i

Puleguide ignored if slewing

Simulator - replaced pie charts to remove need for mschrt20.ocx

Simulator - initializes to use EQASCOM site coords.

Fix to ini Meridian Flip ini reads (didn't work for non English locales)

EQMOD_ASCOM_BETA_V116h

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Fix to edit of park/unpark position name.

EQMOD_ASCOM_BETA_V116g

Fix to limits - limit on slew status not saved to ini

Fix to W slew (if tracking rate=rate+1 to compensate for sidereal motion)

Number of definable park and unpark position increased to 5

Fix so alignment save on park never writes empty alignment lists

EQMOD_ASCOM_BETA_V116f

Fix to support PECPHASE, PECGAIN reads

Fix to PEC phase slider change.

Addition of PECFILE interface.

EQMOD_ASCOM_BETA_V116e

Main form height reduced slightly

Fix to PECSET

EQMOD_ASCOM_BETA_V116d

Fix to PEC Export

EQMOD_ASCOM_BETA_V116c

Align polarscope home position definition and goto functions added.

Fix to PEC

EQMOD_ASCOM_BETA_V116b

Align polarscope function added.

EQMOD_ASCOM_BETA_V116a

ASCOM CommandString Interface to support PEC Phase, PEC Gain

ASCOM CommandString change so the enabling/disabling PEC also starts/stops tracking

ASCOM CommandString Interface to support MOUNTVER, DRIVRVER and DLLVER

Go faster N-point calculations.

Max stars used in N-Point calc read from ini file

Resizeable polarscope view

EQMOD_ASCOM_BETA_V115h

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Custom mount support - test release

PEC restructure.

EQMOD_ASCOM_BETA_V115f

Alignment preset index saved on preset load and save (previously only saved on form closure).

Com port string prefix added for com10+ support

EQMOD_ASCOM_BETA_V115d

Setup form forced to top.

EQMOD_ASCOM_BETA_V115c

Manual guiding via slew controls using pulseguide movements

EQMOD_ASCOM_BETA_V115b

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txt extension forced for limit file saves

ASCOM error messages corrected.

EQMOD_ASCOM_BETA_V115a

Automatic pier flip option added.

Park to current no longer redefines the user defined park.

EQMOD_ASCOM_BETA_V114g

Fix to bug preventing Tour launch.

Bug fix to Alignment save / load (wouldn't let you select both options)

Bug fix to pulseguide enable defaults

EQMOD_ASCOM_BETA_V114f

Encoder timer changed to be more tolerant of communications failures. On failure the emulated RA and last known DEC positions are used. An emergency stop is tried after five successive failures.

EQMOD_ASCOM_BETA_V114e

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Bug fix: moveaxis - RA and DEC axis prescaler was left a default "1" if rate was negative.
Bug fix: If park state was "parking" joystick controls were still active.
Bug Fix: Alt and Az labels swapped in Horizon Editor listbox.
Bug Fix: Limit file reference now cleared when horizon is cleared.
Bug Fix: Horizon editor checkbox not initialised on form load.

EQMOD_ASCOM_BETA_V114d

Horizon editor added
ASCOM Pulseguide can be disabled if need,

EQMOD_ASCOM_BETA_V114C

Log to file added to ASCOM trace
PEC now automatically applied to sidereal tracking.
RA & DEc included in PEC timestamp
Fix:- ASCOM interface now only returns status as parked when scope reaches park position - previously it would report parked whilst the mount was still parking.
Fix: ASCOM AbortSlew. Slew aborts only applied if already slewing. On abort completion tracking is returned to pre-slew rate.
Self installer added.

EQMOD_ASCOM_BETA_V114b

ASCOM trace added (double click ASCOM logo)
EQTour & EQMOSAIC launch now writes ASCOM driver ID to their ini files.
Option for full ASCOM compliance - No slews unless tracking is set (default to non compliant to work with CDC, HNSKY, Stellarium)
PEC ASCOM interface added via CommandString.
Alignment preset load, bug fix to allow for internationalisation (decimal separator)

EQMOD_ASCOM_BETA_V114a

Joystick calibration
Joystick disable option via ini file
ASCOM DestinationPierSider support
AS0COM tracking - tracking rate offsets applied whenever tracking started.
ASCOM Park check and error reporting for MoveAxis, tracking etc. - greater level of conformance
PEC extra error handling and debug output

EQMOD_ASCOM_BETA_V113t

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Support for ASCOM Rates collection

EQMOD_ASCOM_BETA_V113s

Option to load alignment from preset on unpark
Option to save alignment to preset on park
Right click added to Tour/Mosaic buttons to set exe path.
Tooltips added for Mosaic & Tour buttons
PoleStar Hour angle display added.
File name now displayed as part of PEC status frame title
Updated Spanish dll

EQMOD_ASCOM_BETA_V113r

Fix to EQ5 & EQ3 steps per worm rev calculation

EQMOD_ASCOM_BETA_V113p

ASCOM PierSide read support added.

EQMOD_ASCOM_BETA_V113p

N-point 3-Point Center Point, Sync Append as N-point

EQMOD_ASCOM_BETA_V1130

M0odified N-point (ALT/AZ Coordinate Transformation)

EQMOD_ASCOM_V113n

Additional error checking to Tour/Mosaic quick launch.
Form resize of Joystick config form (left bigger than it need be in a previous release)

EQMOD_ASCOM_BETA_V113m

Addition of EQMosaic and EQTour quick launch buttons.
Spiral button replaced with graphical button.
Park/Unpark button now takes caption text from appropriate park/unpark drop down.
Spanish dll updated.
Polar Alignment tool - Initial framework included for evaluation.

EQMOD_ASCOM_BETA_V113L

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Park status saved on DCOM termination, ASCOM disconnection and on PARK slew completion
Mount status now shows "PARKING..." and "PARKED" when slew is complete.
PulseGuide Monitor moved to one of the cyclic status displays. Individual zoom for RA and DEC axis.

EQMOD_ASCOM_BETA_V113k

Park/Unpark operation:
Individual Park buttons replaced with drop-downs list to select behaviour and single Park/Unpark button to action.
ASCOM Pulseguide Monitor:
Available via double click on ASCOM PulseGuiding frame.
Pulseguide corrections are plotted across a time axis with the height/amplitude of the wave determined by the duration value being passed to the eqmod driver.
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Here you can easily visualize the characteristics of the corrections being sent to the mount. Sample of them would be oscillations or correction overshoots, undershoots (less aggressive) and no correction at all. The graph changes real time depending on the type of modifications made to the guiding parameters.
RA and DEC Correction Pulsewidth gain:
A 100% gain setting means EQMOD will apply "as is" the correction
duration value as provided by the client autoguiding software. Anything below 100 will force EQMOD to reduce the correction duration as a "percentage" of what the autoguiding software has submitted. That is for example a "75%" gain setting would convert a 100 millisecond
correction to 75 milliseconds.
Motor Position Emulation:
EQMOD ASCOM now emulates the values in between the 200ms AutoRA
Sync sample. Previously clients requesting either motor position or RA/DEC coordinates may have read values up to 200ms out of date. New 'emulated' values are now calculated on request.

PEC: PE correction rates are now pre-calculated to ensure minimum drift remained caused by the quantisation of ideal rate into those the mount can recognise. Any drift induced by PEC can be assessed by using the EQMOD_RA_DRIFT_METER application with PEC running and noting any net gain over a multi cycle period (there will be cyclical drift due to the correction process).
The PEC playback is now automatically resynchronised to the current motor position and so the [r00esynch] button has been removed.
An issue with earlier mount control boards not returning the number of worm steps has been fixed. If a valid number isn't returned then it is loaded from the ini file instead (default EQ6 value).
PEC save now uses a file format compatible with perecorder version 1.0.12 or later. PEC file load has been change to accept perecorder V1.0.12 file format (earlier versions should also load).
Graphical tracking buttons are trialled with this version. Each button displays associated tooltip text (loaded from the various language dlls) when hovering over it
EQMOD V1.13j includes French, Spanish and Dutch language dlls.

Fix:

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Pulse guide Interval setting automatically saved on ini file upon movement of the slider bar and not only on driver exit.

New:

Added an "Auto RA Sync" option

Auto RA Sync function was initially applied on old EQMOD releases and then removed when Maurice reported a drift when the mount is being polled at a regular interval of 200ms. However this drift is not known to exist on mounts on later versions. If ever the drift exists, it can be compensated using the RA Drift Compensate slider bar (which is not available as user-define-able setting back then). Auto syncing will work best for PERecorder and PECPlayback without relying on the emulated stepper values as it reads absolute mount positions both during recording and during playback.

With this release, the auto sync function is made available at the user's option to enable it or to disable it. To make PEC work best on the two modes;

Auto RA Sync function Disabled: RA value is generated using emulated (PC clock accurate) stepper values

*

RA Motor counter values are emulated here and less communication is imposed on the board avoiding any Comms drift.

Mount has to be properly RA Drift Compensated for the emulation data to be (tuned to the

*

sidereal rate) virtually "In Sync" with the mount's stepper motor counter. PEC should become accurate at this point avoiding any "PEC drift" as earlier reported by Chris V.

*

This setting will work best on old board versions (V1.05 and earlier) as the mount does not require RA Drift compensation and the emulated data is always in-sync with the true stepper counter data.

Auto RA Sync function Enabled: RA Emulation is disabled here as EQMOD reads the stepper board every 200ms

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*

May exhibit a COMMs drift on earlier board version which can be easily compensated using the "RA Drift Compensation"

*

PERecorder and PECPlayer will be A LWAY S "in Sync" here avoiding "PEC Drift" but you have to watch out for the reported COMMs drift

If user is not using PEC, best option is to disable the AutoSync function. This to ensure that there will be no COMMs drift regardless of board version. If user wishes to use PEC, both modes will work, you are simply required to RA Drift Compensate on both settings.

The RA Drift Compensation setting is automatically reset to "0" whenever the RA Sync function setting is changed. This ensures that the user has to re-define his RA compensation settings.

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The EQMOD PROJECT
EQMOD_ASCOM_BETA_V113h

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Uploaded a test version of the EQMOD driver which improves the Stepper Emulator routines (used primarily for PERecording and PEC playback). Sidereal tracking accuracy is not related to this modification.
The versions prior to this release uses VB timers as 'software emulation' for stepper counters. The VB timers tend to lose their count accuracy whenever there are heavy processes working at the windows background and the errors tend to accumulate until the next sync operation because the stepper motor count is incremented based on fixed a constant on every timer tick.
Current version uses the PC's on-board hardware clock as basis for the computation. The VB timer here is now used to read the PC clock and convert its value to an emulated stepper motor count.
This version also includes the V1.3 Spanish DLL.
EQMOD_ASCOM_BETA_V113g

Fix:
Extend RA Compensation settings: from -20 up to 20 (at 0.024 rcsec/sec per step)
RA Compensation settings now also compensates joystick/button/pad count slews
New Adjustable Eqmod Parameter:
Pulse guide Granularity Setting (Minimum Correction Pulse width) - The original minimum width setting was hard coded to 50 milliseconds (default value). Users can now adjust this value using a slider bar from 10 milliseconds to 50 milliseconds allowing correction pulse widths as low as 10 milliseconds on the given guide rate. PHD for example have correction duration values lower than 50 milliseconds. The combination of PEC, Drift compensation and Pulseguide granularity settings would allow the autoguiding software to poke even "minuscule" corrections to the mount from 0.1x up to
0
.9x of the sidereal rate.
Users who are comfortable with their own pulse guide settings should keep this value to 50 milliseconds.

EQMOD_ASCOM_BETA_V113f

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Drift compensation slider bar. This slider bar basically "fine-tunes" the RA motor tracking rate. However, not all mounts require RA motor speed compensation, thus you may have to leave the settings to 0.

The drift compensation slider bar settings are stored in the ini file

thus this should only be a one time setting unless you feel the need to compensate also for drift caused by polar alignment.

Usage:

Basically you move the slider bar to the desired setting and then click any of the tracking buttons. A positive value rotates the motor faster, a negative value rotates the motor slower.

NOTE: You need to click the desired tracking button again every time you change the compensation setting.

The drift compensation settings also adjusts the custom tracking rate, PEC, Sidereal, lunar, Solar, and pulse guide rates using your target minimal drift sidereal rate as the base rate.

The RA compensation setting does not affect the mounts slews (spiral, gotos, joystick, pad).

EQMOD_ASCOM_BETA_113e

"PEC+Sidereal" displayed when tracking with PEC (previously custom rate was displayed)

Joystick configuration modified to include PEC+Sidereal tracking button assignment.

Mount worm period is now determined automatically thereby providing PEC support for EQ5. The Worm Period is exposed via Com interface RAWormPeriod.

Sidereal rate stored and read form the EQMOD ini file.

TimeStamp button added to the PEC display. When pressed, EQMOD reads the mounts RA motor position and writes it, together timestamp to the

ini file. This feature is included so that if third party software such as K3CCDTools or PHD etc. is used record sidereal PE it will be possible for PECPrep to use the position time stamp to synchronise the acquired data to worm position and thereby produce a PE file that can be read into perecorder for smoothing & drift removal. Whilst perecorder is the preferred tool for PE acquisition this may provide an acceptable method for those using camera types that perecorder doesn't currently support.

PEC + Pulse guiding changes:

When a pulse guide command is received the correction pulse is applied using the current PEC rate not sidereal. During the pulse period PEC rate calculations continue but are not applied to the mount. When the Pulse finishes the rate is set to the result of the most recent PEC calculation.

Sync mode and N-Point checkboxes have been replaced with two drop down lists – "Alignment Behavior" and "Sync Behavior". Hopefully this will remove some confusion over these options.

EQMOD_ASCOM_BETA_V113d

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Changes from previous version as follows:
Bug fix to Autoguider DEC rate load from ini
PE corrections stopped on Park.
[Sidereal + PEC] button enabled on manual PEC file load.
New [Display+] button added to cycle through main status displays
On manual PEC file load main status frame shows the PEC curve.
[setup] button moved to allow minimal desktop footprint.
Window now restores both height when setup is closed - If the user resizes the window (perhaps to show only the status display) then on [setup] the window is expanded in height and width - on closing setup the window restores to the previous size.

EQMOD_ASCOM_BETA_113c

Integrated PEC playback. This represents the first stage of full PEC integration and allows tracking a PEC+Sidereal rate.
Full integration of PEC with other EQMOD services such as pulse guiding, gamepad button support etc. have not yet be completed and
will follow in due course.
Some interface changes have been necessary to make space to add this
new feature.:
PulseGuiding settings: Vertical sliders have been replaced by horizontal sliders.
AutoGuider Port Rate: Individual rate buttons replaced by drop down lists.
Alignment/Sync: AFFINE_TAKI+POLAR option added (removed from "Other Settings")
Slew Controls: Spiral search controls added (removed from "Other Settings")
Track Rate: Custom tracking controls added; PEC+Sidereal button Added.

EQMOD_ASCOM_BETA_V113b

A new 'custom' interface to allow clients to instigate Sidereal rate adjustment without causing EQMOD to background poll the RA/DEC motor positions (the current MoveAxis interface does this). This interface may be subsequently removed once PEC has been fully integrated into EQMOD itself.
The Custom Tracking Rate is now saved into the ini file on EQMOD load
and saved on EQMOD closure as per the recent request on this forum.

The EQMOD PROJECT
EQMOD_ASCOM_BETA_V113a

The simulator and actual driver now use separate ini files. Find the sim files in %appdata
\EQMOD_SIM. If you want you can copy ini files back and forth as much as you like.
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%
EQMOD_ASCOM_BETA_V112l

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Bug fixes:
RA Limit reset was still being overridden to default position on start up. Now if you set it to 0 it stays at 0.
If EQMOD was maximised then the setup button pressed it would crash due to an unhandled exception
–
fix: handle the exception!
Fix to MoveAxis function such that in-progress slews take priority.
New features
The Slewpad from can now be resized and the associate controls will reposition accordingly. This allows you to have a larger (or indeed smaller) slew pad area to receive mouse clicks. Dimensions are stored in the ini file so are preserved
Two new COM interfaces added SyncRaMotor and SyncDecMotor. These return the current motor position from the mount and force a synchronisation of the emulated positions maintained by the driver. The provision of these new functions is the primary reason for this release as they are useful in syncronising motor position with PEC capture and Playback (currently under development). It is likely that to use these applications in future V112l or later will be a pre-requisite.

Table of Contents