FocusMax Help

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Introduction

Introduction

Focusing CCD-based telescopes is one of the drudgeries astronomers constantly face. FocusMax was designed to solve this difficult problem! With availability of motorized focusing hardware, comes an opportunity to fully automate the focusing operation. FocusMax is routinely used in unattended, all-night robotic-telescope operations such as asteroid and supernova searches, astrometry, photometry, imaging, etc. The only requirements are a CCD based telescope, a commercially available motorized-focuser and CCD camera control software. FocusMax can be downloaded from HTTP://www.focusmax.org. Check our site regularly for updates.

I hope you enjoy FocusMax

Steve Brady

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Release Notes
Requirements
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Support

Created with the Standard Edition of HelpNDoc: iPhone web sites made easy

Version

Version date: Feb-25, 2014

Created with the Standard Edition of HelpNDoc: Easily create EPub books

Requirements

Requirements

Imaging software:

CCDSoft from Software Bisque http://www.bisque.com/sc/
                 ** OR **
MaxIm DL/CCD from Diffraction Limited http://www.cyanogen.com/

ASCOM Platform:

http://ascom-standards.org/

Drivers:

Focuser driver from focuser provider or link above

Telescope Drivers (required for telescope control)

Planetarium Programs (not required but desirable):

TheSky from Software Bisque http://www.bisque.com/sc/

Starry Night Pro from Starry Night http://www.starrynight.com/

DeepSky from DeepSky http://www.deepsky2000.com/

See current listing at http://ascom-standards.org/Community/Partners.htm

Astrometric Engine:

PinPoint from DC Dreams http://pinpoint.dc3.com/ (required for AcquireStar)

Getting Started

Getting Started

Before you begin:

1. Install the required software as described in Requirements.

2. Setup the camera software:

Select your imaging software on the System Tab – current choices are MaxIm or CCDSoft which will load your camera software.
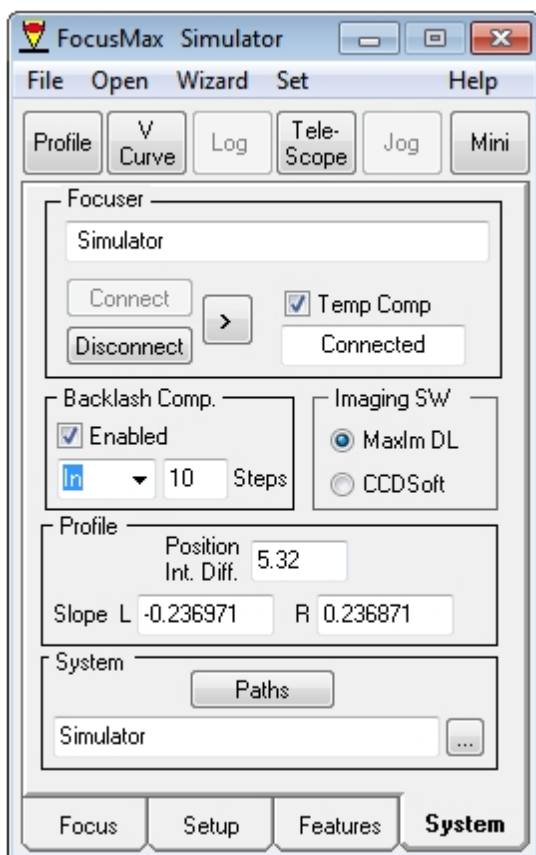
If you are using CCDSoft then the server settings must be setup::
Menu/Camera/Server Settings and enable the following:

    Allow remote connections
    Allow exposures
    Allow temp regulation
    Allow filter control
    Hide server window

    Uncheck all other settings in particular make a GIF and BMP copy
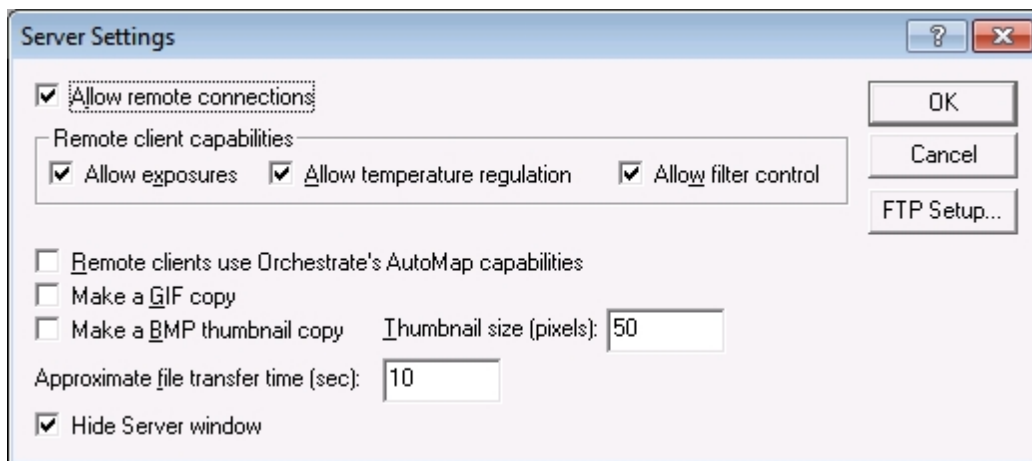
Select the Focus Tab and press the Expose button to verify that the camera will initiate an exposure – if not, then verify that you have selected your camera in the camera control software.
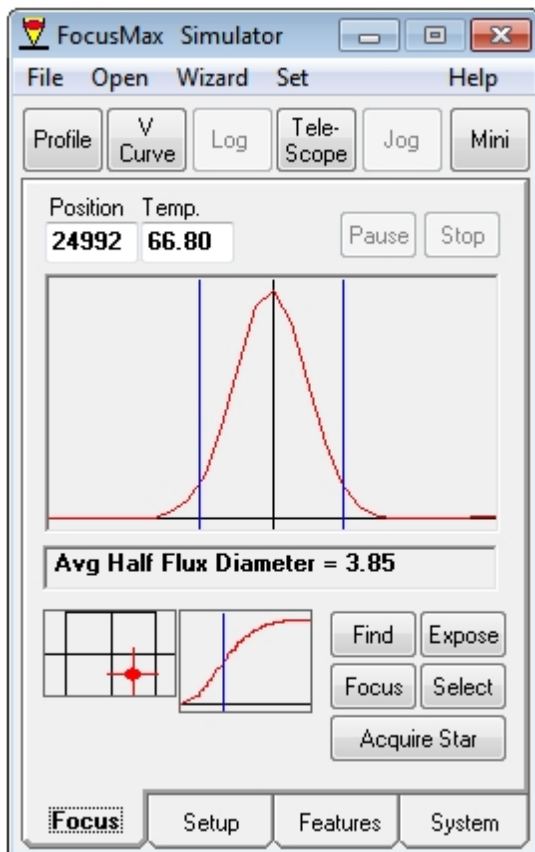
3. Connect to the focuser

   o Select the System Tab, press the '>' button in the Focuser frame and select Choose to select your ASCOM focuser driver.
   o Press the '>' button in the Focuser frame and select Setup to access the ASCOM focuser driver and set your communication (com) port.
   o Press the 'Connect' button to initiate communications with your focuser via the ASCOM driver – the text box should now read 'Connected' - if not then open the driver Setup window and try selecting another com port. Failure to connect to the focuser is not a FocusMax issue and is typically a driver or cabling issue.
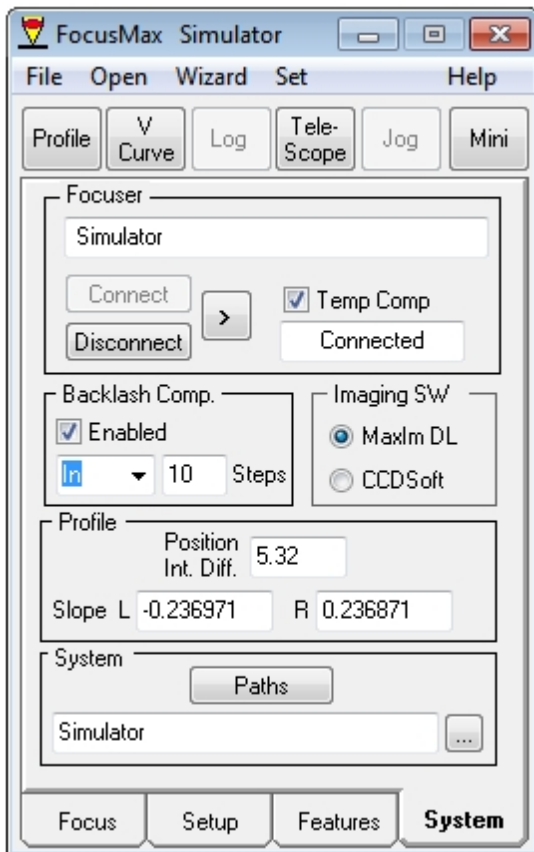
Press the Jog button which will open the a dialog box that:
- o displays the focuser current position

- o allows you to move the focuser in or out X number steps

- o allows you to set a position for the focuser to move to
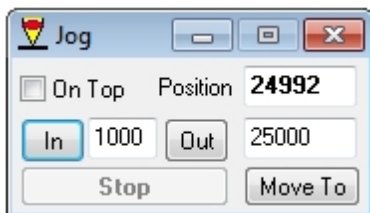
Verify that your focuser will move through the entire range of motion according to the focuser specifications.
- o Enter 0 and press the Move To button
- o Enter the max travel position and press the Move To button

If adjustments are required, then press the '>' button in the Focuser frame and select Setup to access the ASCOM focuser driver settings.

4. Create a unique System Name

The System ini Files and Log Files are simple text files that you can review or modify with any text editor.

Two System ini Files will be created in the user profile directory:

MySystem – a default name, which can later be changed to describe your system.
Simulator – when selected, this system name will permit off line testing and learning of the FocusMax software features.

In addition, on startup, FocusMax will create several default directories in the user profile directory (Documents or My Documents, depending on the operating system).

\Log, for Log Files

\Images, for any images that are saved during Vcurve measurement or autofocus

Note:

The default system name is 'MySystem' found on the System Tab. It is suggested that you create a system name that is unique for your setup. To create a unique system name, Select File/System/Save As and to save the file under a unique name.
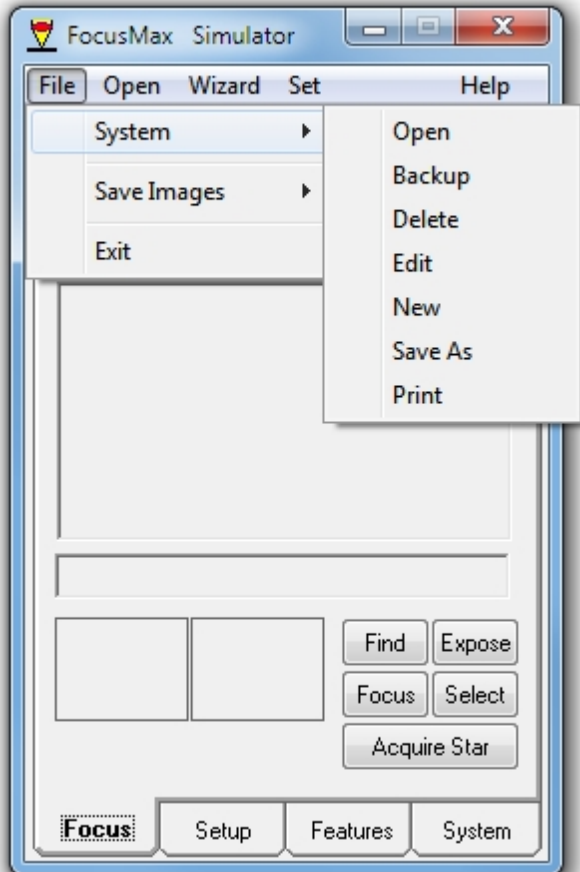
5. Window positions:

You can arrange and save the positions of the currently open windows on the desktop by selecting Menu/Set/Window Arrangement/Save.
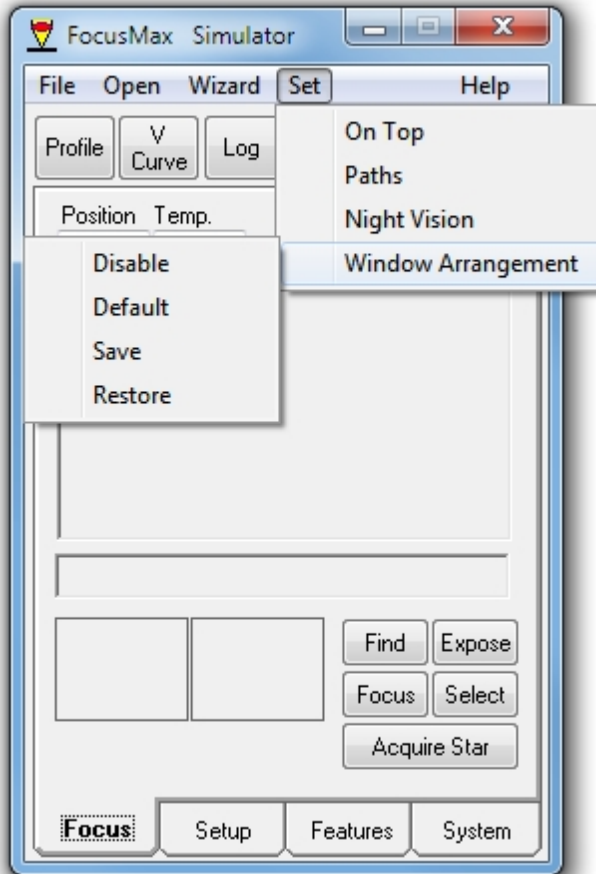
If you followed the above steps successfully you have now:

- o Selected and established a connection to your focuser via the ASCOM focuser driver

- o Have learned to manually Jog the focuser

- o Have created a unique name for your current system which FocusMax will use to save your settings.

MaxIm Simulator

Running FocusMax With MaxIm Simulators

MaxIm will generate a 5 star pattern that can be used

1. Install FocusMax V3.7.0.73+
2. "Simulator".ini system file on System Tab
3. Select focuser ASCOM Simulator Focuser Driver or Simulator Focuser on System Tab

MaxIm

4. Camera model = Simulator
5. Noise = On
6. Guide errors = Both
7. FWHM = 5

Press advanced button

8. Array size 768 x 511
9. Normalize ADU units to 0.1 sec (guider also)
10. Pixel Width 10 & Height 10
11. Uncheck Color and Full frame operation
12. Connect to the camera

- Press Find button on Focus Tab should find the brightest star lower right
- Open Profile and delete any Vcurve data that may be present
- Run FirstLight Wizard selecting Simulator system name
- You can also connect to your real focuser to run it through the paces using system Simulator.ini and Simulator camera. You may want to mover the focuser to the mid-point of its range of travel before you begin.

Support

Support

There has been a significant increase in the number of focusers, cameras, telescopes, mounts, since FocusMax was first released in 2001.

It is recommended that you join the Yahoo FocusMax users group http://tech.groups.yahoo.com/group/FMaxUG/ where you will find tips, suggestions and answers to questions from other astronomers.

Tabs

Tabs

The following describes the Tabs found on the FocusMax window.

Focus
Setup
Features
System

Focus

Focus Tab

The Focus Tab allows you to control and monitor the auto focus operations. It displays the target star Half Flux Diameter (HFD) and provides several methods for selecting the target star for auto focusing described below. It also presents the plots of the Vertical Bin of the star image (the largest plot), the smaller Flux Integral plot and the Graphical Position on the star on the CCD chip.
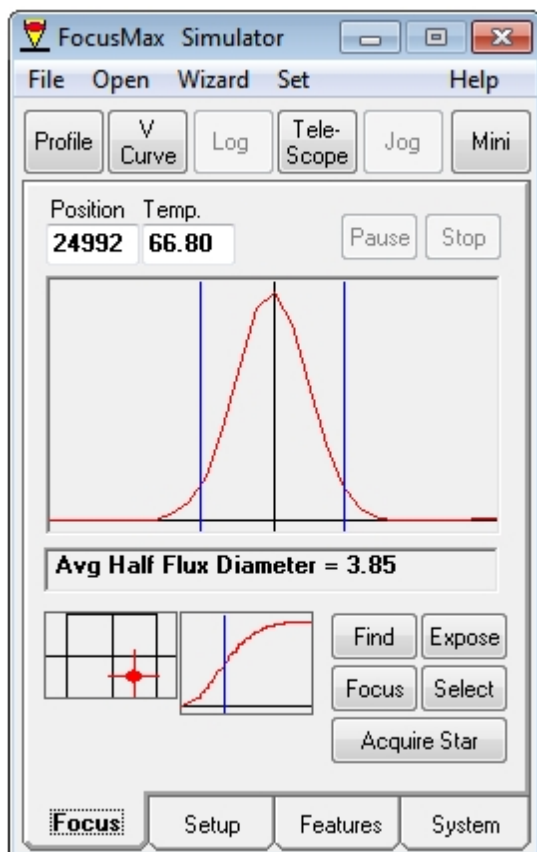
Find button

Pressing the Find button will:

- o Expose a frame using using the Target Star binning on the Setup Tab
- o Find the brightest star
- o Subframe the star using the focus binning defined on the Setup Tab
- o Adjust the exposure up or down starting with base exposure on the Setup Tab until the flux is within the user defined range

Expose button

Takes a single exposure subframe image, using the focus binning defined on the Setup Tab centered on the CCD chip coordinates using during the Find, Focus or Select operations.

Focus button

Initiates the auto focus operation centered on the brightest star on the chip

- a) It will first take a binned image as defined on the Setup tab
- b) Automatically find the brightest star
- c) Measure the HFD (Half Flux Diameter) and total star flux
- d) Subframe the star using the focus binning defined on the Setup Tab
- e) Adjust the exposure up or down starting with base exposure on the Setup Tab until the flux is within the user defined range
- f) Move the focuser to the Start HFD setting on the Setup Tab
- g) Begin the focuser position move to the Best Focus Position.
- h) Continue sampling the star measuring HFD
- i) Move to the Best Focus Position.

The details of the auto focus algorithm can be found by pulling down the FocusMax Help menu and selecting Technical Paper.

Select button

Allows the user to select a specific star in the field for auto focus. It performs the same basic auto focus operation as the Focus button. Select first exposes frame per the binned Target Star setting on the Setup Tab and then allows you to click on a target star (useful in crowded star field). It will create a binned subframe around the selected star then begin the same auto focus operation used by the Focus button. This feature is only available if MaxIm is the selected imaging software.

AcquireStar button

Selects a star from a star catalog, slews the telescope, performs the autofocus routine then performs a return slew. This requires the full version of PinPoint to be installed.
See [AcquireStar](#) for more.

Find button

Useful for finding the brightest star on the CCD chip. Find will first take a user defined binned exposure, identify the brightest star and then switch to a user defined focus binned sub frame centered on the brightest star with the Frame Width specified on the [Setup Tab](#).

Stop or the Pause buttons

Can be clicked at any time during an active operation. Stop will fully terminate the operation without the ability to continue. Pause allows a temporary pause of the active operation. During the pause, the Pause button will flash. A click of the Pause button while it is flashing will continue the operation.

Position

The focuser position is displayed near the top of the Focus Tab Window along with the temperature if the focuser has temperature-sensing capability. If you are using a relative focuser then double clicking the Position window will zero the Position value.

Temperature

The current focuser temperature is displayed near the top of the window

FocusMax graphical display boxes

● The large graphical box is a vertical bin of the framed region centered on the star. The vertical lines to the left and right of the curve is the boundaries of the star. The regions outside of the boundaries are used to determine the background level of the image, which is subtracted from the image before the vertical bin curve is plotted.

● The left small box near the bottom shows the position of the selected star on the camera chip. The smaller box inside shows the Central Region defined by the Features Tab, "CCD Central Region" when enabled and Percent of the chip specified to look for the star to be used.

● The right small box shows a plot of the star diameter along the x-axis and integrated flux along the y-axis. The integrated flux is zero at the edge of the star and increases to the full star flux at the star diameter. The Half Diameter (HFD) is the point marked on the flux integral plot with a vertical line.

Setup

Setup Tab

The Setup Tab is used to specify the important parameters that will be used during the auto focus routine, such as camera Exposure Time, Near Focus HFD, etc.
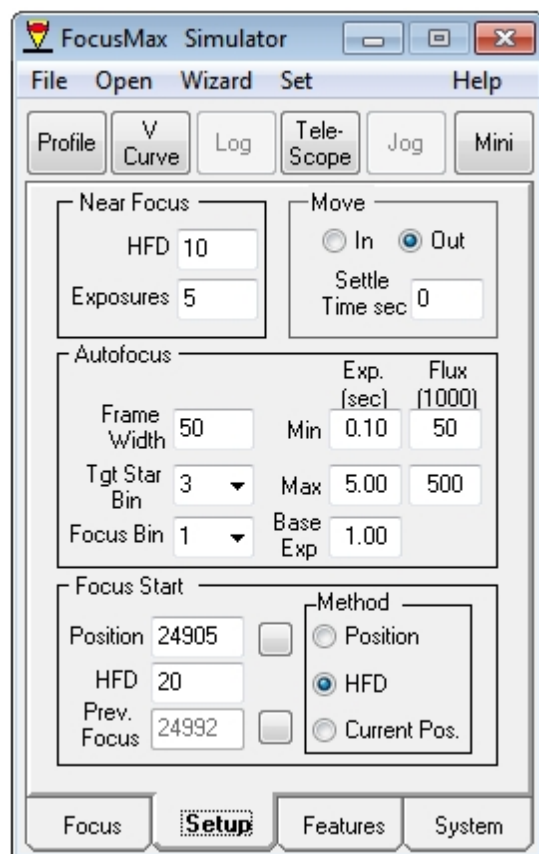
Near Focus HFD

The HFD (half flux diameter) is used to determine the Near Focus Position where FocusMax takes all of the Near Focus exposures. A typical setting is 10.

Near Focus Exposures

Used to set the number of exposures taken (with no focuser movement) at the Near Focus Position. The HFD values measured during these exposures will determine the Best Focus Position. A good setting is 5 exposures but values as low as 1 are accepted. Using larger numbers increases the averaging, which reduces seeing noise. Using smaller numbers shortens the time needed to find the Best Focus Position, but with reduced precision.

Move Direction

Set the focuser move direction in the direction that your telescope focuses best without excessive backlash

or mirror flop. For a typical SCT telescopes, the best Move Direction is In which moves the primary mirror in a direction against gravity, thereby causing the focal plane to move out. Settle time is the number of seconds to pause after a focuser move.

Frame Width

Set the initial sub frame size used when conducting a Vcurve run or when clicking the Expose button on the Focus Tab. A typical setting is 100 pixels. If your telescope has limited star tracking ability, you may need to increase the Frame Width to keep the star within the frame. The sub frame is always a square so that the width equals the height.

Target Star Bin

The initial binning that is used to identify the target star for autofocus

Focus Bin

The subframe binning used during the autofocus run. If you are using a DSLR camera then is recommended that binning be set to 2 for both Target and Focus binning.

Min/Max Flux (x1000)

Flux is the total integrated light (intensity) of the star on the chip. The Min/Max setting is the desired flux range for the target star. If the flux is too high, then the exposure will be adjusted down, too low and the exposure will be adjusted up.

Min/Max Exp

Sets the Min and Max exposure that FocusMax will use to bring the target star into the flux min/max setting.

Base Exp

Sets the starting exposure that will be adjusted to bring the target star flux into the Min/Max Flux setting.

Focus Start

FocusMax can use any one of three different algorithms to determine the Initial Position where auto focus operations start. The Initial Position should be chosen sufficiently far away from the Best Focus Position so that all subsequent focuser moves will be in the same direction approaching the focus position (the preferred Move Direction described above in step 3 above). These algorithms are selected in the Focus Start frame. Choose one of the three algorithms by clicking one of the radio buttons, each of the algorithms is briefly described below.

- Position – FocusMax will start by moving the focuser to the Initial Position specified in the position text box. It then starts the sequence of exposures and focuser Position moves that converge to the final move to the Best Focus Position. This is the fastest method for auto focus but requires some knowledge of your system such as which side of Best Focus you need to start. Fortunately, this value can be determined following a successful auto focus run by clicking the arrow button (in some cases this is done automatically). Clicking the arrow sets the position text box based on the information found in the HFD and Previous Focus text boxes. If the Best Focus Position is close to the value found in the Previous Focus box, then clicking the arrow will calculate a Position that will give a measured value of HFD near the value specified in the HFD text box.

- HFD - First takes an exposure at the current position and measures the HFD. It then moves the focuser in the direction specified by the Move Direction, takes an exposure and measures a second HFD. FocusMax then estimates the position needed to achieve the Initial Position which is calculated from the values found in the HFD and Previous Focus text boxes. After arriving at the Initial Position, additional moves and exposures are taken to converge to the Near Focus Position. At the Near Focus position, exposures are taken and the Best Focus Position is determined. This may be the slowest

algorithm but it is a safer option, as you do not care where you start relative to the Best Focus Position. Typical HFD settings for this algorithm are 15 – 20.

- <u>Current Position</u> – First takes an exposure at the current position and measures a first HFD. It then moves the focuser in the direction set in the Move Direction frame, takes an exposure and measures a second HFD. From these two HFDs it estimates the Position move needed to get to the Near Focus Position. The Near Focus exposures are taken and the Best Focus Position is determined. This algorithm does not move to an Initial Position. The current position can also be set by pressing the small button to the right of the text box.

Which algorithm is best? This depends on your knowledge of the Best Focus Position. For instance, if you have a temperature stable system where the Best Focus Position does not change very much during your observation run, then the Position algorithm will be the fastest. At the other extreme, if you are setting up your system for the evening and you have no information of where the Best Focus Position is, then you should use the Current Position algorithm for the first auto focus.

If you have a system that drifts considerably with temperature throughout your observing run then the HFD algorithm might be best. It will recalculate the Initial Position each start of the auto focus based on the previously determined Best Focus Position so that the drifts will not accumulate.

No matter which algorithm you choose, FocusMax has fail-safe features that will eventually get you to the Best Focus Position. For instance, if you somehow get on the wrong side of Best Focus, FocusMax will detect this and then take corrective action to move back to the correct side. Unusual conditions may cause the out of focus star disk to be larger that the exposure sub-frame. FocusMax will detect this condition and then take another exposure with double the sub-frame width so that the correct HFD can be measured. Since all three algorithms will eventually get to Best Focus, the selection of these algorithms only impacts the speed of the auto focus. The selection has no impact on auto focus accuracy.

Features

Features Tab

The Features Tab contains user settings that allow the user to optimize FocusMax for their particular observing program.
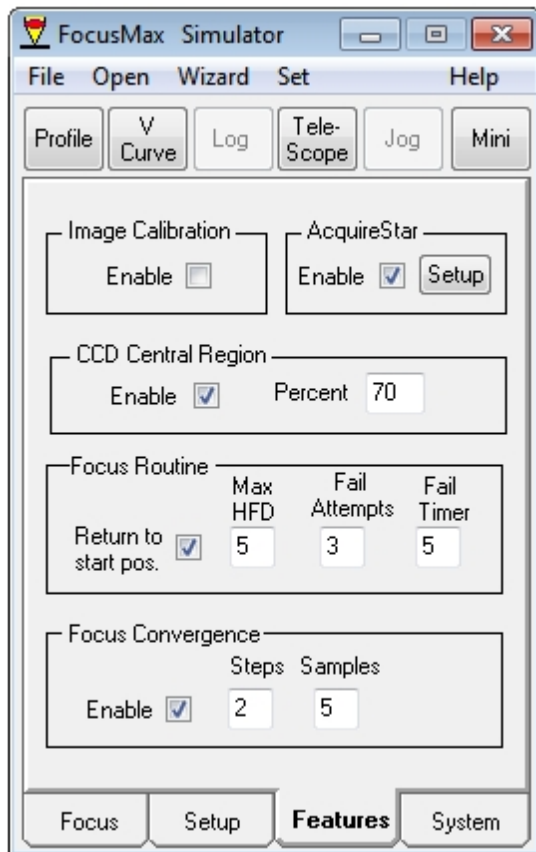
Image Calibration

This feature is requested by users that may have CCD defects such as hot pixels which FocusMax may attempt to use utilize for focusing. Enable image calibration which is found on the Features tab and follow this procedure

MaxIm image calibration

1. Create a set of dark & bias frames at the binning used for the initial image and autofocus sub-frame images (see Target Star Bin and Focus Bin on Setup Tab for settings).Dark frame exposures should span the range which FocusMax may use (0.1, 1, 5, 10 sec...). You may want to create a set of calibration frames from 1x1 through 4x4 just in case you decide to change bin size.
2. Save the calibration frames to a directory
3. Load the saved images into MaxIm using menu/Process/Set Calibration

MaxIm will extract the appropriate image and position in the calibration image to calibrate the FocusMax frames for the initial target star section and autofocus sub-frame images.

CCDSoft image calibration

CCDSoft will utilize the Image Reduction: AutoDark with each frame.
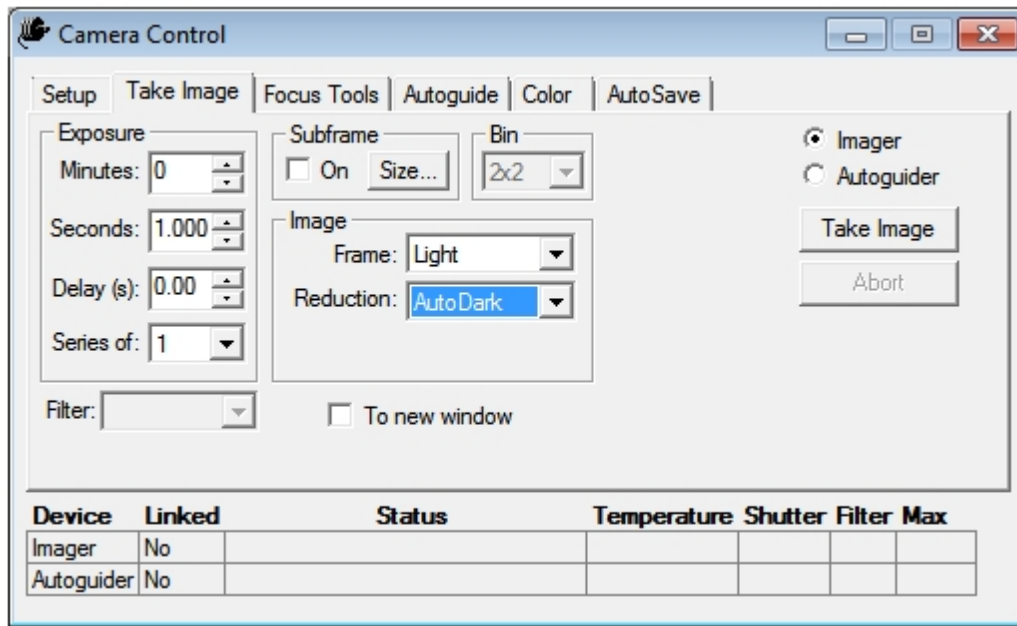
AcquireStar

AcquireStar will identify and acquire a target star for autofocus that falls within a user defined requirements. This feature requires the full version of PinPoint and will not work with the current version of PinPoint LE bundled with MaxIm V4 or higher. Astronomers are using AcquireStar with automated telescopes to perform a periodic focus update to assure that images acquired during the night are perfectly focused. AcquireStar can be operated manually by a push of a button or through automation within a script. AcquireStar is also very useful when the telescope is initially centered on a large bright galaxy or nebula that would normally cause a simple autofocus to fail. Acquire star will automatically move the telescope away from the bright galaxy, autofocus on an appropriate star and then return to the original position of the galaxy. Click the AcquireStar Setup button to change the parameters used for the Acquire Star operations. This is explained more fully in the AcquireStar section of this Help.

Press the Setup button to access AcquireStar and PinPoint setup tabs.

CCD Central Region

The CCD Central Region is used to limit the automated target star detection to a user defined central region on the CCD. This reduces the influence of optical aberrations that may be present in the optical system. SCT and fast Newtonian users with large CCD chips may want to set this to 50% in order to minimize the influence of astigmatism, curvature of field, coma, etc. The default setting is 75%. The Enable check-box when checked will allow this feature to be used. The CCD Central Region is drawn with a box on the CCD chip diagram found on the lower left corner of the Focus Tab.

Focus Routine

- Return To Start Position when enabled will send the focuser to the previous starting position before the autofocus routine was initiated if the final HFD exceeds the Max HFD setting (typically the Best Focus Position of the last successful autofocus run). This is a useful feature for all night robotic observing sessions where thin clouds could influence the autofocus routine and cause it to leave the system out of focus..

- Max HFD is the maximum HFD value that is considered a reasonable Best Focus HFD. If the value is exceeded, then an error message is posted to the Log and the focuser will return to the previous position.

- Fail Attempts is the number of iterations that FocusMax will attempt repeated exposures if the target star is lost. A typical setting is 5. This is useful when encountering scattered clouds.

- <u>Fail Timer</u> is the wait time in seconds between attempts to recover the target star if lost (perhaps due to a passing cloud). A typical setting is 5 seconds.

Focus Convergence

Enabling this feature will find the best focus position by taking repeated sub-frame images and measuring until the average HFD falls within a boundary (or tolerance) that is set by the user. This feature is very useful when the seeing is poor.

- <u>Steps</u> are the number of focuser steps (units) that the average HFD must fall within. You can think of as a tolerance.

- <u>Samples</u> is the number of consecutive measurements that must fall within the above step setting before FocusMax determines that sufficient sampling has occurred and considers the predicted position as the position for the final focuser move.

Below is an example of an autofocus run in which Focus Convergence was enabled. The default sampling rate is 5 samples which would have yielded a final focus position of 4178. Note that the average position continued to trend upward and did not begin to converge until sample measurement 27 resulting in a final focus position of 4196 which is difference of 18 steps. Note that FocusMax would have stopped at the default of 5 exposures but continued
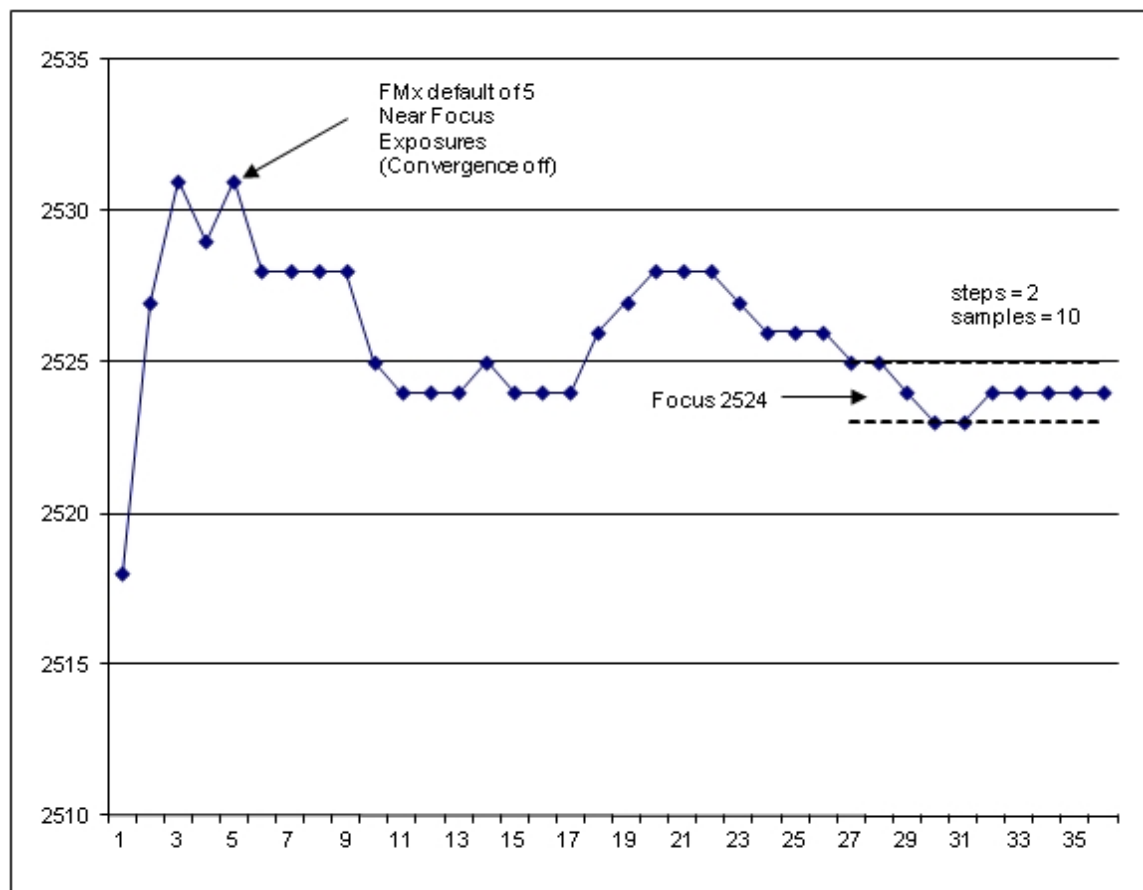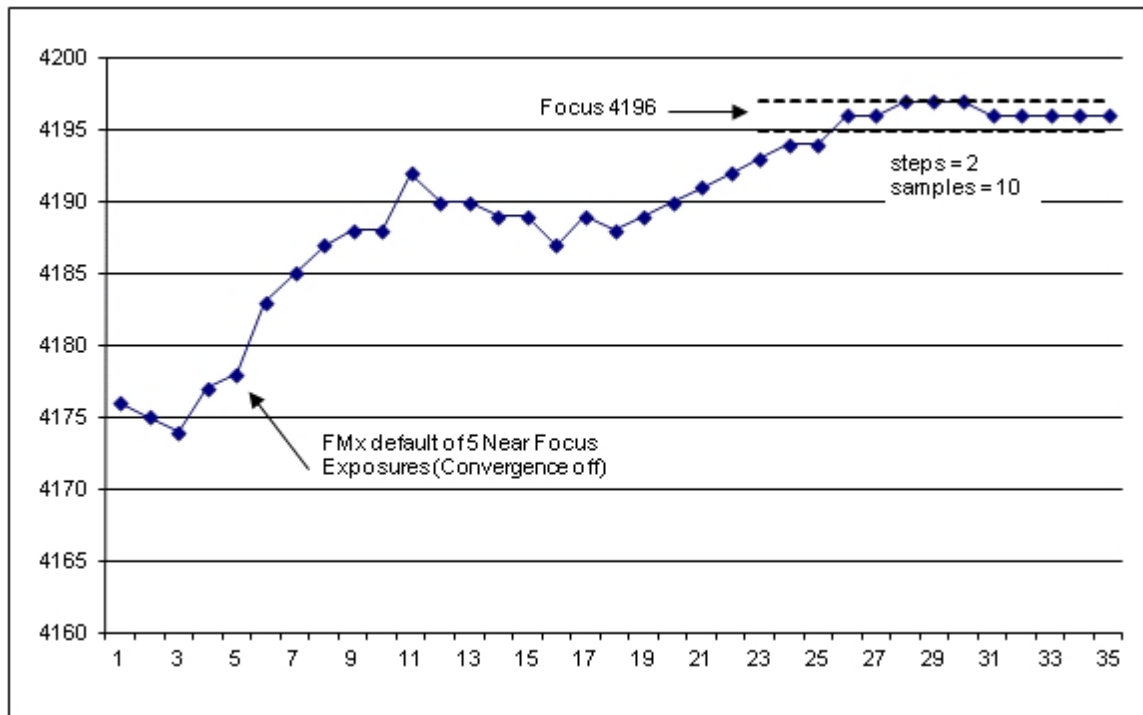
System

System Tab

The System Tab allows selection of the focuser and the System information. It also displays the three parameters used during the auto focus routine that characterize the selected System.
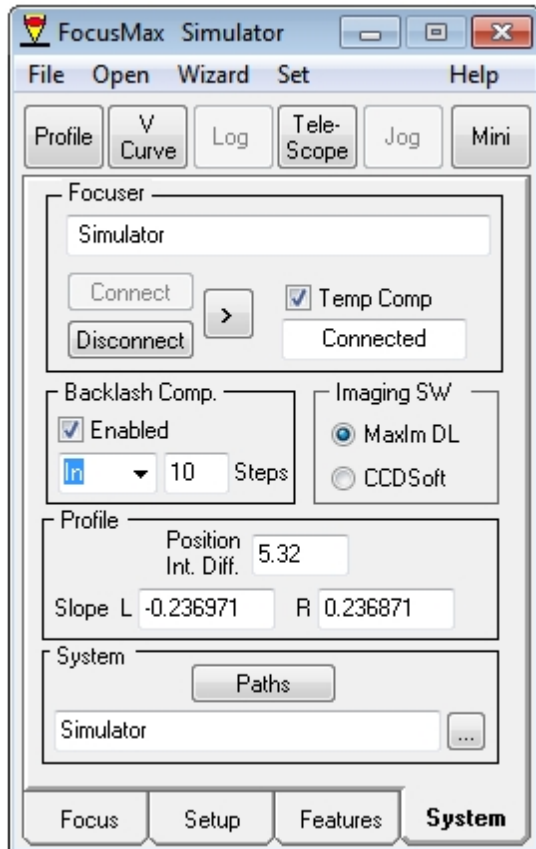
Focuser Selection

The focuser can be selected or changed by clicking the > button and select the ASCOM Focuser Chooser

- Selecting <u>Setup</u> will allow you to customize the settings for the selected ASCOM focuser.

- <u>Connect</u> button on the System Tab Focuser frame to load the selected focuser.

- <u>Disconnect</u> button will terminate communication with the focuser

Backlash Compensation Settings

This is used to set the desired backlash compensation value and direction. Use this feature if the focuser driver does not allow backlash compensation or you wish to have FocusMax make the required focuser moves. Backlash compensation is important as FocusMax is designed to drive the focuser in one direction toward the focus position thus eliminating error in the final focus position.

Do not activate FocusMax and focuser driver backlash compensation at the same time.

Imaging Software Selection

Currently, FocusMax supports MaxIm DL and CCDSoft for camera control. When a selection is made, the application will be automatically loaded (provided it is installed and fully functional).

If you like to use both MaxIm DL and CCDSoft, you can quickly switch between the two with these radio buttons. This will automatically disconnect your camera from one imaging software and reconnect it to the other.

Profile

This frame contains the three parameters that characterize the selected System for autofocus operations. These parameters are the heart of the FocusMax algorithm and are unique for each system configuration. After System characterization, the text boxes will display

- Left & Right Slopes

- Position Intercept Difference that are used during an auto focus run.

The Profile parameters are calculated and automatically entered from the System Profile window.

System

- System contains the information and file location for FocusMax for a particular configuration. Start by selecting a System by clicking the small button to the right of the system name box or from the menu item Set >> Paths. This will open the System selection window. You can either select an existing System file or create a new System file. To select an existing System file, simply double click on the existing name on the System selection window. To create a new System name, type in a unique new name in the File name box. When you click Open, the new System ini Files will be created with default parameters.

- Paths button is used to verify the path for your Log Files and Image Files. The Log Files stores a running log of actions, measurements and errors that may be encountered while operating FocusMax. During the Vcurve Sequence or also during auto focusing, the star images exposed by FocusMax can be saved in the Image files directory for review at a later time, (try saving the Vcurve images and blinking them in MaxIm DL or CCDSoft to get a dynamic view of your system optical properties!). You can switch on the Save Images feature from the top menu with File>>Save Images.

Buttons

Buttons

The following descries the command buttons found on the FocusMax window

[Profile](#)
[Vcurve](#)
[Log](#)
[Telescope](#)
[Jog](#)
[Mini](#)

Profile

Profile Button

The System Profile window displays the saved Vcurve data that characterizes the selected System. Open the System Profile window by clicking the Profile button or by pulling down the Open menu and selecting Profile.

The header section

Shows the summary information of the detailed data saved in the bottom section.

- Left Slope defined as the slope of the best-fit line for the left side of the Vcurve,
- Right Slope defined as the slope of the best-fit line for the right side of the Vcurve,
- Position Intercept Difference is defined as the number of focuser steps measured between the left and the right lines where they intercept the horizontal axis (the axis where HFD =0).

These three characterization parameters are automatically saved to the System Tab and used by FocusMax for autofocusing. These parameters, shown in the top section, are averages of the rows in the bottom section that have the character "Y" in the Use column.

The lower data grid section:

- The First Column can be clicked to highlight a single row or a series of rows that may then be deleted when the Delete Records button is clicked.
- The Use column can be toggled from Yes to No, or No to Yes by clicking on the cell. This will automatically include or exclude data which will update the Profile results shown in the upper part of the window.
- The Date and Time when the Vcurve was saved to the System Profile. The rows are sorted with more recent data toward the top.
- Position Intercept Difference defined above.
- Left Slope & Right Slope of the Vcurve best-fit lines.
- Useful information is logged into the Comments column which is useful for identifying rows to exclude.
- The information is easily edited by double clicking on the desired cell and entering the new information in the pop-up box. The update will be saved to the System ini Files when the System Profile window is

closed. You can increase or decrease the size of the lower section by simply dragging the lower edge of the System Profile window. All changes made in the grid are immediately averaged and reflected to the upper section data.

Vcurve

Vcurve Button

Before you can auto focus with FocusMax, you need to characterize your system. If you were to click the Focus button before this characterization you would get some dialogs asking for some parameters that you do not yet know. These parameters are unique to your system and you first need to measure them. The First Light Wizard will automate the V curve generation and can be found on the Wizards pull down menu.
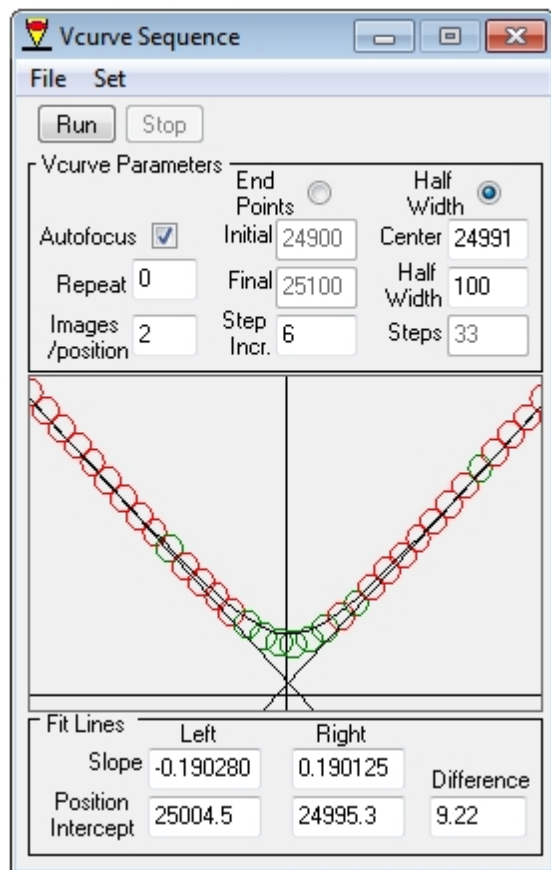
See FirstLight Wizard Tutorial for details

See Running Vcurves Tutorial for details

Log

Log Button

Pressing the Log button brings up the running Log, which will give you a written record of the FocusMax activities. The Log file is automatically saved in the directory that you specified for the Log path on the System Tab

The default path is: C:\Users\xxx\Documents\LogFiles
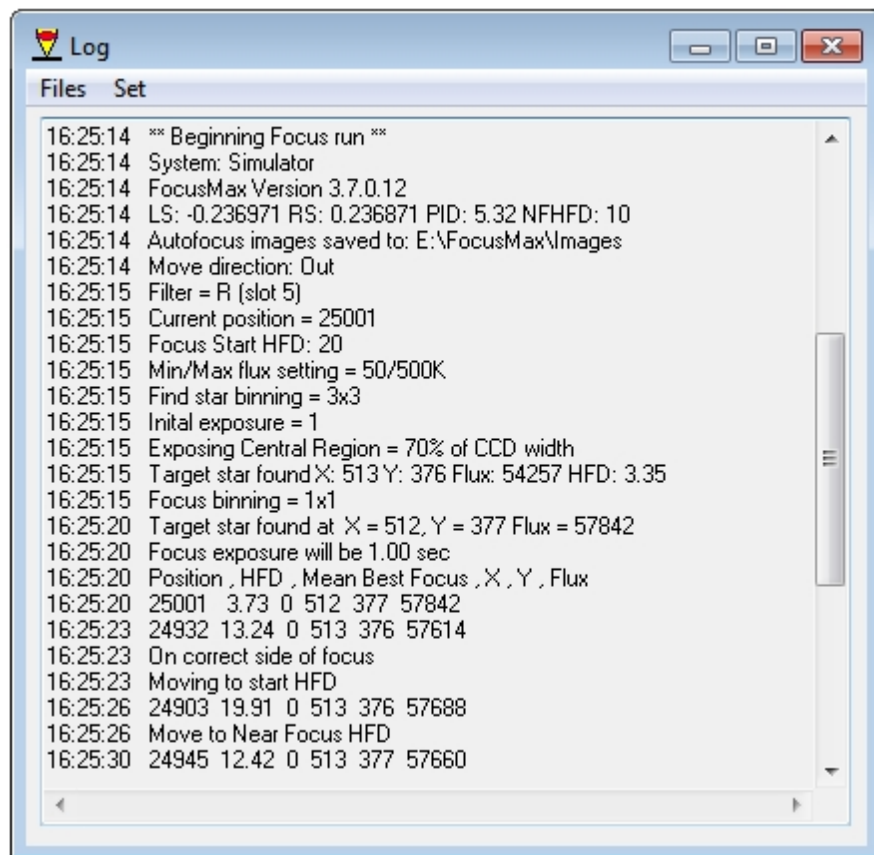
The Log is an excellent way to follow the details of the auto focus operations. On the left of each line is a time stamp that uses the time set on your computer clock.

Every time you start FocusMax, a new Log file is created in the Log directory with a unique file name. This name has a date and time stamp that corresponds to the computer time when FocusMax was started. These saved Log files are especially useful for tracking down focusing problems. If you request technical support, it is very helpful if you attach the Log files of the observing session where you encountered the problem. You can change the directory where the Log files are saved with the System Tab .

Dragging the edges of the Log window easily modifies its size in both the X and Y dimensions.

Telescope

Telescope Button

Telescope control is an integral part FocusMax and provides advanced capabilities such as Auto Star Center, Jog, AcquireStar, etc.

See Telescope for details

Jog

Jog Button

Press the Jog button which will open a dialog box that:

- displays the focuser current position
- allows you to move the focuser in or out X number steps
- allows you to set a position for the focuser to move to

Verify that your focuser will move through the entire range of motion according to the focuser specifications.

- Enter 0 and press the Move To button. If the Log shows that the move will exceed focuser limits then open you may have the Limit Focuser Travel in Menu/Options. - setting to 0 should allow for full range of motion
- Enter the max travel position and press the Move To button
- If adjustments are required, then press the '>' button in the Focuser frame and select Setup to access the ASCOM focuser driver settings.

Mini

Mini Button

Pressing the Mini button closes the main FocusMax window and presents a series of command buttons less graphics and setting tabs. This is useful to reduce desktop clutter.

Menu

Menu

The following describes each of the menu items found on the FocusMax window

> [File](#)
> [Setup](#)
> [Wizard](#)
> [Set](#)
> [Help](#)

File

Menu File
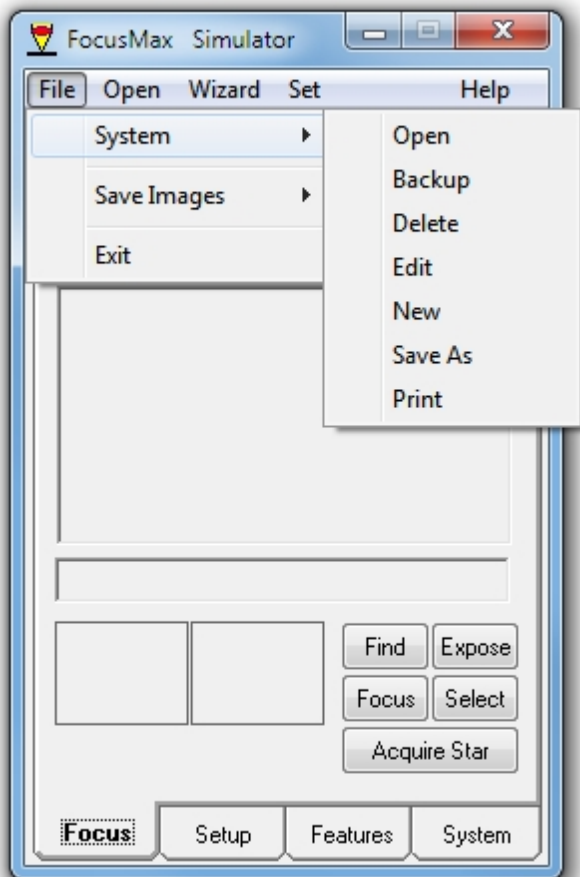
System:

- <u>Open</u> - will allow you to open a different system.ini file

- <u>Backup</u> - will create a backup file of the current system.ini with a .bak extension

- <u>Delete</u> - will allow you to delete a saved system.ini file

- <u>Edit</u> - will allow you to load a system.ini and edit the contents

- <u>New</u> - will create a new default file with a name the you choose

- <u>Save As</u> will save the current active system.ini to a different name

- <u>Print</u>- print the current active system.ini

Save Images

Allows you to save the autofocus and Vcurve images for future reference. The directory is set from the System Tab when the Paths button is pressed.
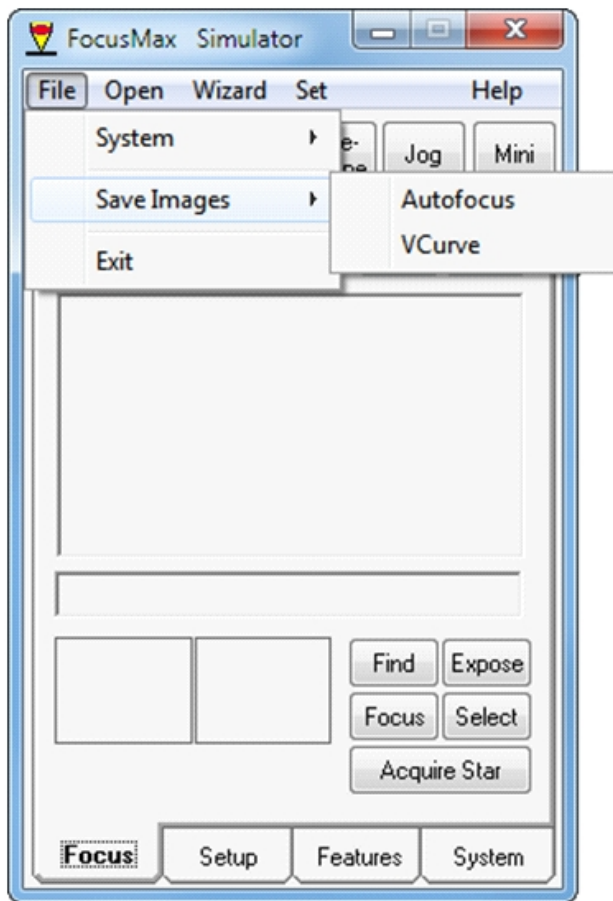
Open

Menu Open
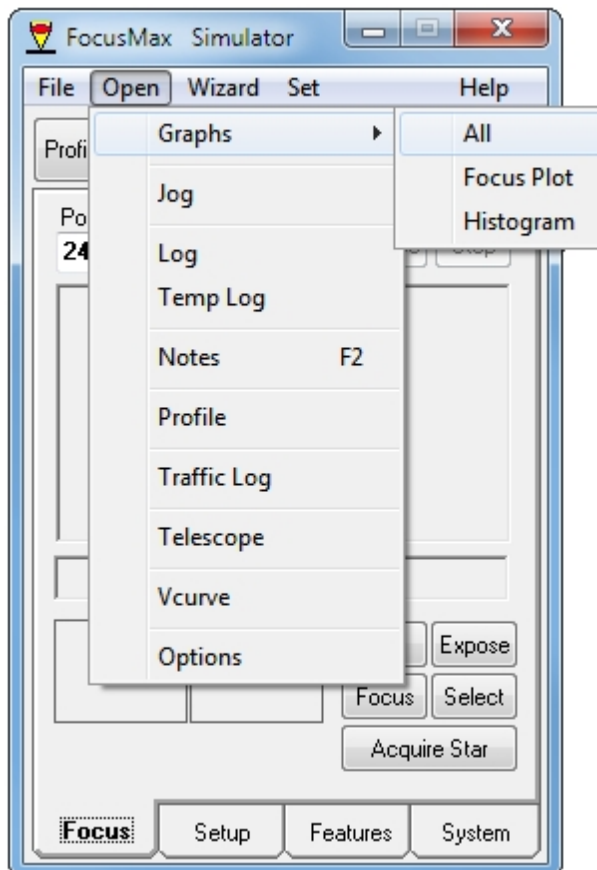
Graphs

The Focus Plot shows:

●   The Predicted Focus Position for each sub-frame image taken during the autofocus run.
●   The Mean Best Focus is the average predicted focus position which is shown in the Log.

If the Focus Convergence feature is enabled on the Features Tab then the plot will show how the focus position is converging.
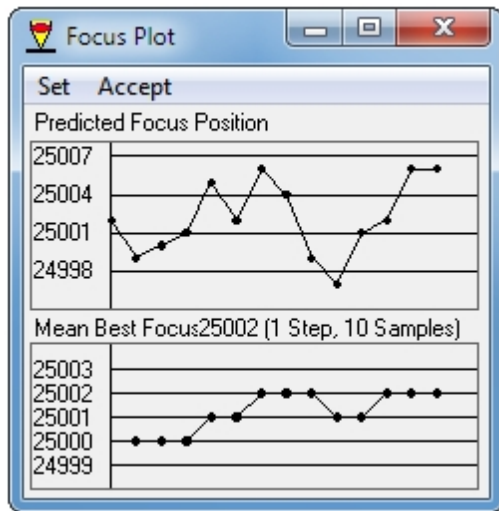
The Histogram Plot shows the occurrences of number of predicted predicted focus position and is useful as a measure of displaying seeing variation
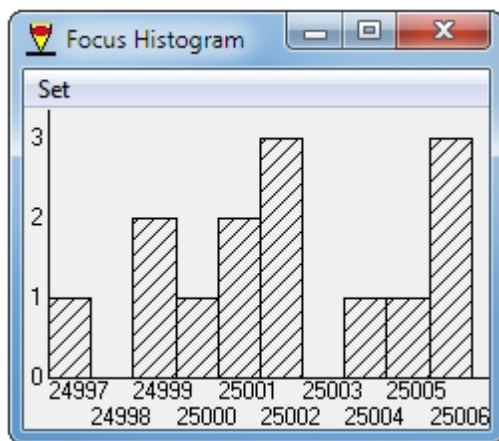
Jog
See Jog

Temperature Log

The Temperature Log is useful for tracking changes in temperature and identify when an autofocus run occurred during the night
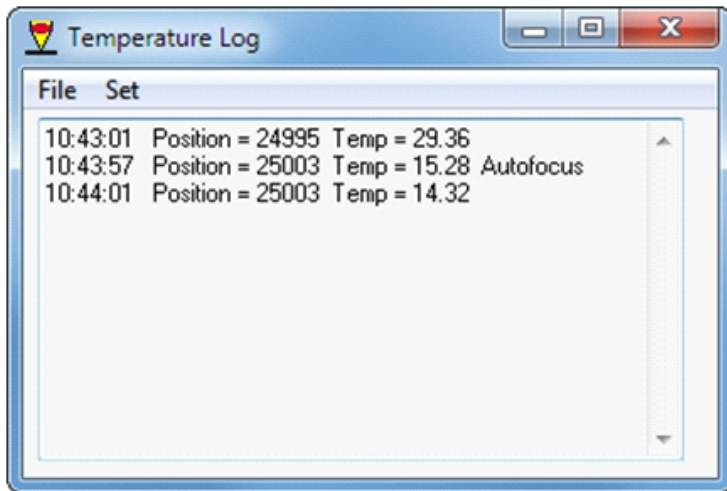
Notes

Allows you to enter information that will be saved in the files directory. Example might be tips, procedures, work-flow, information on various user settings, etc.

Profile

See [Profile](#)

Traffic Log

The Traffic Log will post various operations that are performed internal to FocusMax -see log below.
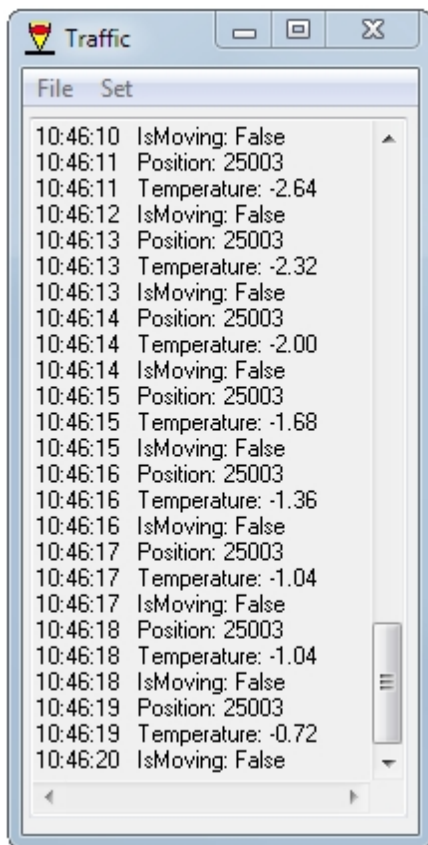
Telescope
See [Telescope](#)

Vcurve
See [Vcurve](#)

Options
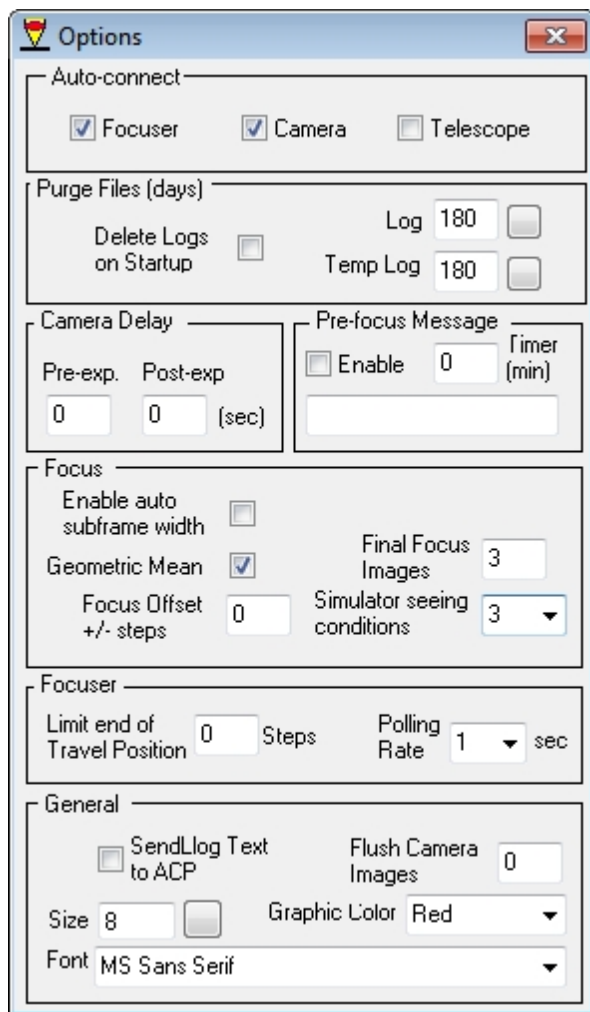
Auto-connect

Allows you to select which functions will be loaded and automatically connected when FocusMax loads. Most users will set Focuser and Camera to connect and Telescope if AcquireStar is being used.

Note: It is suggested that the appropriate functions should be set to auto-connect FocusMax is being scripted by a host program so that when a new instance of FocusMax is created the connections will be made automatically. Default is none.

- Auto-connect focuser
- Auto-connect camera
- Auto-connect Telescope

Purge files

Allows you to automatically delete logs older than specified at start up. Pressing the buttons will manually delete the files immediately. Default 180 days

Camera Delay

Pre and Post exposure delay will allow the user to insert a pause before the shutter is opened and after the shutter is closed.

Pre-focus Message

WIll allow you to create a message and set the time for the message to be posted to the screen before the auto-focus routine is initiated. This can be used a a reminder to do perform an activity. Default is 0

Focus

- Enable auto subframe width will allow FocusMax to calculate subframe size based on measured HFD

- Geometric Mean will replace the arithmetic mean default method for calculating the mean focus position. This was implemented based on a conversation with Dr. Barry Megdal at the 2012 Advanced Imaging Conference (AIC)

  The geometric mean tends to dampen the effect of very high or low values which may bias the mean if an average (arithmetic mean) were calculated.

  Example: 2,5,10

  Average = 5.7

  Geometric Mean = 4.6

- Simulator seeing conditions will introduce noise to HFD to simulate variable seeing conditions

- Focus Offset allows you to move the focuser in or out by a defined number of steps. THis may be useful if the user is performing photometry and desires slightly out-of-focus stars. Default is 0

- Final Focus Images defines how many images are to be taken and averaged after the best focus has been determined. This is an important feature as it yields an improved estimate of the HFD of the star at focus.

Focuser

- Limit End of Travel Position setting allows you to guard band or limit the full travel so as to avoid hitting a hard stop. FOr example if the setting is 10 steps, the the focuser will only travel between position 10 and max travel - 10. Default = 0

- Polling Rate will set the the time in which the focuser is polled for temperature and position. Some focuser can not handle a 1 sec rate and setting the rate higher helps. Default = 1

General

- Send Log to to ACP is useful if to consolidate the log information if using ACP as a host application

- Flush Camera Images setting will initiate user defined number of exposure to flush the chip to help prevent ghost image of the target star after the autofocus run. This is useful for users who are performing photometry.

- Graphic Color allows you to select from Red, Green or Blue for screen color to be sued with the various FocusMax graphics. Setting Blue or green is useful if you are using a red filter on front of a laptop display. Default = Red

- The Font and Font size can be set based on the installed fonts. Some users fond that the standard font (MS Sans Serif, 8) do not fit in the text boxes and button on Win 7 machines.

Wizard

Menu Wizard

Two wizards are available:

1. FirstLight Wizard is designed to assist a new user in calibrating the system by generating a Vcurve and performing the first autofocus run

2. Temperature Compensation Wizard will collect temperature and position data during the night which can be used for determining the temperature coefficient that will be used by the focuser driver to move the focuser in small steps as the temperature changes throughout the night.

FirstLight

First Light Wizard

See FirstLight Wizard in FocusMax Tutorials tutorial for details

FirstLight

Temperature Compensation
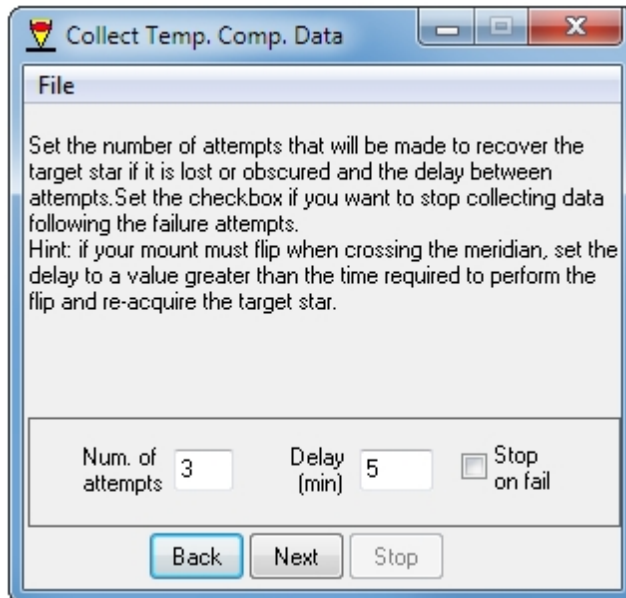
Temperature Compensation Wizard

The Temperature Compensation Wizard is designed to collect position and temperature data over the course of one night. The output is a Log with temperature and positions that can be analyzed using a (spreadsheet such as Excel) to determine the temperature coefficient that is entered into the focuser driver. The Temperature Log will be opened which will provide the position and temperature from each autofocus run throughout the night.
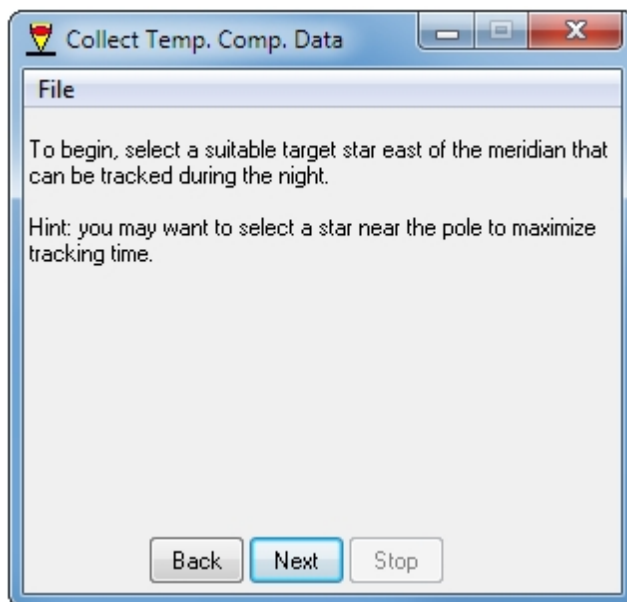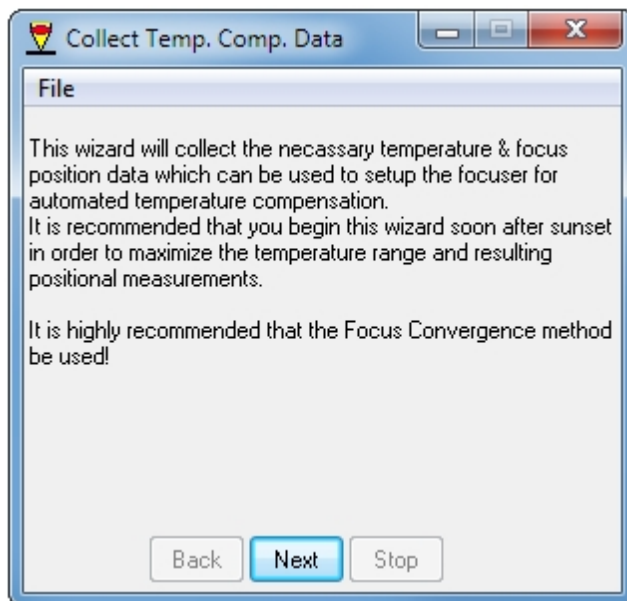
- Set the number attempts to recover the star and the delay between attempts. This feature is to allow time for interruptions such as clouds

- Set the interval to trigger an autofocus run based on time or temperature change. It is a good idea to enable Center with telescope option to assure the star is centered in the filed. This will require that you calibrate your telescope movements.

Verify the autofocus settings before proceeding for min/max flux and min/max exposure time
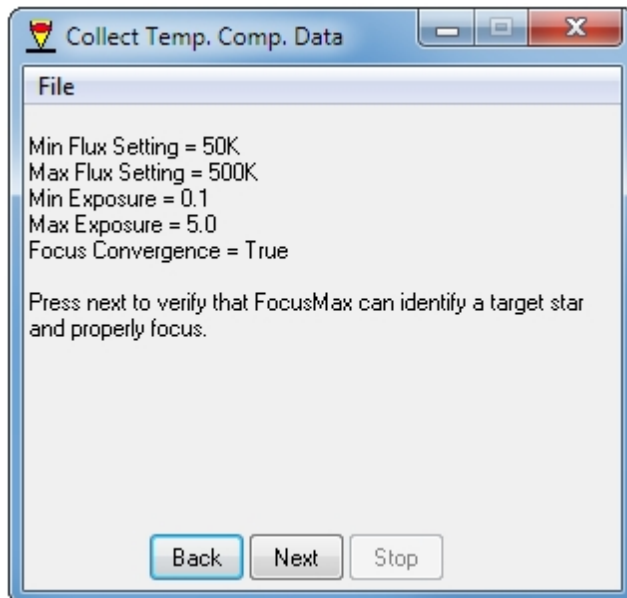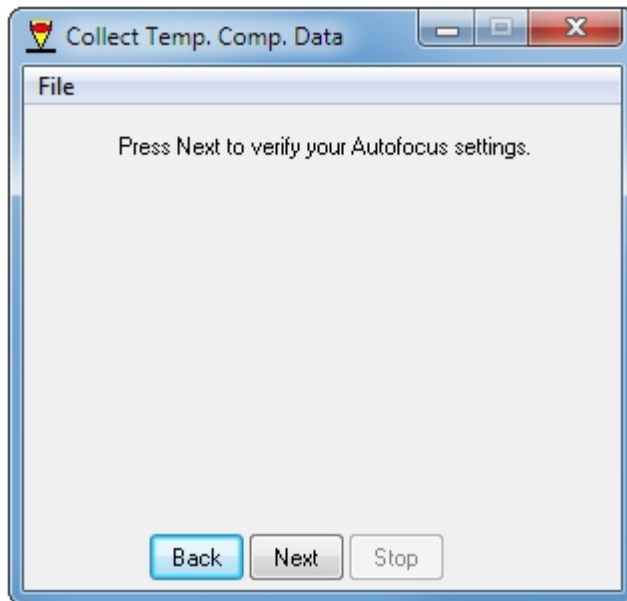
- FocusMax will find the brightest star in the field and display the adjusted exposure time and total flux based

- Set the number of hours to run which will set the date time to stop the operation. This feature may be used for unattended data acquisition.
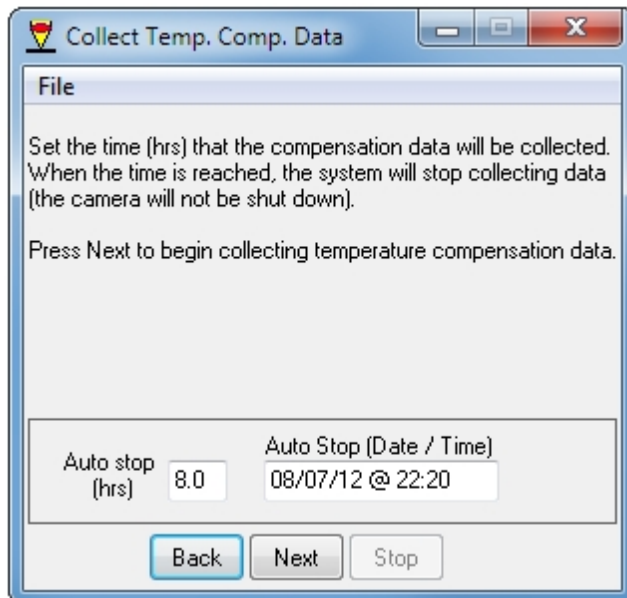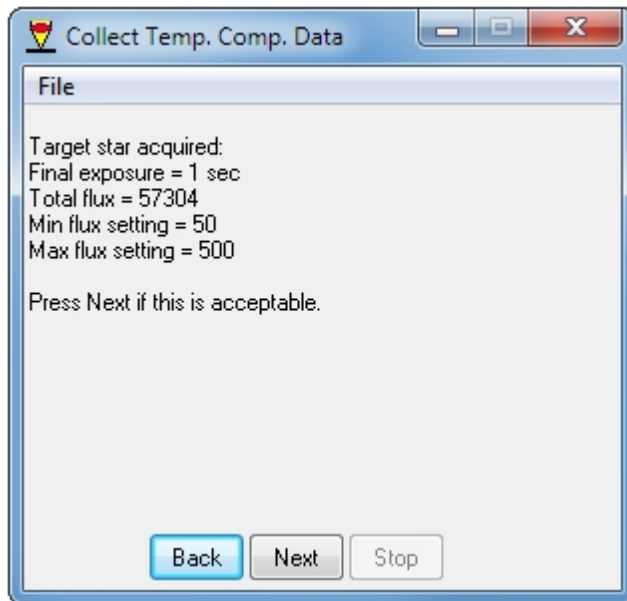
- The Temperature Log will open and you see the temperature based on the interval selected and the temperature following an autofocus run.
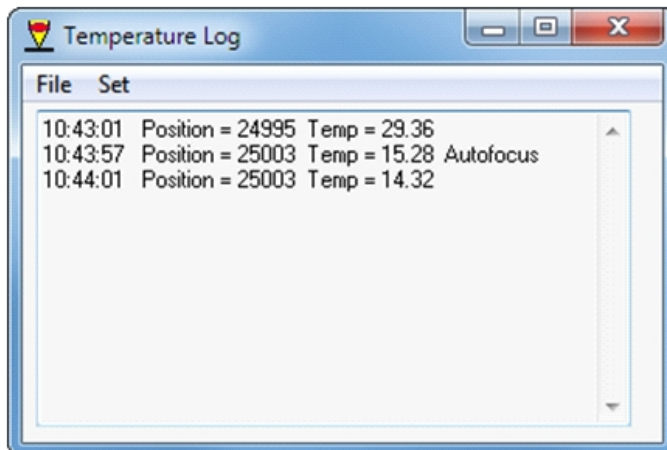
Notes on temperature compensation:

1. Plan to dedicate 1 full night to data collection at a time of year that you will experience the a large temperature swing form early evening throughout the data acquisition session

2. You may want to select a star near the celestial pole to maximize observing time through the night and reduce tracking errors.

3. Study the manual that came with your focuser and verify that you are able to enter a temperature coefficient (steps/degree)

4. Enter the temperature and position data into a spreadsheet (Excel) and perform a linear regression

5. If the graph looks linear and not polynomial:

    Is the correlation coefficient (r) reasonable per the following:

    +1.0 Perfect positive correlation

    <== best here or above
    +0.5 Moderate positive correlation

     0 No correlation

    -0.5 Moderate negative correlation

    <== best here or below
    -1.0 Perfect negative correlation

6. Run the Temperature Compensation over several nights but DO NOT combine the data into one dataset.

7. Compare the temperature coefficients - do they have similar slopes?

8. Do the regression lines overlap?

9. Are the lines offset from one night to the next but have the same slope?

10. Not all focusers are able to provide temperature readings that accurately track ambient temperature well. The author has one focuser in which the temperature probe is located in a box along with eh electronics and was never able to find strong correlation between temperature and position. The focuser used in the observatory utilizes an external sensor that is placed near the primary mirror of the 16" Newtonian reflector.This focuser tracks ambient temperature well find a strong correlation of 89%. Temperature compensation has allowed the author to reduce the autofocus frequency from 60 to 120 minutes.

11. Some users may find that the temperature vs position graph is not linear which may present a challenge for predicting focuser position as temperature changes.
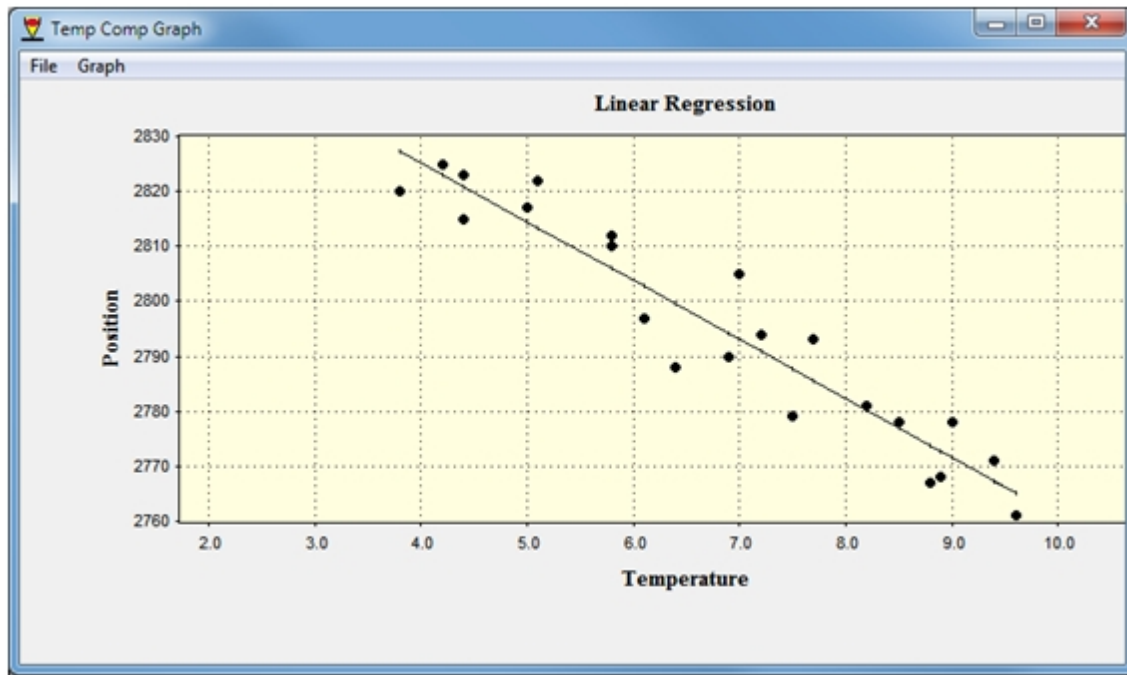
Set

Menu Set
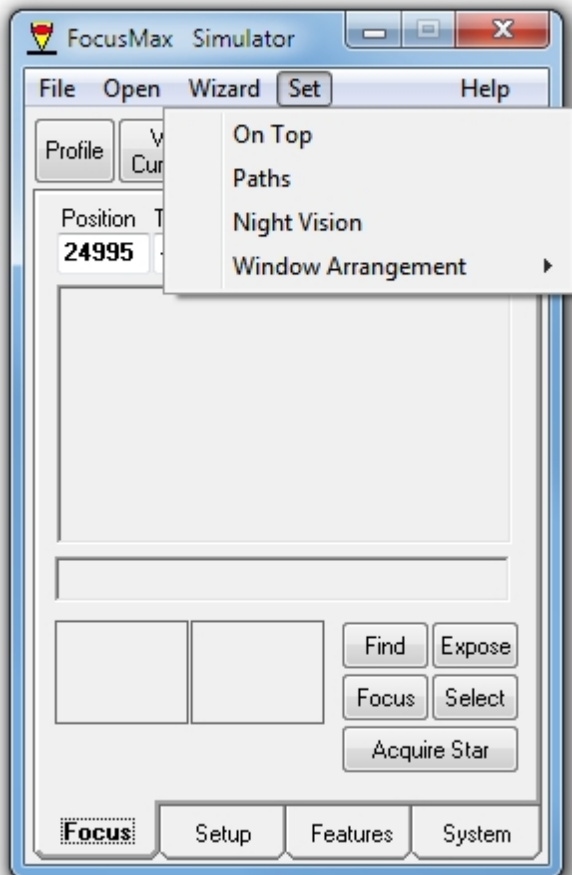
On Top

Selecting On Top will place the window on top of all other windows.

Paths

Open the Paths dialog window that will allow you to change the paths of your saved Images and Logs. Note that the dialog box can be stretched to accommodate the entire path.

Night Vision

Selecting Night Vision will turn the darken the various forms and text boxes to shades of red. This can be undone by deselecting Night Vision.
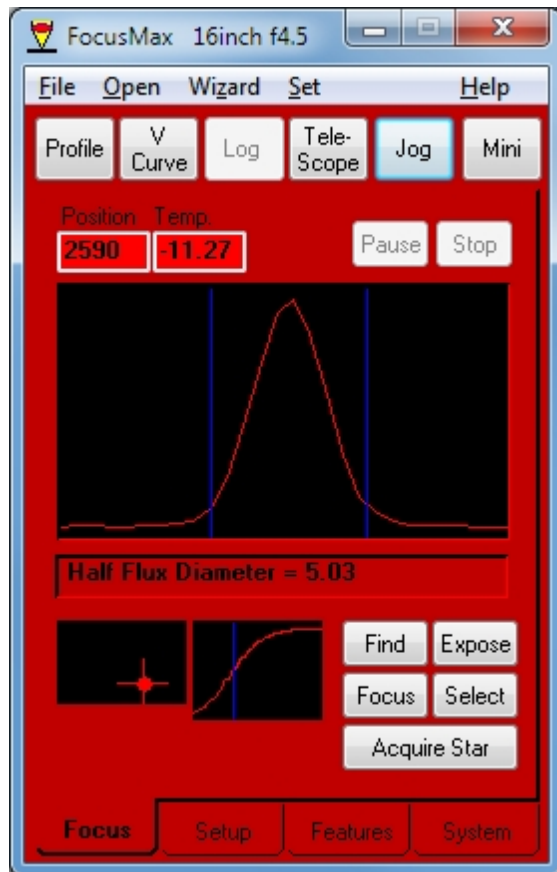
Window Arrangement

- <u>Disable</u> will force FocusMax to open in the default Windows positions at startup
- <u>Default</u> will arrange the windows in the default FocusMax positions
- <u>Save</u> will save the current position of all open FocusMax windows which will load in the same position at startup
- <u>Restore</u> will move all open windows to the saved positions (above)
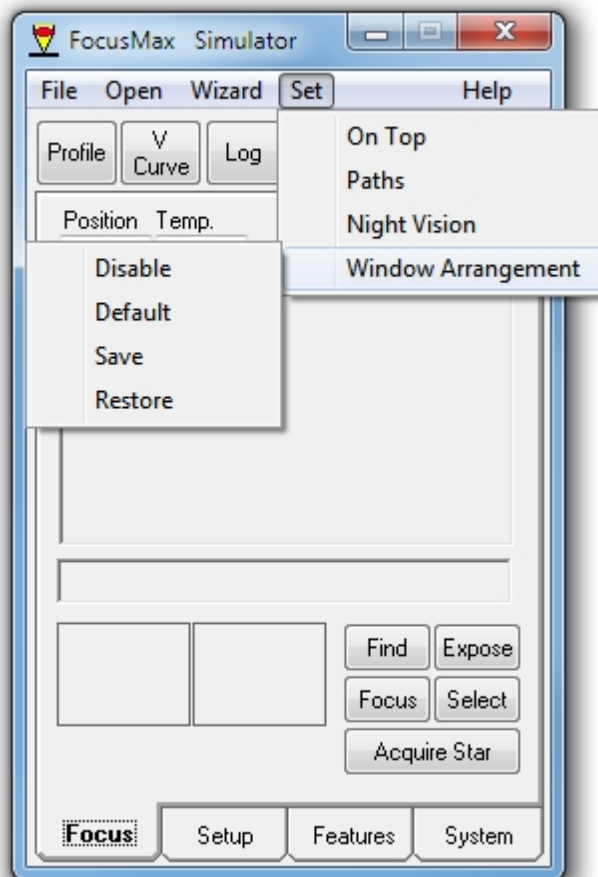
Help

Menu Help

Provides links to FocusMax

- Help

- Yahoo Discussion group

- Technical Paper which provides details on the FocusMax algorithm
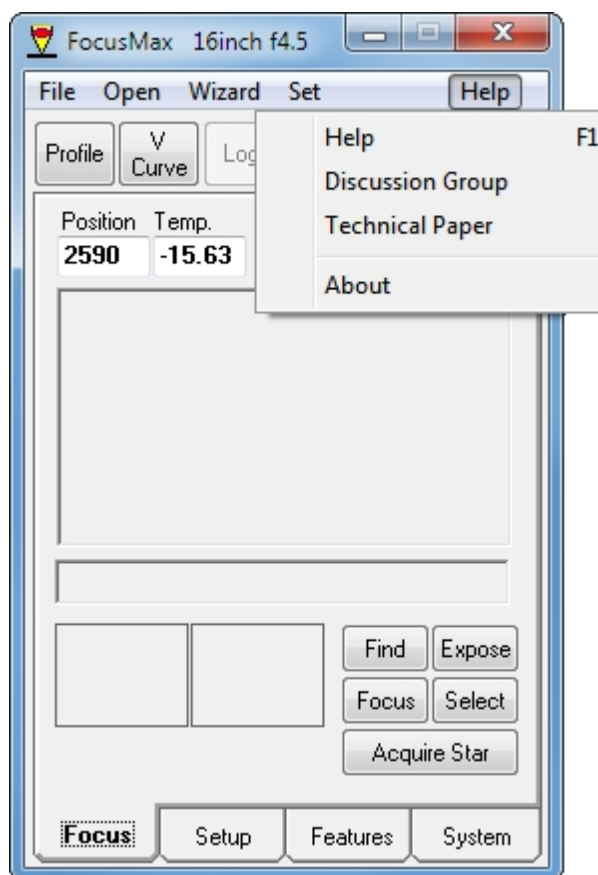
Telescope

Telescope

The telescope may be controlled from FocusMax which allows for star centering either automated (Center Star) or by hand using the directional buttons (N, S, E, W) or automated target acquisition using AcquireStar.

> Control Tab
>
> Setup Tab
>
> Calibrate Tab
>
> Site Tab

Control Tab

Telescope Control Tab

The Telescope Control Tab provides information on current position

- RA& Dec
- Alt & Az
- Local Sidereal Time (LST)
- Hour Angle E (-) and W (+) of the meridian.
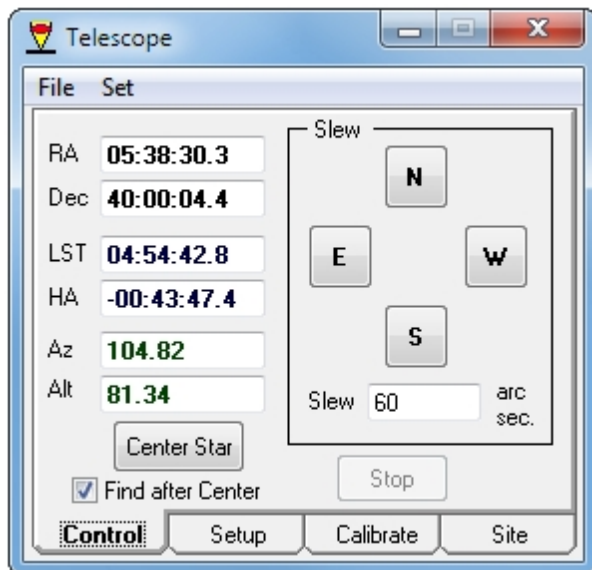
Slew buttons (N, S, E, W) are provided to slew the telescope by the user specified slew distance in arc-sec and clicking the desired slew direction.

Center Star will trigger FocusMax to take an image, select the brightest star in the images and then slew to center the star. This feature requires that the system first be calibrated with the operation found on the Telescope Calibrate Tab.

Setup Tab

Telescope Setup Tab

Used to select and then establish a connection to the telescope set parameters important to telescope operation

Select

Click the Select button to open the ASCOM Telescope Chooser. Within the ASCOM Telescope Chooser you can:

- choose the telescope.
- click the Properties button to open an options selection window specific to your telescope driver.
- click the OK button to close the Chooser and return to the FocusMax Telescope Setup Tab. This also places the name of your telescope in the Telescope Selection box

Connect

Will connect FocusMax to the Telescope via the telescope ASCOM interface

Disconnect

Will disconnect FocusMax from the Telescope

Setup

Will open an options selection window specific to your telescope driver

Status box

Will always inform you of the telescope status - located between the Setup and Select buttons . This must say "Connected" for FocusMax to control your telescope.

Park

Will park the telescope if it is Connected and Unparked.

Unpark

Will unpark the telescope if it is connected and in the park position

Slew Dead Band

The Telescope Center Star function (see the Center Star button on the Telescope Control Tab) will not move the telescope unless the move would cause the target star to move more than the X and Y pixel values specified by the Slew Dead Band.

Meridian flip

Should be enabled if the telescope performs a flip when crossing the meridian - most German Equatorial Mounts (GEM's) do. This feature is used in conjunction with the Center Star and must know which side of the meridian the telescope is pointing.

Dead Zone

The number of degrees E /W of the meridian before the telescope will perform a flip.

Use Topocentric Coordinates

Telescope driver requires topocentric coordinates (JNow, Earth surface) default is enabled

Calibrate Tab

Telescope Calibrate Tab

Calibration Training is required if the Center feature is to be used in FocusMax (see the Center Star button on the Telescope Control Tab). This routine will determine the image scale and CCD orientation by slewing the telescope in all four directions then measuring the corresponding shift in the target star position.

Slew Distance in arc minutes should first be set by the user to an appropriate value for the system. If this value is too large and the star moves off the CCD then the calibration will fail. If this value is too small then the calibration will not have sufficient accuracy.

Start button will trigger FocusMax to take an image, slew the telescope in all directions, taking multiple images to determine the orientation of the camera. This is necessary if the Center Star feature is to be used successfully.

Stop button will stop the calibration process but it may take a few seconds before the stop is completed.

Once calibrated, the Image Scale in arc-sec/pixel and the CCD Angle in degrees will be displayed in the Calibration frame along with the Sky Direction frame will show the directions of North and East on the CCD image. The user can reset the sky direction by selecting Flip Top to Bot. and/or Flip Left to Right options in the Calibration frame.

Site Tab

Telescope Site Tab

The Site Tab is used to set the observing location, time zone, etc. If the Use telescope box is checked then this information is obtained from the Telescope driver (if available).

This must be accurately entered if the AcquireStar feature is to be used.
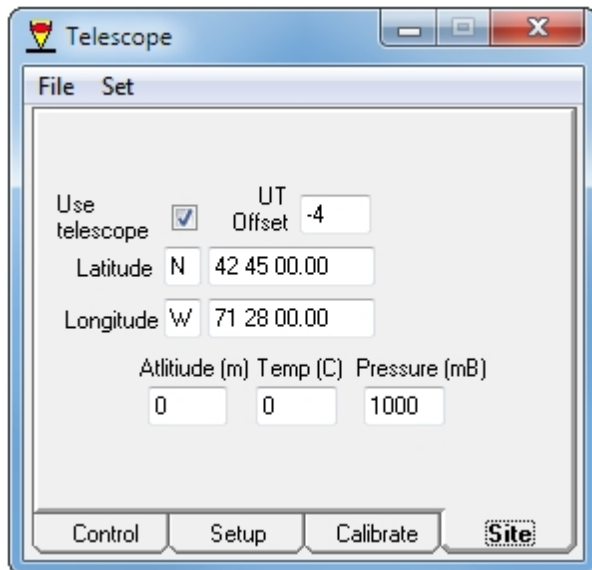
AcquireStar

AcquireStar

AcquireStar will identify and acquire a target star for autofocus that falls within the user defined requirements. This feature requires the full version of PinPoint and will not work with the current version of PinPoint LE bundled with MaxIm V3 or higher. At the push of a button or from a script AcquireStar will (depending on user settings):

● Take an image and plate solve the current telescope position

● Open a star catalog of choice and identify three stars that match the user set up requirements

● Slew the telescope to the first star

● Center the star

● Initiate the Auto-focus routine

● Re-slew the telescope to the starting position

● Take an image, plate solve the current telescope pointing position and fine adjust the telescope pointing

Astronomers are using AcquireStar with automated telescopes to perform a periodic focus update to assure that images acquired during the night are perfectly focused. AcquireStar can be operated manually by a push of a button or through automation within a script.
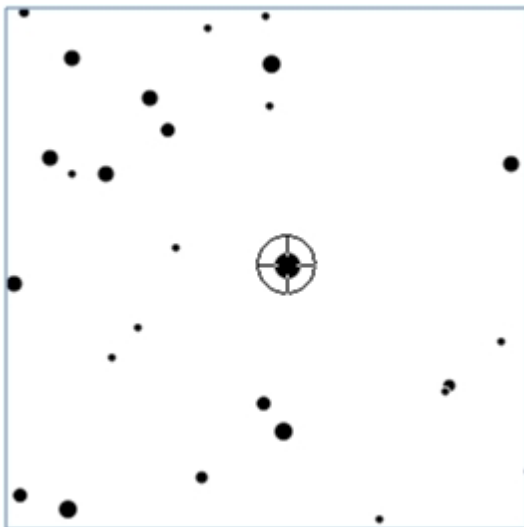
[Setup Tab](#)
[PinPoint Tab](#)

Setup Tab

AcquireStar Setup Tab
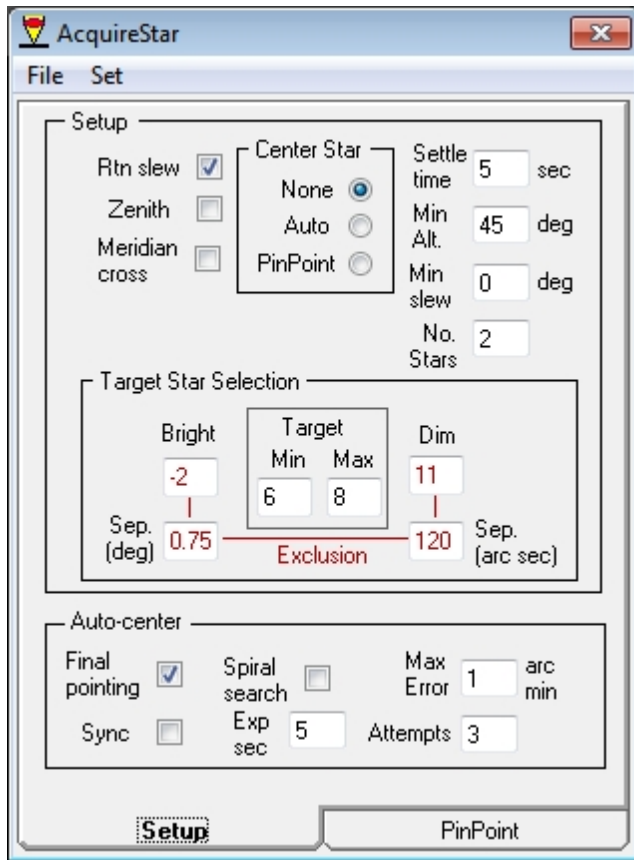
Setup

- Return slew will determine if the telescope will perform a return slew after acquiring the target star and performing the autofocus routine.

- Zenith will start the target star selection at the zenith and expand in 2x2 degree increments until a suitable star is found.

- Meridian Cross when checked will permit a target star from being selected on the other side of the meridian. Enable this feature if you are using a mount the does not flip, such as a fork equatorial mount.

- Settle Time the number of seconds the telescope will pause following a telescope slew

- Min Alt the minimum altitude that the user wants to use for target star identification.

- Min Slew the minimum distance that the telescope must slew away from the current position. This might be handy for deep-sky imager's who must leave the current field that has nebulosity so that FocusMax will not be confused during the autofocus routine.

- Number of Stars allows you to select the minimum number of stars that meet the above input parameters before the telescope slews to acquire the star (default = 3).

Center Star

- None to turn off star centering - can be used if telescope pointing always places the star near the center of the field

- PinPoint to plate solve the telescope pointing

- Auto to use the Telescope Center Star feature to center the brightest star in the filed before beginning the autofocus routine. The Auto option does require that the telescope move directions must be calibrated (see Telescope Setup).

Target Star Selection

- <u>Target Min / Max</u> settings are used to specify the desired target star magnitude range that will be selected from the star catalog.

- <u>Bright</u> is the brighter magnitude range that is undesirable for a target star

- <u>Separation Exclusion (Bright)</u> is the minimum separation in degrees that AcquireStar will accept for a bright star to reduce the chance that a bright star may be in the FOV of the CCD.

- <u>Dim</u> is the dimmest star that will be rejected which will range from the Max magnitude to Dim setting to avoid any dimmer stars that may fall in the FOV of the CCD and appear as a possible double star.

- <u>Separation Exclusion (Dim)</u> is the minimum separation in arc-seconds that AcquireStar will accept for a dim star to reduce the chance that the selected target star will appear as a double star when FocusMax performs the sub-frame images during autofocus.

Auto-Center

- <u>Solve</u> will allow PinPoint to plate solve telescope pointing for the current position and the return slew (if desired)

- <u>Sync</u> will perform a telescope sync following a successful plate solve.

- Spiral Search will be initiated if selected. PinPoint performs a plate solve by overlaying the image over adjacent catalog positions looking for a plate solution.

- <u>Exposure</u> setting (seconds) that will be used for the PinPoint plat solve routine.

- <u>Max Error</u> is the maximum error that the user will accept before AcquireStar will attempt to fine tune the telescope position and then perform another plate solve attempt.

    Example:
    Setting Max Error = 0.0833 arc-min (5 arc-sec)
    With the authors 16 f/4.5, 70" FL telescope (1.05 "/pixel), Paramount ME and a fresh TPoint model, the return slew position is within a few arc-seconds after one, sometimes two 2 pointing updates

- <u>Attempts</u> is the number of plate solve attempts for telescope pointing to achieve the Max Error setting.

The tables below describe different combinations that can be selected with Center Star, Return Slew and Final Pointing Update and a description of the operational process.

Method	Center Star	Return Slew	Final Pointing Update
1	PinPoint	√	√
2	PinPoint	√	X
3	PinPoint	X	X
4	Auto	√	√
5	Auto	√	X
6	Auto	X	X
7	None	√	√
8	None	√	X
9	None	X	X

Method	Process Description
1	PinPoint plate solve current position → find target stars from star catalog → slew telescope to target star → PinPoint plate solve → refine telescope position to user defined Max Error → autofocus → return slew → PinPoint plate solve → refine telescope position to user defined Max Error → AcquireStar completed
2	Use current telescope RA & Dec → find target stars from star catalog → slew telescope to target star → PinPoint plate solve → refine telescope position to user defined Max Error → autofocus → blind return slew (no PinPoint plate solve) → AcquireStar completed
3	Use current telescope RA & Dec → find target stars from star catalog → slew telescope to target star → PinPoint plate solve → refine telescope position to user defined Max Error → autofocus → AcquireStar completed (no return slew)
4	PinPoint plate solve current position → find target stars from star catalog → slew telescope to target star → auto-center star → autofocus → PinPoint plate solve → refine telescope position to user defined Max Error → AcquireStar completed
5	Use current telescope RA & Dec → find target stars from star catalog → blind slew telescope to target star → auto-center star → autofocus → blind return slew (no PinPoint plate solve) → AcquireStar completed
6	Use current telescope RA & Dec → find target stars from star catalog → blind slew telescope to target star → autofocus → AcquireStar completed (no return slew)
7	PinPoint plate solve current position → find target stars from star catalog → slew telescope to target star → autofocus brightest star → PinPoint plate solve → refine telescope position to user defined Max Error → AcquireStar completed
8	Use current telescope RA & Dec → find target stars from star catalog → blind slew telescope to target star → autofocus brightest star → blind return slew (no PinPoint plate solve) → AcquireStar completed
9	Use current telescope RA & Dec → find target stars from star catalog → blind slew telescope to target star → autofocus brightest star → AcquireStar completed (no return slew)

PinPoint Tab

AcquireStar PinPoint Tab
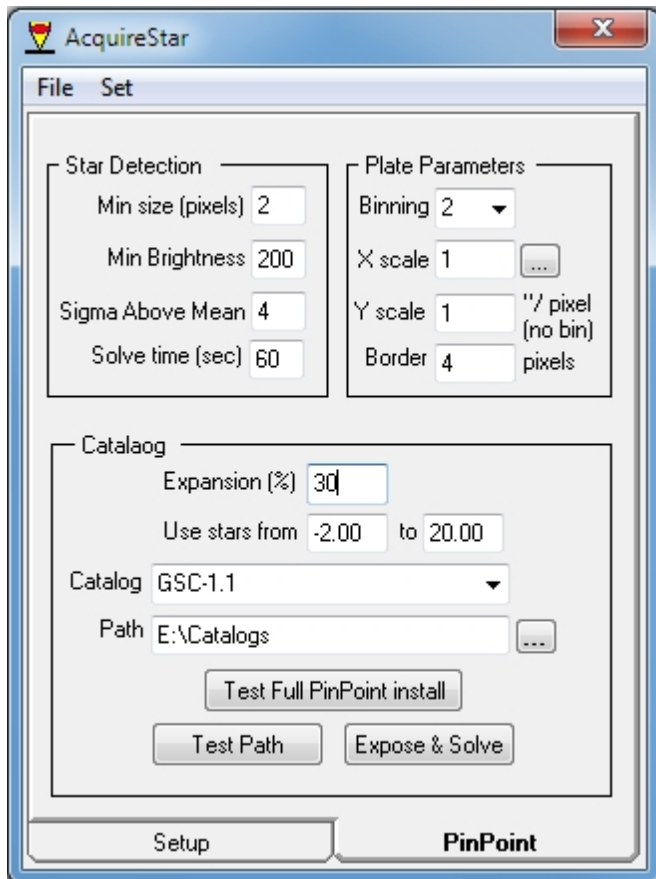
Star Detection

The settings above are typical PinPoint settings except for entries listed in the Plate Parameters frame which are unique to your system and the catalog used.

Plate Parameter

- <u>Binning</u> defines the camera binning that will be used for determining telescope pointing. It is recommended that you use 2+ to improve S/N and reduce image download time

- <u>X/Y scale</u> are to be entered for you camera unbinned. A calculator is provided by pressing the small button.

- <u>Border</u> is the number of pixels to ignore around the perimeter of the image when plate solving

Catalog

- <u>Expansion</u> setting will read additional stars from the catalog to aid in plate solving

- <u>Use Stars from</u> will extract stars in this range form plate solving

- <u>Catalog</u> combo lists the current catalogs that are available to be used by PinPoint.

- <u>Path</u> is the full path to the catalog chosen

- <u>Test Full PinPoint Install</u> button will verify that the full version of PinPoint has been installed which is required for AcquireStar

- <u>Test Path</u> button to verify that AcquireStar can access and read and count the number of stars in a 1.0x1.0 degree field centered on RA 00:00:00, Dec 0:00:00 from the chosen star catalog.

- <u>Expose and Solve</u> button will take an image of the sky using the PinPoint parameters defined then plate solve to determine telescope pointing. This is useful for troubleshooting PinPoint and system setup.

Scripting

Scripting FocusMax

FocusMax exposes a rich series of methods and properties that may be scripted by the user or a host applications (ACP, CCD Autopilot, CCD Commander, etc). There are many choices as to what language to use which includes, VBScript, JScript, Perl, Python,or higher level development platforms such as MS VB6, VB.NET, etc.

FocusMax provides two primary objects:

- FocusControl: methods and properties that can be used to control FocusMax functions (see FocusControl Properties and Methods).

- Focuser: methods and properties that can be used to control focuser functions (see Focuser Properties and Methods).

To script FocusMax you must

declare a variable

create an instance of the FocusMax object you would like to use

example:

Dim FMx

Set FMx = CreateObject("FocusMax.Focuser")

Any FocusMax method or property can be used:

FMx.Move(1000) will move the focuser to position 1000

FMx.Position will return the current focuser position

FocusControl Properties
FocusControl Methods
Focuser Properties
Focuser Methods

FocusControl

FocusControl

The FocusControl provides a rich set of FocusMax Methods and Properties that can be utilized in a script

Properties

FocusControl Properties

AcquireStarAllowSyncEnable

AcquireStarAllowSyncEnable

Property
AcquireStarAllowSyncEnable (Boolean)

Syntax
FocusMax.FocusControl.AcquireStarAllowSyncEnable = [Boolean]

Remarks
Set or Get if the telescope will perform a sync following successful plate solve in AcquireStar /
AcquireStarAsync.

AcquireStarAsyncStatus

AcquireStarAsyncStatus

Property
AcquireStarAsyncStatus (Integer)

Syntax
FocusMax.FocusControlMethod.AcquireStarStatus = [Integer]

Remarks
Initiates AcquireStar method

Returns the status of the current or previous AcquireStar operation which was started using the
AcquireStarAsync method.

A return value of:

 0 means the operation failed

 1 means the operation succeeded

-1 means the operation is in progress.

AcquireStarCenterMethod

AcquireStarCenterMethod

Property

AcquireStarCenterMethod (Integer)

Syntax

FocusMax.FocusControlMethod.AcquireStarCenterMethod = [Integer]

Remarks

Set AcquireStar centering method

0 = none

1 = auto-center

2 = plate solve

AcquireStarEnable

AcquireStarEnable

Property

AcquireStarEnable (Boolean)

Syntax

FocusMax.FocusControl. AcquireStarEnable = [Boolean]

Remarks

Set or Get the AcquireStar feature.

AcquireStarFinalPointingUpdate

AcquireStarFinalPointingUpdate

Property

AcquireStarFinalPointingUpdate (Boolean)

Syntax

FocusMax.FocusControl.AcquireStarFinalPointingUpdate = [Boolean]

Remarks

Set or Get the telescope final pointing update after autofocus

AcquireStarMeridianCrossEnable

AcquireStarMeridianCrossEnable

Property

AcquireStarMeridianCrossEnable (Boolean)

Syntax

FocusMax.FocusControl.AcquireStarMeridianCrossEnable = [Boolean]

Remarks

Set or Get if the mount will cross the meridian during target acquisition in AcquireStar / AcquireStarAsync.

AcquireStarMinAltitude

AcquireStarMinAltitude

Property

AcquireStarMinAltitude (Double)

Syntax

FocusMax.FocusControl.AcquireStarMinAltitude = [Double]

Remarks

Set or Get the min altitude allowed in selecting a target star with the AcquireStar / AcquireStarAsync feature.

AcquireStarMinSlew

AcquireStarMinSlew

Property

AcquireStarMinSlew (Double)

Syntax

FocusMax.FocusControl.AcquireStarMinSlew = [Double]

Remarks

Set or Get the min slew distance allowed in selecting a target star with the AcquireStar / AcquireStarAsync feature.

AcquireStarMaxMagTgtStar

AcquireStarMaxMagTgtStar

Property

AcquireStarMaxMagTgtStar (single)

Syntax

FocusMax.FocusControl.AcquireStarMaxMagTgtStar = [single]

Remarks

Sets the brightest target star to use for autofocus run.

AcquireStarMinMagTgtStar

AcquireStarMinMagTgtStar

Property

AcquireStarMinMagTgtStar (single)

Syntax

FocusMax.FocusControl.AcquireStarMinMagTgtStar = [single]

Remarks

Sets the dimmest target star to use for autofocus run.

AcquireStarMaxCatStarMag

AcquireStarMaxCatStarMag

Property
AcquireStarMaxCatStarMag (single)

Syntax
FocusMax.FocusControl.AcquireStarMaxCatStarMag = [single]

Remarks
Sets the brightest target star in to search in the star catalog.

AcquireStarMinCatStarMag

AcquireStarMinCatStarMag

Property
AcquireStarMinCatStarMag (single)

Syntax
FocusMax.FocusControl.AcquireStarMinCatStarMag = [single]

Remarks
Sets the dimmest target star in to search in the star catalog.

AcquireNumberStars

AcquireNumberStars

Property
AcquireNumberStars (Integer)

Syntax
FocusMax.FocusControl.AcquireNumberStars = [Integer]

Remarks
Set or Get the minimum number of stars that will be selected that based on the AquireStar parameters that have been set AcquireStar / AcquireStarAsync (default = 3).

AcquireStarReturnSlewEnable

AcquireStarReturnSlewEnable

Property

AcquireStarReturnSlewEnable (Boolean)

Syntax

FocusMax.FocusControl.AccquireStarReturnSlewEnable = [Boolean]

Remarks

Set or Get the telescope return slew in AcquireStar / AcquireStarAsync method after completing the autofocus routine.

AcquireStarReturnSlewError

AcquireStarReturnSlewError

Property

AcquireStarReturnSlewError (Double)

Syntax

FocusMax.FocusControl.AcquireStarReturnSlewError = [Double]

Remarks

Set or Get the acceptable slew error (arc-min) in AcquireStar / AcquireStarAsync.

AcquireStarSettleTime

AcquireStarSettleTime

Property

AcquireStarSettleTime (Double)

Syntax

FocusMax.FocusControl.AcquireStarSettleTime = [Double]

Remarks

Set or Get the telescope settle time (sec) following a slew in AcquireStar / AcquireStarAsync.

AcquireStarSolveEnable

AcquireStarSolveEnable

Property

AcquireStarSolveEnable (Boolean)

Syntax

FocusMax.FocusControl.AcquireStarSolveEnable = [Boolean]

Remarks

Set or Get plate solve to determine current telescope pointing during pre and post slews in AcquireStar / AcquireStarAsync.

AcquireStarSolveExposure

AcquireStarSolveExposure

Property

AcquireStarSolveExposure (Double)

Syntax

FocusMax.FocusControl.AcquireStarSolveExposure = [Double]

Remarks

Set or Get the plate solve exposure duration (sec) in AcquireStar / AcquireStarAsync.

AcquireStarSpiralSearchEnable

AcquireStarSpiralSearchEnable

Property

AcquireStarSpiralSearchEnable (Boolean)

Syntax

FocusMax.FocusControl.AcquireStarSpiralSearchEnable = [Boolean]

Remarks

Set or Get method to perform a spiral search to determine telescope pointing if plate solve fails

AcquireStarZenithEnable

AcquireStarZenithEnable

Property

AcquireStarZenithEnable (Boolean)

Syntax

FocusMax.FocusControl.AcquireStarZenithEnable = [Boolean]

Remarks

Set or Get if the target star will be selected from a star catalog starting at the zenith in AcquireStar / AcquireStarAsync.

AutoFocusExpMax

AutoFocusFluxMax

Property

AutofocusExpMax (Long)

Syntax

FocusMax.FocusControl.AutoFocusExpMax = [Long]

Remarks

Set or Get the max exposure setting used for autofocus with the Focus / FocusAsync feature.

AutoFocusExpMin

AutoFocusExpMin

Property

AutofocusExpMin (Long)

Syntax

FocusMax.FocusControl.AutoFocusExpMin = [Long]

Remarks

Set or Get the minx exposure setting used for autofocus with the Focus / FocusAsync feature.

AutoFocusFluxMax

AutoFocusFluxMax

Property

AutofocusFluxMax (Long)

Syntax

FocusMax.FocusControl.AutoFocusFluxMax = [Long]

Remarks

Set or Get the max flux setting used for autofocus with the Focus / FocusAsync feature.

AutoFocusFluxMin

AutoFocusFluxMin

Property

AutofocusFluxMin (Long)

Syntax

FocusMax.FocusControl.AutoFocusFluxMin = [Long]

Remarks

Set or Get the min flux setting used for autofocus with the Focus / FocusAsync feature.

AutoConnectTelescope

AutoConnectTelescope

Property

AutoConnectTelescope (Boolean)

Syntax

FocusMax.FocusControl. AutoConnectTelescope = [Boolean]

Remarks

Set or Get if the telescope will auto-connect when FocusMax is started. This is useful when used with [AcquireStar](#) / [AcquireStarAsync](#).

CCDCentralRegionEnable

CCDCentralRegionEnable

Property

CCDCentralRegionEnable (Boolean)

Syntax

FocusMax.FocusControl.CCDCentralRegionEnable = [Boolean]

Remarks

Enable (true) or disable (false) the CCD Central Region Width Percent for detecting a target star.

CCDCentralRegionWidthPercent

CCDCentralRegionWidthPercent

Property

CCDCentralRegionWidthPercent (Integer)

Syntax

FocusMax.FocusControl.CCDCentralWidthRegion = [Integer]

Remarks

Set or get the CCD Central Region Width Percent for detecting a target star.

Exposure

Exposure

Property

Exposure (Double)

Syntax

FocusMax.FocusControl.Exposure = [Double]

Remarks

Set or Get the CCD Exposure time in seconds.

FailAttempts

FailAttempts

Property

FailAttempts (Integer)

Syntax

FocusMax.FocusControl.FailAttempts = [Integer]

Remarks

Set or get the number of attempts to obtain additional exposures after an initial failed exposure.

FailTimer

FailTimer

Property

FailTimer (Integer)

Syntax

FocusMax.FocusControl.FailTimer = [Integer]

Remarks

Get or set the wait time in seconds between attempts to recover the target star if lost. A typical setting is 5 seconds.

FocuserBacklashDirection

FocuserBacklashDirection

Property
FocuserBacklashDirection (String)

Syntax
FocusMax.FocusControl.FocuserBacklashDirection = [String]

Remarks
Set or Get the focuser backlash direction:

0 = In

1 = Out

FocuserBacklashEnabled

FocuserBacklashEnabled

Property
FocuserBacklashEnabled (Boolean)

Syntax
FocusMax.FocusControl.FocuserBacklashEnabled = [Boolean]

Remarks
Set or Get the focuser backlash state.

FocuserBacklashSteps

FocuserBacklashSteps

Property
FocuserBacklashSteps (Long)

Syntax
FocusMax.FocusControl.FocuserBacklashSteps = [Long]

Remarks

Set or Get the focuser backlash setting in steps.

FocuserGuardBandSteps

FocuserGuardBandSteps

Property

FocuserGuardBandSteps (Long)

Syntax

FocusMax.FocusControl.FocuserGuardBandSteps = [Long]

Remarks

Set or Get the focuser guardband to limit travel to extreme min/max position.

FocuserTempComp

FocuserTempComp

Property

FocuserTempComp (Boolean)

Syntax

FocusMax.FocusControl.FocuserTempComp = [Boolean]

Remarks

Set or Get the focuser temperature compensation setting.

FocusConvergenceEnable

FocusConvergenceEnable

Property

FocusConvergenceEnable = [Boolean]

Syntax

FocusMax.FocusControl.FocusConvergence = [Boolean]

Remarks

Set or Get the FocusConvergence setting.

FocusConvergenceSamples

FocusConvergenceSamples

Property

FocusConvergenceSamples (Long)

Syntax

FocusMax.FocusControl.FocusConvergence = [Long]

Remarks

Set or Get number samples during when using autofocus convergence method

FocusConvergenceSkew

FocusConvergenceSkew

Property

FocusConvergenceSkew (Long)

Syntax

FocusMax.FocusControl.FocusConvergence = [Long]

Remarks

Set or Get the skew data rejection when using autofocus convergence method

FocusConvergenceSteps

FocusConvergenceSteps

Property

FocusConvergenceSteps (Long)

Syntax

FocusMax.FocusControl.FocusConvergence = [Long]

Remarks

Set or Get the Set number of focuser steps (tolerance) when using Focus Convergence method

FocusRoutineFailAttempts

FocusRoutineFailAttempts

Property

FocusRoutineFailAttempts (Integer)

Syntax

FocusMax.FocusControl.FailAttempts = [Integer]

Remarks

Set or Get the number of attempts to autofocus before declaring failure

FocusRoutineFailTimer

FocusRoutineFailTimer

Property

FocusRoutineFailTimer (Integer)

Syntax

FocusMax.FocusControl.FailTimer = [Integer]

Remarks

Set or get the time is seconds that the next attempted exposure will start after a failed exposure.

FocusRoutineMaxHFD

FocusRoutineMaxHFD

Property

FocusRoutineMaxHFD (Single)

Syntax

FocusMax.FocusControl.FocusRoutineMaxHFD = [Single]

Remarks

Get or set the maximum value of the Best Focus HFD value used to determine acceptability of the final focused target star following a focus run.

If the measured HFD exceeds this value, the focuser Position is returned to the start position.

Note, for this property to be active, the property FocusRoutineReturnToStartPositionEnable must be set to true.

FocusRoutineReturnToStartPositionEnable

FocusRoutineReturnToStartPositionEnable

Property

FocusRoutineReturnToStartPositionEnable (Boolean)

Syntax

FocusMax.FocusControl.FocusRoutineReturnToStartPositionEnable = [Boolean]

Remarks

Enable (true) or disable (false) the focuser return to start position if an error is encountered or Best Focus HFD is greater than the value specified by the property FocusRoutineMaxHFD.

HalfFluxDiameter

HalfFluxDiameter

Property

HalfFluxDiameter (read only, Single)

Syntax

FocusMax.FocusControl.HalfFluxDiameter

Remarks

Returns the Half Flux Diameter of the brightest star measured in pixel units.

This should be preceded by some Method that measures the HFD such as Focus or a FindStar or else it will return 0.

IsBusy

IsBusy

Property
IsBusy (read only, Boolean)

Syntax
FocusMax.FocusControl.IsBusy

Remarks
Returns the status if FocusMax is busy with an operation

Position

Position

Property
Position (read only, Long)

Syntax
FocusMax.FocusControl.Position

Remarks
Returns the current focuser position, in steps. Valid only for absolute positioning focuser's. An error will be thrown for relative positioning focusers.

SavedImagePath

SavedImagePath

Property
SavedImagePath (String)

Syntax

FocusMax.FocusControl.SavedImagePath = [String]

Remarks

Set or get the Path for the Saved Image files. When written, this property first checks for an existing directory and if not found creates a new directory. An error is raised if the named directory does not already exist and this property is unable to create a new directory. Setting SavedImagePath has the same effect as user entered changes to the Image box of the FocusMax System Tab.

SavedLogPath

SavedLogPath

Property

SavedLogPath (String)

Syntax

FocusMax.FocusControl.SavedLogPath = [String]

Remarks

Set or get the Path for the Log files. When written, this property first checks for an existing directory and if not found creates a new directory. An error is raised if the named directory does not already exist and this property is unable to create a new directory. Setting SavedLogPath has the same effect as user entered changes to the Log box of the FocusMax System Tab.

ShowFocusHistogram

ShowFocusHistogram

Property

ShowFocusHistogram (Boolean)

Syntax

FocusMax.FocusControl. ShowFocusHistogram = [Boolean]

Remarks

Set or Get the focus histogram display during the autofocus routine.
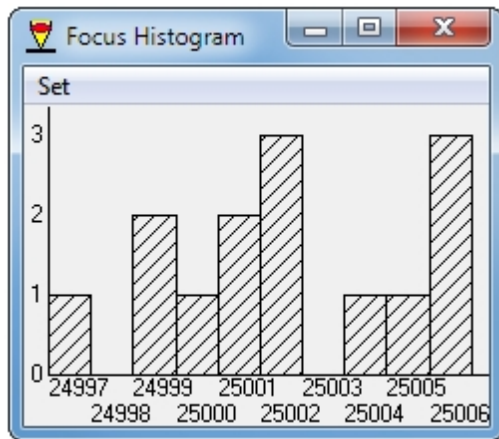
ShowFocusPlot

ShowFocusPlot

Property

ShowFocusPlot (Boolean)

Syntax

FocusMax.FocusControl.ShowFocusPlot = [Boolean]

Remarks

Set or Get the focus plot display during the autofocus routine.
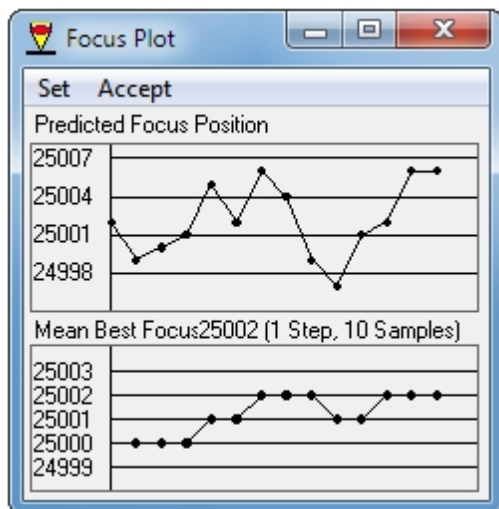
SingleExposeAsyncStatus

SingleExposeAsyncStatus

Property

SingleExposeAsyncStatus (read only, Integer)

Syntax

FocusMax.FocusControl.SingleExposeAsyncStatus = [Integer]

Remarks

Returns the status of the current or previous single expose operation started using the SingleExposeAsync method.

A return value of:

 0 = operation failed

 1 = operation succeeded

-1 = operation is in progress

SingleExposeFrameWidth

SingleExposeFrameWidth

Property

SingleExposeFrameWidth (Integer)

Syntax

FocusMax.FocusControl.SingleExposeFrameWidth

Remarks

Returns or sets the Width in pixels of the SingleExpose Frame. The Frame is always square so that the Height equals the Width. This reads or sets the Frame Width parameter on the Setup Tab.

StarXCenter

StarXCenter

Property

StarXCenter (Single)

Syntax

FocusMax.FocusControl.StarXCenter

Remarks

Returns or sets the CCD chip X coordinate of the center of the brightest star. It will return 0 unless preceded by a Focus or a FindStar Method, or is set with the StarXCenter Property.

StarYCenter

StarYCenter

Property
StarYCenter (Single)

Syntax
FocusMax.FocusControl.StarYCenter

Remarks
Returns or sets the CCD chip Y coordinate of the center of the brightest star. It will return 0 unless preceded by a Focus or a FindStar Method, or is set with the StarYCenter Property.

Temperature

Temperature

Property
Temperature (read only, Single)

Syntax
FocusMax.Focuser.Temperature

Remarks
Returns the current ambient temperature as measured by the focuser. Throws an error if ambient temperature is not available.

SystemFileName

SystemFileName

Property
SystemFileName (String)

Syntax
FocusMax.FocusControl.SystemFileName

Remarks

When read: Returns the System ini File Name. When written: Selects the Named System. The Name contains the full Path, the ini File Name and the Extension. An example SystemFileName is "C:\Program Files\FocusMax\Data Files\LX 200 f 6.3.ini".

This is very useful for modifying any of the System parameters. First modify the desired parameters in a valid System ini file and then set SystemFileName equal to the System ini File Name.

TotalFlux

TotalFlux

Property

TotalFlux (read only, Single)

Syntax

FocusMax.FocusControl.TotalFlux

Remarks

Returns the Total Half Flux of the target star.

Version

Version

Property

Version (read only, String)

Syntax

FocusMax.FocusControl.Version

Remarks

Returns the current FocusMax.exe version as read by Windows.

FindStarAsyncStatus

FindStarAsyncStatus

Property

FindStarAsyncStatus (read only, Integer)

Syntax

FocusMax.FocusControl.FindStarAsyncStatus =[Integer]

Remarks

Returns the status of the current or previous find star operation started using the [FindStarAsync](#) method.

A return value of:

 0 = operation failed

 1 = operation succeeded

-1 = operation is in progress

AcquireStarMinMagTgtStar

AcquireStarMinMagTgtStar

Property

AcquireStarMinMagTgtStar (single)

Syntax

FocusMax.FocusControl.AcquireStarMinMagTgtStar = [single]

Remarks

Sets the brightest target star to search from selected star catalog.

FocusAsyncStatus

FocusAsyncStatus

Property

FocusAsyncStatus (read only, Integer)

Syntax

FocusMax.FocusControl.FocusAsyncStatus = [Integer]

Remarks

Returns the status of the current or previous autofocus operation started using the [FocusAsyncStatus](#) method.

A return value of:

0 = operation failed

1 = operation succeeded

-1 = operation is in progress.

Methods

FocusControl Methods

AcquireStar

AcquireStar

Method
AcquireStar ( ) as Boolean

Syntax
FocusMax.FocusControlMethod.AcquireStar

Parameters
None

Returns
True if start is successful.

Remarks
Initiate AcquireStar method

AcquireStarAsync

AcquireStarAsync

Method
AcquireStarAsync ( ) as Boolean

Syntax
FocusMax.FocusControl.AcquireStarAsync

Parameters

None

Returns

True if start is successful.

Remarks

Starts the AcquireStar autofocus operation and returns immediately. AcquireStar identifies a target star from a catalog based on user criteria, slews the telescope, acquires the star, initiates the autofocus routine and performs a return slew.

Note that AcquireStarAsync allows your script to be active during the operation, which may take many seconds. You may need to periodically check the AcquireStarAsyncStatus property to determine when the status of the operation.

Delay

Delay

Method

Delay (Double)

Syntax

FocusMax.FocusControl.Delay = [Double]

Parameters

None

Returns

Nothing

Remarks

Initiate a user defined delay which is useful to assure script operations are complete .

FindStar

FindStar

Method

FindStar () as Boolean

Syntax

FocusMax.FocusControl.FindStar

Parameters

None

Returns

True if start is successful.

Remarks

Starts the Find Star operation and returns when FindStar is complete. This looks for the brightest star on the CCD, finds its StarXCenter, StarYCenter, then takes a SingleExpose of SingleExposeFrameWidth at the star coordinates, and finally measures and updates the HalfFluxDiameter Property. If the star cannot be found this Method sets HalfFluxDiameter = 0. This Method has the same effect as if the user clicked the Find button on the Focus Tab.

Note that the FindStar may take many seconds and your script will not progress beyond FindStar until the operation is complete. Use FindStarAsync to get immediate return to your script, which allows parallel operation with your script.

FindStarAsync

FindStarAsync

Method

FindStarAsync ( ) as Boolean

Syntax

FocusMax.FocusControl.FindStarAsync

Parameters

None

Returns

True if start is successful.

Remarks

Starts the Find Star operation and returns immediately. This looks for the brightest star on the CCD, finds its StarXCenter, StarYCenter, then takes a SingleExpose of SingleExposeFrameWidth at the star coordinates, and finally measures and updates the HalfFluxDiameter Property. If the star cannot be found this Method sets HalfFluxDiameter = 0. This Method has the same effect as if the user clicked the Find button on the Focus Tab.

Note that the FindStarAsync allows your script to be active during the Find Star operation, which may take many seconds. You may need to periodically check the FindStarAsyncStatus property to determine when the Find Star is complete. Use method FindStar when it is more convenient to simply stop the execution of your script until the Find Star is complete.

Focus

Method
Focus ( ) as Boolean

Syntax
FocusMax.FocusControl.Focus

Parameters
None

Returns
True if start is successful.

Remarks
Starts the auto focus operation and returns when Focus is complete. This finds the brightest star on the CCD, and then controls the focuser Position until Best Focus is achieved. It updates the Properties StarXCenter, StarYCenter and HalfFluxDiameter. If the auto focus is not successful this Method sets HalfFluxDiameter = 0. This Method has the same effect as if the user clicked the Focus button on the Focus Tab.

Note that the Focus may take many seconds and your script will not progress beyond Focus until the operation is complete. Use FocusAsync to get immediate return to your script, which allows parallel operation with your script.

FocusAtStarCenter

Method
FocusAtStarCenter( ) as Boolean

Syntax
FocusMax.FocusControl.FocusAtStarCenter

Parameters
None

Returns
True if start is successful.

Remarks

Perform autofocus at star defined by StarXCenter and StarYCenter. This does not perform do the initial Full Frame Find Star exposure.

FocusAtStarCenterAsync

FocusAtStarCenterAsync

Method
FocusAtStarCenterAsync( ) as Boolean

Syntax
FocusMax.FocusControl.FocusAtStarCenter

Parameters
None

Returns
True if start is successful.

Remarks
Perform autofocus at star defined by StarXCenter and StarYCenter as an Async function. This does not perform do the initial Full Frame Find Star exposure.

FocusAsync

FocusAsync

Method
FocusAsync ( ) as Boolean

Syntax
FocusMax.FocusControl.FocusAsync

Parameters
None

Returns
True if start is successful.

Remarks
Starts the auto focus operation and returns immediately. FocusAsync finds the brightest star on the CCD,

and then controls the focuser Position until Best Focus is achieved. It updates the Properties StarXCenter, StarYCenter and HalfFluxDiameter . If the auto focus is not successful this Method sets HalfFluxDiameter = 0. This Method has the same effect as if the user clicked the Focus button on the Focus Tab.

Note that FocusAsync allows your script to be active during the Focus operation, which may take many seconds. You may need to periodically check the FindStarAsyncStatus property to determine when the Focus is complete. Use method Focus when it is more convenient to simply stop the execution of your script until the Focus is complete.

Halt

Halt

Method

Halt ( )

Syntax

FocusMax.FocusControl.Halt()

Parameters

None

Returns

Nothing

Remarks

Immediately stops any operation initiated by a FocusMax.FocusControl Asynchronous method.

This will terminate exposures and stop the motion of any focusers that are capable of being stopped by software commands.

Some focusers such as the Optec TCF-S may not be stopped by this function.

Note that Halt is only useful for the Asynchronous methods such as FocusAsync, FindStarAsync and SingleExposeAsync. Halt cannot be executed during Synchronous methods because these methods do not return control to the script until the operation is complete.

Move

Move

Method

Move (Long)

Syntax

FocusMax.FocusControl.Move(Long)

Parameters
None

Returns
Nothing

Remarks
If property Absolute is true, then this is an absolute positioning focuser. The Move command tells the focuser to move to an exact step position, and Position is an integer between 0 and property MaxStep.

If property Absolute is false, then this is a relative positioning focuser. The Move command tells the focuser to move in a relative direction, and Position is an integer between – MaxIncrement and + MaxIncrement.

RunVcurve

RunVcurve

Method
RunVcurve () Boolean

Syntax
FocusMax.FocusControl.RunVcurve

Parameters
None

Returns
True if start is successful.

Remarks
Will load Vcurve window if FocusMax is not buy performing a function (autofocus, AcquireStar, ...) and initiate a synchronous Vcurve run using defined settings

SendToLog

SendToLog

Method
SendToLog ( )

Syntax

FocusMax.FocusControl.SendToLog

Parameters
None

Returns
Nothing

Remarks
Sends string to the Log which is useful for documenting script steps.

ShowLog

ShowLog

Method
ShowLog ( )

Syntax
FocusMax.FocusControl.ShowLog

Parameters
None

Returns
Nothing

Remarks
Opens the Log window

SingleExpose

SingleExpose

Method
SingleExpose ( ) as Boolean

Syntax
FocusMax.FocusControl.SingleExpose

Parameters
None

Returns
True if start is successful.

Remarks

Takes a Single Exposure and returns when the exposure is complete.

The exposure is taken at the current StarXCenter and StarYCenter with SingleExposeFrameWidth and it measures a new StarXCenter ,StarYCenter and HalfFluxDiameter.

If the star cannot be found this Method sets HalfFluxDiameter = 0. You can initially set the StarXCenter and StarYCenter values of the brightest star on the CCD with the FindStar or the Focus Methods.

This Method has the same effect as if the user clicked the Expose button on the Focus Tab.

Note that the SingleExpose may take many seconds and your script will not progress beyond SingleExpose until the operation is complete. Use SingleExposeAsync to get immediate return to your script, which allows parallel operation with your script.

SingleExposeAsync

SingleExposeAsync

Method

SingleExposeAsync ( ) as Boolean

Syntax

FocusMax.FocusControl.SingleExposeAsync

Parameters

None

Returns

True if start is successful

Remarks

Takes a Single Exposure and returns when the exposure is complete using SingleExposeAsyncStatus.

The exposure is centered at the current StarXCenter and StarYCenter with SingleExposeFrameWidth and it measures a new StarXCenter,StarYCenter and HalfFluxDiameter. If the star cannot be found this Method sets HalfFluxDiameter = 0.

You can initially set the StarXCenter and StarYCenter values of the brightest star on the CCD with the FindStar or the Focus Methods.

This Method has the same effect as if the user clicked the Expose button on the Focus Tab.

Focuser

Focuser

Standard ASCOM Focuser Methods and Properties that can be used to control focuser functions

Standard ASCOM Focuser Methods and Properties that can be used to control focuser functions

Properties

Focuser Properties

Absolute

Absolute

Property
Absolute (read-only, Boolean)

Syntax
FocusMax.Focuser.Absolute

Remarks
Returns true if the focuser is capable of absolute position; that is, being commanded to a specific step location.

GetFocuserID

GetFocuserID

Property
GetFocuserID (read-only, String)

Syntax
FocusMax.Focuser.GetFocuserID

Remarks
Returns the focuser that is connected to FocusMax

IsMoving

IsMoving

Property

IsMoving (read-only, Boolean)

Syntax

FocusMax.Focuser.IsMoving

Remarks

Returns true if the focuser is currently moving to a new position. Returns false if the focuser is stationary

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Link

Link

Property

Link (Boolean)

Syntax

FocusMax.Focuser.Link = [Boolean]

Remarks

Set true to start the link to the focuser; set false to terminate the link.

The current link status can also be read back.

An error will be raised if the link fails to change state for any reason.

MaxIncrement

MaxIncrement

Property

MaxIncrement (read only, Long)

Syntax

FocusMax.Focuser.MaxIncrement

Remarks

Returns the maximum increment size allowed by the focuser; i.e. the maximum number of steps allowed in one move operation.

For most focusers this is the same as the MaxStep property.

MaxStep

MaxStep

Property
MaxStep (read only, Long)

Syntax
FocusMax.Focuser.MaxStep

Remarks
Returns the maximum step position permitted. The focuser can step between 0 and MaxStep.

If an attempt is made to move the focuser beyond these limits, it will automatically stop at the limit.

Position

Position

Property
Position (read only, Long)

Syntax
FocusMax.Focuser.Position

Remarks
Returns the current focuser position, in steps. Valid only for absolute positioning focusers.

An error will be thrown for relative positioning focusers.

StepSize

StepSize

Property
StepSize (read only, Single)

Syntax
FocusMax.Focuser.StepSize

Remarks

Returns the step size in Microns for the focuser. Throws an error if the focuser does not intrinsically know what the step size is.

TempComp

TempComp

Property

TempComp (Boolean)

Syntax

FocusMax.Focuser.TempComp = [Boolean]

Remarks

If property TempCompAvailable is true, then setting TempComp to true puts the focuser into temperature tracking mode. While in temperature tracking mode, Move commands will be rejected by the focuser. Set to false to turn off temperature tracking.

An error will be raised if TempCompAvailable is false and an attempt is made to set TempComp to true.

Setting TempComp to True will allow simultaneous temperature tracking and FocusMax autofocusing. If a Focus or FocusAsync method is called while TempComp is True, FocusMax will temporarily turn off temperature compensation while the autofocus is active. Once the autofocus is complete, the temperature tracking will be resumed.

TempCompAvailable

TempCompAvailable

Property

TempCompAvailable (read only, Boolean)

Syntax

FocusMax.Focuser.TempCompAvailable

Remarks

Returns true if the focuser has a built-in temperature compensation mode that can be activated by property TempComp. Returns false if such a mode is not available.

Temperature

Property
Temperature (read only, Single)

Syntax
FocusMax.Focuser.Temperature

Remarks
Returns the current ambient temperature as measured by the focuser. Throws an error if ambient temperature is not available.

Methods

Focuser Methods

Halt

Method
Halt ( )

Syntax
FocusMax.Focuser.Halt

Parameters
None

Returns
Nothing

Remarks
Immediately stops any focuser motion due to a previous Move command. Some focusers may not support this function, in which case an exception will be thrown.

Move

Move

Method
Move (Long)

Syntax
FocusMax.Focuser.Move(Long)

Parameters
Long Position - Step distance or absolute position, depending on focuser.Absolute

Returns
Nothing

Remarks
If property Absolute is true, then this is an absolute positioning focuser. The Move command tells the focuser to move to an exact step position, and Position is an integer between 0 and property MaxStep.

If property Absolute is false, then this is a relative positioning focuser. The Move command tells the focuser to move in a relative direction, and Position is an integer between – MaxIncrement and +MaxIncrement.

SetupDialog

SetupDialog

Method
SetupDialog ()

Syntax
FocusMax.Focuser.SetupDialog()

Parameters
None

Returns
Nothing

Remarks
Brings up a dialog box for the user to enter in custom setup parameters, such as a COM port selection. If

no dialog is required or supported, the function returns immediately.
FocusMax does not require a setup dialog and so it returns immediately.

WaitForSec

WaitForSec

Method
WaitForSec (Double)

Syntax
FocusMax.Focus.WaitForSec(Double)

Parameters
Number of seconds

Returns
Nothing

Remarks
Delay for defined number of seconds.

Sample Scripts

Sample Scripts

Copy the following to to the clipboard (Ctl-C) and paste into Notepad (Ctl-V) and save as MyScript.VBS
Sample #1

```
Dim FMx
Dim FMxFoc
Dim Position
Dim SysName

Set FMx = CreateObject("FocusMax.FocusControl")
Set FMxFoc = CreateObject("FocusMax.Focuser")

'Get current active system name
SysName =  FMx.SystemFileName
wscript.echo "System = " & SysName
```

```
'Get and store the current focuser position
Position = FMx.Position
wscript.echo "Position = "  & Position


'Move focuser 100 units in minus direction from current position
FMx.Move(Position - 1000)
Do
Loop while FMxFoc.IsMoving
wscript.echo "Position = " & FMx.Position


'Return focuser to original position
FMx.Move(Position)
Do
Loop while FMxFoc.IsMoving
wscript.echo "Position = " & FMx.Position


'Load new focuser system.ini - note file name and full path is required
FMx.SystemFileName = "E:\FocusMax\Simulator.ini"
FMx.Delay (1)


'Perform autofocus async
FMx.FocusAsync
Do
Loop while FMx.FocusAsyncStatus = -1


'Load original focuser system.ini file
FMx.SystemFileName = SysName
FMx.Delay (1)
wscript.echo "System = " & SysName


wscript.echo "Press OK to exit"
====================================
```

Sample #2

```
Dim FM
Dim FMxFocuser
Dim TgtPosX, TgtPosY, TgtStarHFD


Set FM = CreateObject("FocusMax.FocusControl")
'Set FMxFocuser= CreateObject("FocusMax.Focuser")


FM.ShowLog


FM.FocusAsync
```

```
Do

Loop while FM.AcquireStarAsyncStatus = -1

FM.Focus

FM.FindStar
TgtPosX = FM.StarXCenter
TgtPosY = FM.StarYCenter
TgtStarHFD=FM.HalfFluxDiameter
wscript.echo "X=" & TgtPosX & " Y=" & TgtPosY & " HFD=" & TgtStarHFD


wscript.echo "Focus position = " & FM.Position


FM.SingleExpose

FM.Move(FM.Position + 500)
wscript.echo "Position = " & FM.Position

wscript.echo "Press OK to exit"
```

System Files

System Files

Each System is unique and requires an ini file that stores the user settings and System Profile data on the hard drive. When a new System is created, a default ini file is generated that can be modified as required. The ini file is an ordinary text file that can be edited by the user with any text editor. The System ini Files are typically found in the "C:\Users\xxx\FocusMax" directory. An example ini file is shown below. Most of the ini file values are dynamic and will change as the user updates a FocusMax setting.

Sample

Sample

Sample System ini File

[Config]
MoveDirection =Out
SettleTime =0
BestFocusSampleLimit =5
NearFocusHFD =8
FocusStartHFD =12
StartFocusType =2
SubFrameWidth =100
Exposure =1.00
VcurveSteps = 30
VcurveHalfWidth =106
VcurveStepIncr =7
InitialFocusPosition =9937
PreviousFocus =10001
WizardVCurveStartHFD = 20
TempMovingAvg = 5
TempLogInterval = 0.5
ConvergenceSteps = 2
ConvergenceSamples = 5
MaxSkew = 1
FocusPlotEnable = 1
ShowFocusPlot = 0
CameraPreExpDelay =0
CameraPostExpDelay =0
CCDCentralRegionEnable =0
CCDCentralRegionWidthPercent =75
FocusRoutineReturnToStartPositionEnable =1
FocusRoutineMaxHFD =6.0
FocuserBacklashDirection=0
FocuserBacklashSteps=0
FocuserBacklashEnabled=0
DebugMode=0
MyFocuserID=FocusSim.Focuser
TgtStarBin=2
AutoFocusBin=1
FocusConvergenceSteps=2
FocusConvergenceSamples=5

FocusConvergenceMaxSkew=1

FocusConvergenceEnable=1

AutoFocusFluxMin=50

AutoFocusFluxMax=500

AutoFocusExpMin=1.00

AutoFocusExpMax=5.00

FocuserTempComp=0

NewProfileFormat=1

TC_PreviousTemperature=1.76

TC_PreviousFocuserPosition=10001

CameraImageTimeout=15

FocuserPollingRate=1

FocuserGuardBandSteps=0

AutoConnectFocuser=1

AutoConnectCamera=1

AutoConnectTelescope=0

VcurveImages_Step=1

[User]

FailAttempts = 3

FailTimer = 5

MsgDisplayTime =5

VcurveMaxSigma=3.0

FocusRoutineFailAttempts=3

FocusRoutineFailTimer=5

AutoUpdateVcurveParameters=1

[System]

RightSlope =0.196718

LeftSlope =-0.196909

PosIntercept =5.97

[Data]

Y|2012/06/25|12.47.40|5.97|-0.196909|0.196718|Binning=1 Total pts=31 Good pts=30

Tips & Troubleshooting

Tips & Troubleshooting

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Temperature Compensation

Tips

Tips

1. Slippage can occur in a focuser which may result in the final focus position drifting when running back to back focus runs or when running consecutive Vcurves. Go through the focuser mechanism and inspect / tighten pinion gears in a rack and pinion focuser, tighten rollers that interface with the draw tube in Crayford style, etc.

2. Backlash:

   Verify that Backlash is turned on in either FocusMax **or** the focuser driver but **not both**. The backlash setting will verify and is highly dependent on the focuser and telescope construction. For example, the traditional SCT that focuses by moving the primary mirror will require significant backlash in the winter as the mirror may experience slip-stick due to the grease applied in the ways.

   Most users set the focuser backlash in the direction against gravity so as to lift the payload if appropriate for your telescope. This is difficult for a Newtonian on a German Equatorial that will experience various focuser orientation depending on where the telescope is pointed in the sky.

   What backlash setting to use? This will depend on the focuser - it is best if you can measure it directly with a drop indicator or reference the manual or ask the manufacturer.

3. Verify that you focuser will move through the entire range of motion from 0 to max travel and that is able to move this distance in one contiguous move. If not, then open the driver window and make adjustments. Before testing, verify that the Limit End of Travel Position setting in Menu/Open/Options is set to 0.

4. You are setting up a new computer and need to transfer your system.ini files:
   a) Open FocusMax on the original computer
   b) Select the System Tab
   c) Pres the small button to the right of the system name at the bottom of the window to identify the path where the files are stored (default C:\Users\XXX\Documents)
   d) Open FocusMax on the new computer and create or modify the default path
   e) Copy all of the .ini files to your new computer

5. If the Vcurve appears flat at the bottom then increase the max HFD setting to extend the height of the Vcurve if possible.

   If the Vcurve has a flat top then it may indicate that the focuser has reached end-of-travel and slippage is occurring.

6. If a focus run fails and the focuser returns to the last known good focus position then check if the Return to start position is enabled. If the HFD from the focus run exceeds this setting, then FocusMax will consider the focus run a failure and return to the previously known good position. It is also a good idea to setup FocusMax yo take 3 - 5 at the conclusion of the autofocus run images which will be averaged before determining if the final HFD is unreasonable - see Menu/Open/Options/Final Focus Images (Final Focus Images).

7. The parameters in the Vcurve window will automatically update when the cursor leaves the text box.

   To turn this feature off, open the active system.ini and find the entry: AutoUpdateVcurveParameters and set to 0 (default = 1 enabled).

8. To determine the best setting for Focus Start HFD and Near Focus HFD (see Setup Tab)
   a) Generate a Vcurve
   b) From the Log identify the right or left most extreme HFD value (20.33 in the example below).
   c) Examine the Vcurve graph and identify the circle which begins to deviate from a straight line.
   d) Determine the circle position in the Log by counting down the number of circles (step 2).
   e) Round up the HFD value in the Log and add 1 or 2 HFD units to assure that the Near Focus Position is on the linear portion of the 'V'. Enter the value in the **Near Focus HFD** box would be 12 in the example below.
   f) Enter the **Focus Start HFD** some 5 units higher than the Near Focus HFD which would be 17 in the example below.

Log

```
18:28:59  Temperature = 49.2
18:29:01  Single Exp. HFD  20.33 @ 24901 X: 511 Y: 382 Flux: 57060
18:29:04  Single Exp. HFD: 19.06 @ 24907 X: 511 Y: 382 Flux: 57557
18:29:07  Single Exp. HFD: 17.86 @ 24913 X: 511 Y: 382 Flux: 57070
18:29:10  Single Exp. HFD: 16.71 @ 24919 X: 511 Y: 382 Flux: 56876
18:29:13  Single Exp. HFD: 15.55 @ 24925 X: 511 Y: 382 Flux: 56649
18:29:16  Single Exp. HFD: 14.46 @ 24931 X: 511 Y: 382 Flux: 57388
18:29:19  Single Exp. HFD: 13.34 @ 24937 X: 511 Y: 382 Flux: 56951
18:29:22  Single Exp. HFD: 12.21 @ 24943 X: 511 Y: 382 Flux: 56822
18:29:25  Single Exp. HFD  11.03 @ 24949 X: 511 Y: 382 Flux: 56875
18:29:28  Single Exp. HFD:  9.78 @ 24955 X: 511 Y: 382 Flux: 56638
18:29:31  Single Exp. HFD:  8.65 @ 24961 X: 511 Y: 382 Flux: 57040
18:29:34  Single Exp. HFD:  7.62 @ 24967 X: 511 Y: 382 Flux: 56681
18:29:37  Single Exp. HFD:  6.64 @ 24973 X: 511 Y: 382 Flux: 57151
18:29:40  Single Exp. HFD:  5.56 @ 24979 X: 511 Y: 382 Flux: 56979
18:29:43  Single Exp. HFD:  4.83 @ 24985 X: 511 Y: 382 Flux: 56923
18:29:46  Single Exp. HFD:  4.06 @ 24991 X: 511 Y: 382 Flux: 56986
18:29:49  Single Exp. HFD:  3.50 @ 24997 X: 511 Y: 382 Flux: 56764
18:29:52  Single Exp. HFD:  3.48 @ 25003 X: 511 Y: 382 Flux: 57166
18:29:55  Single Exp. HFD:  3.87 @ 25009 X: 511 Y: 382 Flux: 57171
18:29:58  Single Exp. HFD:  4.41 @ 25015 X: 511 Y: 382 Flux: 57058
18:30:01  Single Exp. HFD:  5.25 @ 25021 X: 511 Y: 382 Flux: 56787
18:30:04  Single Exp. HFD:  6.27 @ 25027 X: 511 Y: 382 Flux: 56959
18:30:09  Single Exp. HFD:  7.39 @ 25033 X: 511 Y: 382 Flux: 57051
18:30:12  Single Exp. HFD:  8.35 @ 25039 X: 511 Y: 382 Flux: 56711
18:30:15  Single Exp. HFD:  9.45 @ 25045 X: 511 Y: 382 Flux: 57126
18:30:18  Single Exp. HFD: 10.52 @ 25051 X: 511 Y: 382 Flux: 56798
18:30:21  Single Exp. HFD: 11.65 @ 25057 X: 511 Y: 382 Flux: 57179
18:30:24  Single Exp. HFD: 12.97 @ 25063 X: 511 Y: 382 Flux: 57266
18:30:27  Single Exp. HFD: 14.01 @ 25069 X: 511 Y: 382 Flux: 57410
18:30:30  Single Exp. HFD: 15.17 @ 25075 X: 511 Y: 382 Flux: 56911
18:30:32  Single Exp. HFD: 16.40 @ 25081 X: 511 Y: 382 Flux: 57278
18:30:35  Single Exp. HFD: 17.64 @ 25087 X: 511 Y: 382 Flux: 57200
18:30:38  Single Exp. HFD: 18.81 @ 25093 X: 511 Y: 382 Flux: 57382
18:30:41  Single Exp. HFD: 19.82 @ 25099 X: 511 Y: 382 Flux: 57378
18:30:42  VCurve Sequence Complete
18:30:42  LS: -0.188549 RS: 0.188821 PID: 11.14
18:30:42  Results saved to Profile: Simulator
```

Vcurve Sequence

File   Set

[Run] [Stop]

Vcurve Parameters

Autofocus ☑

		End Points ○	Half Width ◉
	Initial	24901	Center	25001
Repeat	0	Final	25101	Half Width	100
Images /position	1	Step Incr.	6	Steps	33

20.33¶

11.03¶

Fit Lines

	Left	Right	
Slope	-0.188549	0.188821	Difference
Position Intercept	25004.4	24993.2	11.14

9. To achieve a better Vcurve calculation set the Images/position = 3 which will average momentary seeing effects.
    o Next watch the FocusMax Log while running a Vcurve and note the 'lowest' HFD value recorded and its associated 'Position' value. (Some people run Vcurves to find their best focus position instead of performing a FocusMax Focus cycle. I've tried this, it does pretty good, but takes longer compared to a normal Focus run.)
    o When the Vcurve cycle completes adjust your 'Center' value to the best HFD's Position from the Log and run another Vcurve, the 'V' should be centered more precisely.
    o If you found each Vcurve to consistently increment, I'd look closely at your focuser.
      a) First check your Backlash settings.
         Backlash should 'only' be set in "one" place.
      ...FocusMax 'or' in your Focuser's Driver **not** both. This tip has always been important to FocusMax.

      b) Check your focuser is not slipping.
       ...After several Focus runs or Vcurves can your focuser be commanded to return to Zero successfully?
       ...If it returns to Zero on the counter is there any gap of the drawtube before being completely closed?
       ...If there is a gap that could indicate slippage, where the counter is incremented but the drawtube not being moved, slippage.

      c) Here's a 'poor' test for Focuser Slippage:
       .. .Change the direction the focuser movement, from In to Out or visa versa.
       . ..If there is slippage in 'both' directions then the Position increment will appear in both directions. The reason this is a poor test is it is not reliable because the weight load, camera, field corrector/reducer, filterwheel etc., being moved will react differently dependent upon

whether the load is being 'lifted' against gravity or 'lowered' with gravity. You may find your system performs better if you 'lower' your load than the recommended lifting of the load.

"May You Go Among The Imperishable Stars"
Joe Mize www.cav-sfo.com
Chiefland Astronomy Village (CAV), Fla
StarFields Observatory, (SFO).
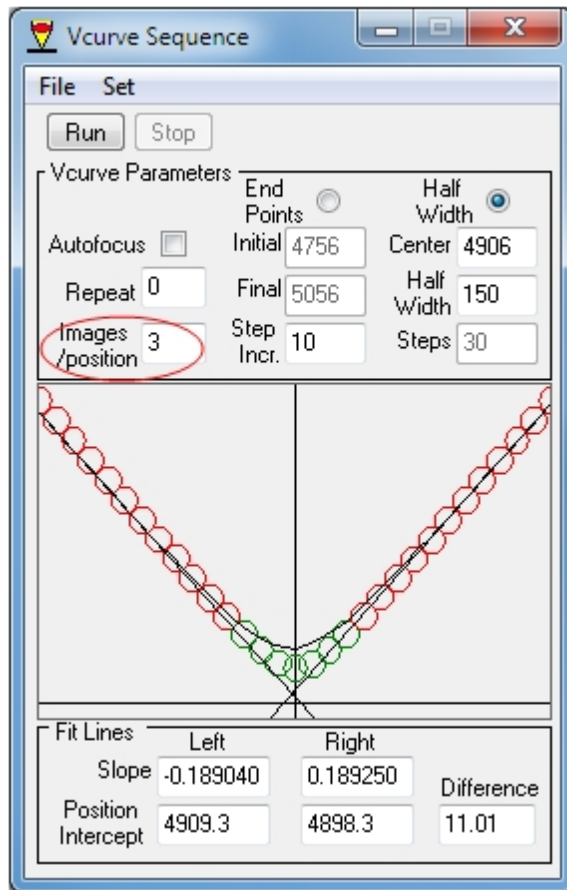
10. How to move a window back on to the screen when it is off the screen and not visible.
    a) Alt-Tab to the desired window
    b) Press Alt-Space to open the Control Menu
    c) Press the M key for Move
    d) Press the left or right arrow key, depending on where you think the window is.

11. Using FocusMax with a Relative focuser:

FocusMax works great with Relative Focusers. The only disadvantage is that the operator has to manage the position of the focuser since FocusMax can not tell when it hits the end of travel. Here is a procedure for manually taking V Curves for a Meade MicroFocuser and an LX-200 but it should also work well with your JMI and LazyFocus.

    a) Manually move the focuser all the way in to the stop. Then time it while it moves all the way out to the other stop. This will give you the total travel time which is about 20 seconds for my microfocuser. Take this time in seconds and multiply it by 1000. This will give you the number of counts for the full range of your focuser. For my microfocuser this is 20,000.
    b) Set the microfocuser to be approximately half way between the two stops. Manually focus the LX-200 using the primary mirror focuser knob. This will properly center the V Curve for your focuser range.
    c) Manually move the Focuser all the way IN.
    d) Launch FocusMax and make sure that the red number in the Position box near upper left side

of window is "0". If it is not zero then double click on the red number and it will go to zero.

- e) Click on the Setup Tab and look in the upper right to make sure that Move Out is selected.
- f) Click on the FocusMax V Curve button to open the Vcurve Sequence window.
- g) Click on the End Points radio button.
- h) Enter "0" in the Initial box.
- i) Enter the number of counts determined in step 1 into the Final box.
- j) Take the number of counts determined in step 1 and divide it by 30. Put this number in the Step Incr. box. For example if you have 20,000 counts in step 1 then the number for the Step Incr. box would be 666. FocusMax should automatically give you a value of 30 in the Steps box
- k) Click the Run button and it should take the V Curve over the entire range of your focuser.

12. Some tips to get FocusMax working with my nSTEP controller from Rigel Systems:

- a) Make sure your account has ADMIN privileges.
- b) Start your ASCOM compliant stepper controller software and check if it can run the stepper directly
- c) Right click FocusMax shortcut and check properties/compatibility tab and and make sure the "run
- d) in compatibility ..." and "run with admin..."check boxes are NOT checked.
- e) Start FocusMax and pick the system tab, select your focuser application and connect.
- f) Select the focuser tab. Correct focus position and temperature should be displayed.
- g) Click on "jog" at the top and see if focuser moves.

13. Tutorial on setting up the MoonLite focuser.

14. Tutorial from Rigel Systems

15. How to install the FeatherTouch (NOT MicroTouch!) ASCOM driver on Platform 6 and WinXP through Win7 - click here

16. FocusMax versions:

In 2011 version number was changed because of reporting differences between how VB6 internally reports application version compared to Windows when you do a FocusMax.exe right click/ properties. For example VB6 reports 3.6.77 and Windows 3.6.0.77. Now when you select Help/About, FocusMax reads the actual FocusMax.exe version that is installed on your PC and not the compiled VB6 version.

Troubleshooting

Troubleshooting

1. This release has been successfully tested with ASCOM Platform V6 SP1.

   If you are upgrading from version V3.6.0.22+, the installer will uninstall the previous version.

   If you are running any version previous to V3.6.0.22

   a) 1. Backup your system ini files (My Documents\FocusMax)

   b) 2. Uninstall FocusMax using Control Panel/Add or Remove Programs. If multiple instances are found then uninstall them as well.

   c) 3. If needed, install ASCOM Platform V6 SP1+ (http://ascom-standards.org/)

   d) 4. Install the new FocusMax release

2. If you use CCDSoft and receive the message Failed to start camera then the CCDSoft camera server settings need to be setup for scripting- see Getting Started .

3. If you are using a DSLR camera set the Target and Focus binning on the Setup Tab to 2x2.

4. Files containing chm are considered potentially malicious when downloaded over the internet. To view or download a .chm file using Explorer 9:

   a) download and save the .chm file to a folder.

   b) Right click on the file, select properties then press the Unblock button at the bottom of the window
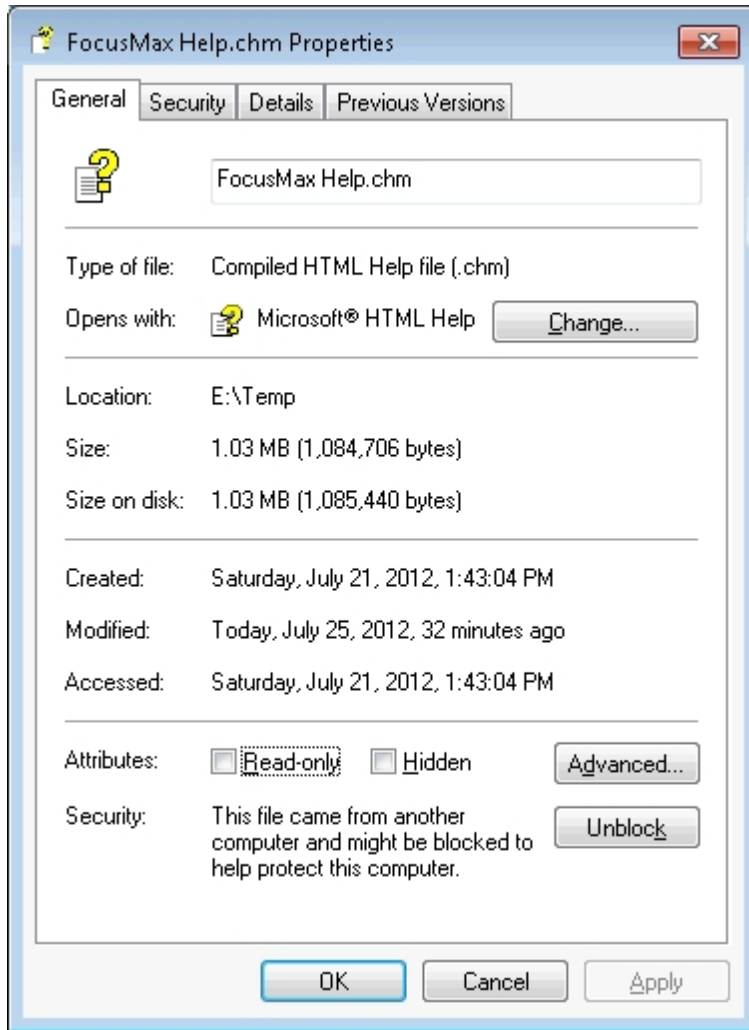
5. If you see a message that the "** Image not available (after waiting XX sec) **" in the Log.

   Open your active system.ini and increase the entry: CameraImageTimeout (new default is 30 sec)

6. FocusMax is written in Visual Basic 6 and has been found that Vista may not properly register all of the needed files.

   This can easily be done by a simple batch file. Take the following text and put it in a text file named

   FixVista.bat

   Cd /d %systemroot%\system32
   Regsvr32 /s /u sysinfo.ocx
   Regsvr32 /s /u mscomct2.ocx
   Regsvr32 /s /u msdatgrd.ocx
   Regsvr32 /s /u comct332.ocx
   Regsvr32 /s sysinfo.ocx
   Regsvr32 /s mscomct2.ocx
   Regsvr32 /s msdatgrd.ocx
   Regsvr32 /s comct332.ocx

   To run this batch file:
   a) Place it anywhere on your hard drive or desktop.
   b) You MUST have "run as administrator" privileges
   c) Double click on the FixVista.bat icon to run the batch file.

This batch file simply un-registers 4 files needed by Visual Basic 6 and then re-registers them properly. You may need to disable UAC although some users are successfully running with this 'feature' enabled.

7. If FocusMax fails to start or you receive an errors such as:
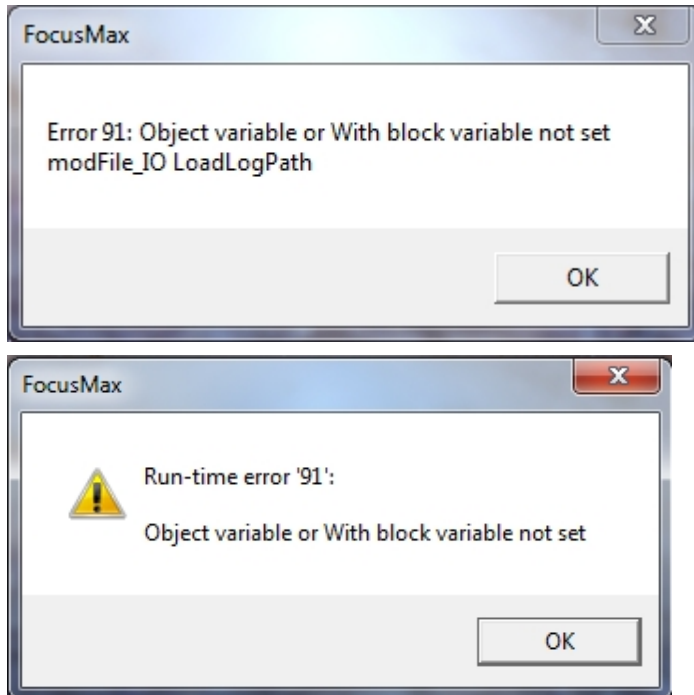
    a) Open ASCOM Profile Explorer that is now on your desktop
    b) Click on Focuser Drivers/FocusMax.Focuser
    c) Click Menu Options Enable Root Edit
    d) Delete FocusMax.Focuser which will delete every entry - FocusMax will recreate the Registry entries this when it starts

8. Start FocusMax which opens MaximDL starts, FocusMax window is not visible but the icon is seen at the bottom of the page. Minimize and maximize does nothing happens. .

    a) Right click the FocusMax icon.
    b) Select Properties, then select "Maximized" in the "Run" pull down menu.
    c) Open FocusMax and then close it.
    d) Right click the FocusMax icon.
    e) Select Properties, then select "Normal Window" in the "Run" pull down menu.

9. Windows performs a reinstall of FocusMax when opened:

    Error 1316. A network error occurred while attempting to read from the file C:\Windows\Installer\xxx.msi A common error message when trying to reinstall/upgrade a software program which usually means a previous installation of a software application is getting in the way of the new installation.

    a) Download a free program from Microsoft that will totally and completely remove the old software then the new version can load unimpeded.
    b) Download and run Microsoft Windows Installer Cleanup Utility
    c) Select the offending program from the list of installed programs, then click Remove.
    d) You'll see a warning box, select OK, the utility will remove all the parts of the program from your computer
    e) Restart your computer, then try loading the new version of the software.

10. Problem with QHY8 camera and receive the following message "MaxIm DL error 65535: Image Not Available.

    Verify that QHY8 camera does not support 3x3 - set FocusMax Binning to 2x2

11. Win 7 Pro (32 bit) and see a window stating "unexpected error; quitting":

    Right clicked the icon-> Properties-> Compatibility-> checked "Run this program in Compatibility Mode"-> from drop down window "XP SP# Mode"

12. FocusMax does not work with MaxIm LE:

    MaxIm LE does not have scripting capability

13. The "as administrator" issue is a new security "feature" in Windows 7. It is a pain, but I guess it is to prevent malicious software that you may inadvertently download from executing a program than can damage or take over your PC. So, even though you may be logged in as a user with administrative privileges, that does not mean all of the programs you launch are run with the admin privilege level - but it does give you the ability to run a program as an administrator.

    Normally, to run a program as an administrator, right-click on the program in the start menu or task bar, or in the Windows explorer, and then choose the "run as administrator" option.& nbsp; This article shows how to configure an application to always run as administrator: http://technet.microsoft.com/en-us/magazine/ff431742.aspx

    -Mike Renzi

14. If the following error message is seen in the Log "FocusMax Error 13: Type incompatible" which is due to PC Regional Setting Please scroll through all of the registry entries using ASCOM Explorer and your system.ini and change

    > True = 1
    >
    > False = 0

    If your regional settings are not English then change the (example French)

    > vrai = 1
    >
    > faux = 0

    This was adopted after V3.6.77 to further eliminate regional setting issues.

    Anyone starting FocusMax with a fresh install will not see this error.

15. Various threads concerning USB hubs and USB cables:

    > http://tech.groups.yahoo.com/group/FMaxUG/message/6554
    > http://tech.groups.yahoo.com/group/MaxImDL/message/52212
    > http://tech.groups.yahoo.com/group/ASCOM-Talk/message/25426
    > http://tech.groups.yahoo.com/group/MaxImDL/message/52082
    > http://tech.groups.yahoo.com/group/MaxImDL/message/52076
    > http://tech.groups.yahoo.com/group/MaxImDL/message/52011

    > List of Serial to USB Adapters:
    > http://tech.groups.yahoo.com/group/ASCOM-Talk/database?method=reportRows&tbl=1

    > USB Viewer:
    > "About your USB connections, here's a Windoz USB Viewer which will show you all
    > your connections. There's tons of info but a little study will show you what's
    > going on and whether you have a bad USB Driver. HTH too...joe :) "
    > http://www.nirsoft.net/utils/usb_devices_view.html

16. A listing of camera error codes:

    > http://www.cyanogen.com/help/maximdl/Camera-Specific_Error_Codes.htm

Filters

Filters and Filter Offsets

Filters used in an imaging train may not be parfocal - that is, they may not focus at the same position. You should only need to generate a set of Vcurves once in any color (even clear / no filter) and then use the Vcurves to focus with any filter. If you are using narrow band fillers then you will have to use bright stars with long exposure times to focus. An alternative is to measure the required filter offsets from a base filter (perhaps Clear) then focus with this filter and apply the required offsets. This can be accomplished with a simple script, Maxlm or form automated imaging software (ACP, CCDAutoPilot, CCDCommander, etc.). Here is my table:

[Focus Offset]
Slot=E,-775
Slot=C,0 <== base filter
Slot=U,51
Slot=B,69
Slot=V,12
Slot=R,8
Slot=I,-38

If imaging in C (0) and rotate to R (+8) I move the focuser +8 steps
I imaging in R and rotate to I (-38) I move the focuser 0-8 (back to C) -38 = -46 steps total

To measure the required offsets:

a) Pick a night of good seeing in which the temperature has stabilized - you do not want to perform this procedure when there is significant temperature change occurring since the focus positions will be a moving target

b) Open FocusMax and select the Features Tab

c) Enable Focus Convergence

d) Set Steps = 1 and Samples between 5 and 10

e) Create a table that lists all of the filters you will be using and add a columns for time, position, temperature and offset (steps)

f) Start with your base filter (say C) and perform an autofocus run

g) Record the time, position and temperature

h) Move to the next filter and repeat step g)

i) If the temperature has changed, cycle back to the base filter and repeat f) and g)

j) Set you base filter as 0 (zero) and calculate the difference in position for each filter relative to this filter.

Example:

C = 1500, R = 1508 => offset is +8 steps

k) If you experience a change in temperature, then use the position from the repeated base filter for the offset calculations

Here is an excellent paper on by Don Goldman and Barry Medal entitled Get Focused (http://www.astrodon.com/Orphan/parfocal_and_critical_focus_zone/)

Seeing

Seeing

Focusing with FocusMax is fairly straight forward as it should be. However, achieving your best possible focus requires more than simply clicking and running. Other considerations should be taken into account for tweaking FocusMax parameters. Your optical system and local conditions are major items for tuning FocusMax. Study of documentation and close attention to what a focus run tells you can lead to a small parameter change which can produce surprising results. The following are some subjects which better understanding can lead to better focusing.

Focusing and CFZ, by Don Goldman:

"In Perfect Focus Article Preprint. This was submitted and published in an abbreviated format in Sky and Telescope entitled "In Perfect Focus", August 2010, page 72 (with Dr. B. Megdal). .It explains why the conventional Critical Focus Zone (CFZ) is too large to get precisely focused stars, and that a new derivation using David Suiter's book guided by data from the freeware program, Aberrator, provides more accurate, but much smaller values. For f/10/, f/7, f/5 and f/3.5 optical systems at 500 nm (green), these new CFZ values become ~ 40, 20, 10 and 5 microns in one direction, respectively. These values are incredibly small! A human hair is 50 microns thick to provide some perspective. Using a high-precision electronic focuser becomes essential for optimum focus."

PDF - http://www.astrodonimaging.com/docs/GetFocusedPreprint.pdf

Additionally, Don has some good on-line image processing tutorials:

http://www.astrodonimaging.com/tutorials/

Seeing and Air Mass:

"In astronomy, air mass (or airmass) is the optical path length through Earth's atmosphere for light from a celestial source. As it passes through the atmosphere, light is attenuated by scattering and absorption; the more atmosphere through which it passes, the greater the attenuation. Consequently, celestial bodies at the horizon appear less bright than when at the zenith. The attenuation, known as atmospheric extinction, is described quantitatively by the Beer-Lambert-Bouguer Law.

"Air mass" normally indicates relative air mass, the path length relative to that at the Zenith at Sea Level, so by definition, the sea-level air mass at the zenith is 1. Air mass increases as the angle between the source and the zenith increases, reaching a value of approximately 38 at the horizon."

http://en.wikipedia.org/wiki/Air_mass_(astronomy)

http://spiff.rit.edu/classes/phys445/lectures/atmos/animloop.gif

Air Mass not only provides an indication of deterioration but also to some extent atmospheric turbulence or Seeing. The more Air Mass light passes through the worse the effects.

http://spiff.rit.edu/classes/phys445/lectures/atmos/single_anim.gif

When star light encounters turbulent air cells these cells can act as lenses to distort and deflect incoming photons on very short timescales. As more and more turbulent air is encountered distortions become compounded leading to madly twinkling and highly refracted colorful stars near the horizon. When this occurs accurate focusing becomes more difficult and usually poorer. Sirius near the horizon:

http://epod.usra.edu/.a/6a0105371bb32c970b0168e5bf0ad1970c-750wi

To minimize these effects it is advisable to focus and image within a few hours of the Zenith, both RA and

DEC, where Air Mass and turbulence minimum. Imaging locations at higher elevations than Sea Level by nature reduces Air Mass some allowing greater angles from the Zenith before Air Mass and Seeing effects becomes a problem. To obtain best images, one should avoid taking exposures at an Air Mass of 1.5 or higher, (40 degrees elevation or less).

Air Mass Extinction Correction Factors

Elevation	Zenith Angle	Air Mass Extinction	Red Extinction	Green Extinction	Blue Extinction
90	00	1.000	1.000	1.000	1.000
80	10	1.015	1.001	1.002	1.003
70	20	1.064	1.005	1.010	1.014
60	30	1.155	1.013	1.025	1.035
55	35	1.221	1.018	1.036	1.050
50	40	1.305	1.025	1.050	1.070
45	45	1.414	1.034	1.068	1.097
40	50	1.555	1.046	1.092	1.132
35	55	1.743	1.063	1.125	1.180
30	60	2.000	1.085	1.172	1.249
25	65	2.365	1.118	1.242	1.356
20	70	2.923	1.170	1.356	1.535
15	75	3.862	1.263	1.574	1.892

Wm. Keck Observatory Air Mass JAVA tool,shows Air Mass for objects. Enter Object, RA & DEC, press "Add/Update Object", select Air Mass or Elevation.

http://www2.keck.hawaii.edu/software/obsplan/obsplan.php

Seeing, Ground Layer:
Usually 0-25ft, is caused mostly by thermal radiation or vortices around or over objects .
http://www.footootjes.nl/Astrophotography_Seeing/Astrophotography_Seeing.html

Seeing, Boundary or Mixing Layer:
From the Earth's surface to ~1,000ft. Wind flow near the surface encounters obstacles reducing wind speed introducing horizontal and vertical turbulence which interacts with the atmospheric layer above. This interaction is the primary transport of smoke and dust.
http://en.wikipedia.org/wiki/Planetary_boundary_layer

NOAA's ADDS Aviation Weather Center:

This is NOAA's ADDS Aviation Weather Center site showing Flight Level Turbulence regions with 12hrs Forecast.

http://www.aviationweather.gov/adds/turbulence/turbnav

Seeing, High Altitude:
There are several Jet Streams flowing around the globe. They reside at a level between the Stratosphere and Troposphere, a mixing level several kilometers wide and thick, where temperatures change from rising with altitude to decreasing with altitude. Jet Streams meander,and change in altitude, split and merge, with velocities ranging from calm to 250mph.

Although high altitude wind speeds don't buffet our telescopes as low level winds they still contribute to observable Seeing because of vertical turbulence. These fast moving rivers form turbulence at boundaries of fast to slow windspeed layers. Which, just as low level convective turbulence, distorts incoming light in a similar manner.

http://spiff.rit.edu/classes/phys445/lectures/atmos/animloop.gif

National Jet Stream Map, updated every 12hrs:

Stream Lines
http://weather.unisys.com/upper_air/ua_cont.php?plot=str&inv=0&t=cur

300spd plots

http://weather.unisys.com/upper_air/ua_cont.php?plot=300&inv=0&t=cur

Animated 60hr 300mb Wind Speed Forecast:
http://weather.unisys.com/nam/loop/nam_300_loop.gif

Radiosonode, weather balloon, readings updated every 12hrs:
...Choose your Region and City code close to your location.
...Click Text and scroll to the 'second' section, "Wind Level Data"
...Scroll to the 300mb line, the fourth column is wind speed in Knots, 1kt = 1.15mph.
http://weather.unisys.com/upper_air/skew/ua_sound.php?type=no&city=ktlh&region=se&t=cur

Because Jet Streams also change altitude,as they meander horizontally, be sure to scan the Speed column above and below the 300mb line for the highest wind speeds in your area.

Over time I have come to the conclusion wind speeds greater than 80kt are not good imaging weather for my 3300mm FL telescope. Star diameters are enlarged and reliable focusing becomes most difficult. Short FL telescopes can tolerate higher wind speeds.

"May You Go Among The Imperishable Stars"
Joe Mize www.cav-sfo.com
Chiefland Astronomy Village (CAV), Fla
StarFields Observatory, (SFO).

"New Critical Focus Zone"

Dr. Jeff Winter has proposed an alternative critical focus zone that takes into account:

● Seeing

● Telescope aperture Telescope focal ratio

● Acceptable focus tolerance

See http://www.goldastro.com/goldfocus/ncfz.php for details

Temperature Compensation

Temperature Compensation

Notes on Temperature Compensasion:

1. The Temperature Compensation Wizard is designed to collect position vs temp data during the night. Most focuser drivers allow the user to enter the slope of the best fit line for TC purposes which can be calculated using Excel.
I was never able to achieve a statistically significant correlation between temp & position with my RoboFocus unit - the temp sensor is installed in the control box along with the electronics.

   I am currently using an Optec TCF with an external temp probe which I placed near the primary of my 16" f4.5 Newtonian which better tracks air temp at the primary. I find that within any one night I have good statistical correlation but poor correlation night to night with similar slopes and data spread around the regression line which is probably due to environmental differences. In other words, I **can not** use data from multiple nights to built a single TC model. The slopes are close but the line can be shifted up or down from night to night. With that, I currently focus at the start of the night, enable TC then refocus every 2-3 hours which is an improvement over every 1 hour without TC.

   Steve Brady 3/20/2012
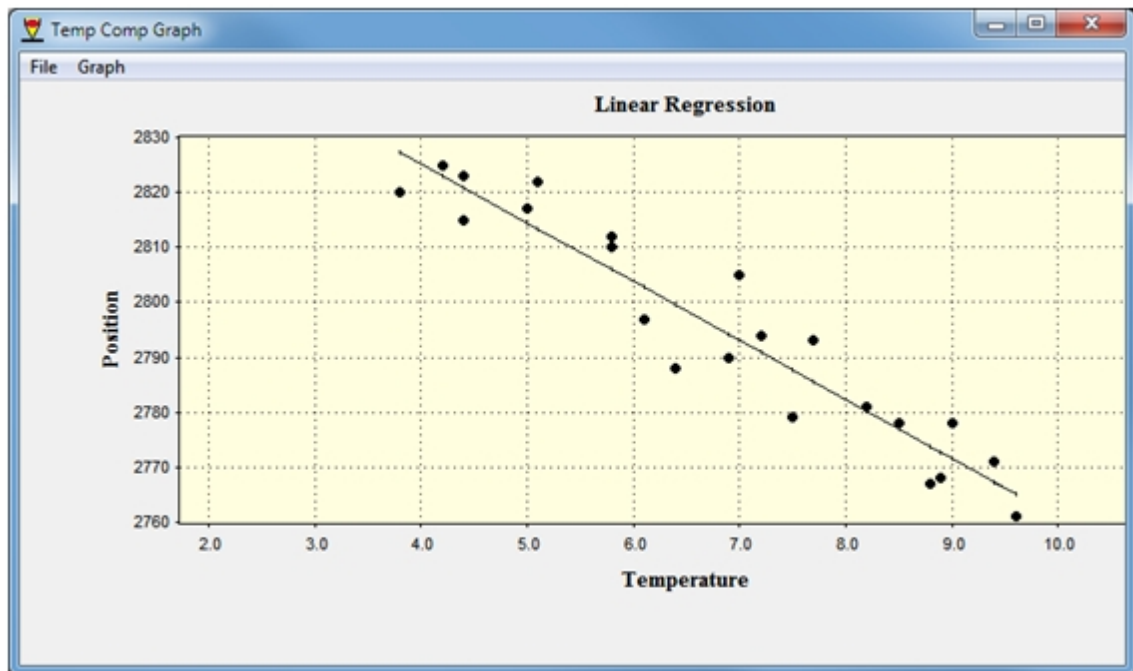
2. In my attempts at Temperature Compensating Focusing (TCF), I have resorted to burying the Temp Probe in styrofoam (except the metal-to-metal contact against the scope near the rear doublet). This helped reduce but not eliminate the non-linearity.

   (http://tech.groups.yahoo.com/group/FMaxUG/message/7779).

3. Mini controller from Moonlite contains a temperature probe. I have been known to take the controller's plastic box apart, cut/drill holes in it to improve ventilation (faster temperature tracking that way), and then tape that controller box to the rear casting of my SCT...to track the temperature of the scope. Seems to work ok, but keep in mind that the temp. sensor is next to electronics that generate heat. After you power up the focuser the temperature readings will not stabilize until about 15 minutes have passed...and that's important if you want to do a decent job of temperature compensation.

   Tom Krajci
   Cloudcroft, New Mexico
   http://picasaweb.google.com/tom.krajci
   Center for Backyard Astrophysics (CBA)
   http://cbastro.org/ CBA New Mexico

American Association of Variable Star
Observers (AAVSO): KTC http://www.aavso.org/

(http://tech.groups.yahoo.com/group/FMaxUG/message/7762)

4. We recently completed some work verifying how temperature compensation works with a classic C14 at our local club observatory. There is no question the relationship between temperature and focal position shift is linear.

As proof, I've just uploaded plots at f/11 and f/6 taken with the C14 on a Paramount ME, Optec IFW, TCF-S focuser, Pyxis rotator and ST-9 camera. The FocusMax (v3.4.40) Temp.Comp.Data learn wizard was used to obtain all data. The two plots can be found in the files section under a new folder labeled "Temperature Compensation."
"http://tech.groups.yahoo.com/group/FMaxUG/files/Temperature%20Compensation/"

The results and corresponding Temperature Coefficient values are shown on the plots as well. These TC values relate to the 2.2 micron step size of the TCF-S focuser. In strictly linear terms we found that the C14 focus at f/11 moves nearly 0.4mm per degree C. The same scope at f/6 (using the Optec NGW 0.5X telecompressor) was only about 0.27mm per degree C.
You are most certainly correct saying that temperature compensation can and does work. We have thousands of customers using the TCF-S and temperature compensation. The key is to perform the due diligence to determine the Temperature Coefficient for your specific optical system as you have done.

Very best,
Jeff.
Jeff Dickerman
Optec, Inc.

(http://tech.groups.yahoo.com/group/FMaxUG/message/4933)

Release Notes

Revision History

FocusMax Revision History

V3.8.0.20 (7/29/2014)
1. Added AcquireStarAvoid.txt to installer
2. Potential fix for Base Exp not being reset in all cases
3. AcquireStar Sync to position bug fix

V3.8.0.19 (6/28/2014)
1. Fixed potential bug where telescope will disconnect if site lat & log <> telescope driver lat & long
2. Worked with Peter Chance at Lakeside to reduce the number of temp & position calls to driver
3. Fixed bug in AcquireStar where if focus failed the next star in list was not used

V3.8.0.15 (5/28/2014)
1. Fixed potential bug in Check for update
2. Added code to bypass Check for Update if under Host control
3. Fixed a potential issue in AcquireStar if number of stars to find in catalog = 0 (default = 3)
4. Changed logic to determine FocusStart position based on one sampling cycle at FocusStart. Previous version would continue to sample until average fell within +/- .05 HFD of target value which may lead to additional sampling cycles
5. Fixed potential bug where TempCompWizard could be disabled when camera is linked during startup

V3.8.0.14 (4/23/2014)
1. Minor improvement to Check for update
2. Moved user defined camera connection delay to address the startup error where camera is not found when link is attempted. User defined delay can be found in Menu/Options (default = 0)

V3.8.0.11 (4/18/2014)
1. Added user defined delay to allow MaxIm to load before connecting to the camera (default = 1 sec) - see Options

V3.8.0.10 (4/7/2014)
1. Bug fix for async telescope slew
2. Fixed bug Check for updates

V3.8.0.8 2/25/2014
1. Modified and removed Log message from verification loop which tests that the camera is ready to begin taking an image.

V3.8.0.7 2/22/2014
1. Increased number of attempts to find NearFocus position from 5 to 10
2. Added registry entry MoveHFD to allow user to set number of HFD units to move when verifying if on correct side of focus (default = 3)

V3.8.0.5 2/9/2014

1. Fixed bug where Target Star Binning may load with an empty value for new system.ini
2. Fixed potential COM memory leak when a FocusMax instance is created then destroyed
3. Fixed shut down bug in Temperature Compensation Wizard
4. Setup/AcquireStar/PinPoint 'Expose & Solve' button will be disabled unless telescope is connected when
5. Added loop to verify that camera status is ready (max 5 sec)
6. Set tmrFocuserConnect to always be enabled
7. Optimized Class_Initialize to reduce load time when creating an instance of FocusMax under COM
8. Added button on AcquireStar/PinPoint that opens a text file with reference to the different star catalog's that are available.

It is intended to be used as a guide for selecting the best catalog for identifying a target star in the desired mag range.

The UCAC4 may not be the best catalog for many users with a mag range of 8 - 16.

Uploaded the final version of Dr la Cour's paper "Statistical View on FocusMax" at http://focusmax.org/documents.html.
It is impressive work and you find it useful for determining how many Vcurves you should have in your Profile and how many
Near Focus samples one should use based on the past estimate of Near Focus error and number of Vcurves in your Profile.
He is a member of this group if you would like to ask any questions.

V3.8.0.0 12/6/2013
1. Fixed bug where error was raised when querying CCDSoft camera for supported binning modes

V3.7.0.99 12/5/2013
1. Fixed bug where camera option button would click off if camera is set to auto-load

V3.7.0.98 12/4/2013
1. Set binning modes based on actual camera capabilities and limited binning to 1x1 through 4x4
2. Fixed bug where camera image not available would be declared when it had actually not timed out
3. Redefined Backlash direction to be applied based on the direction of focuser move.
Currently, BL is applied when the focuser moves in a direction opposite the user defined BL direction (In/Out).

New scheme example:
BL = Out and move is 'In' then BL is not applied
BL = In and move is 'In' then BL is applied

V3.7.0.97 11/16/2013
1. Added message to close FocusMax before downloading and installing update. File can be saved if user does not want to close FocusMax .
2. Fixed bug to disable AcquieStar button when Vcurve slopes are missing
3. Fixed a bug where a minus (-) focus offset would not be applied at the conclusion of the focus run

V3.7.0.96 11/11/2013
1. Added async version check on FocusMax startup.
Testing shows async startup time = 2 sec, non-async = 15 sec if there is no Internet connection
Long wait will be a concern for users who use automation host software and do not have Internet access

V3.7.0.95 11/10/2013
1. Added verification that AcquireStar will select at least 1 star from star catalog
2. Fixed bug that may generate an error message when sending log information to ACP
3. Fixed a bug that prevented the Temperature Compensation Wizard timer from firing
4. Added option to Park Telescope at conclusion of Temperature Compensation run
5. Added 'Check for Updates' to Menu/Help
6. Added a message to the Log at startup that a new FocusMax version is available for download

V3.7.0.93

1. Eliminated tracking check for AcquireStar - some mounts will report Tracking = False if telescope link initiated is by AcquireStar

2. Fixed bug where Windows error message is generated if the FocusMax Log is not open and user presses the AcquireStar "Expose & Solve" button

3. Refined code that tests if focuser is on the correct side of focus to eliminate potential of focuser continuing to walk outward and reaching end of travel

4. Added counter as a safety countermeasure to constrain outward moves to 5 total

V3.7.0.91

1. Additional work around for tracking status

2. Bug fix for telescope window reopening after being closed

3.

V3.7.0.87

1. Added ini file parameter which will save Vcurve method to use End Point or Half Width method when Vcurve window is closed

2. Added additional error messages associated with camera and focuser

3. Fixed bug relating to work around for (CGE) that cannot get tracking status

4. Fixed bug that turns tracking off when AcquireStar is initiated

V3.7.0.86

1. Vcurve center will be updated along with end points when an autofocus run is completed after each Vcurve generation provided the user has enabled the Auto-focus option on the Vcurve window

V3.7.0.85

1. Added work around to monitor telescope tracking state for telescope that do not allow the state to be read (Celestron GE). This method should be robust for all telescope hardware & drivers. For telescope that cannot read tracking state: user must use ASCOM Profile Explorer to set TelescopeTrackingConnect = 1 to always force tracking on when the connection is made to the telescope.

2. Bug fix for international users if ini file contains mixed decimal separator

V3.7.0.84

1. Added validation to trap non-numeric entries

2. Added ability to set telescope tracking on when connection is made - Registry setting TelescopeTrackingConnect = 1 must be manually set to enable. This is added for CGE mounts that turn tracking when connecting to telescope

3. Added the following properties to set/get target star magnitude boundaries for AcquireStar

    o AcquireStarMinMagTgtStar

    o AcquireStarMaxMagTgtStar

4. Added the following properties to set/get target star magnitude boundaries for AcquireStar

    o AcquireStarMinCatStarMag

    o AcquireStarMaxCatStarMag

V3.7.0.79

1. Fixed bug that turned off telescope tracking on some mounts that ASCOM CanSetTracking = False

2. Added trap to catch ini & registry entry that may contain a space which may generate error '13'

V3.7.0.78

1. Small format change to Profile window to give additional width to comments section
2. Added error trapping to ASCOM Astrometry Transform functions
3. Added Row number to Profile Vcurve data grid

V3.7.0.76

1. The Profile window will now open / reopen at the successful conclusion of a Vcurve run and data to system.ini file. Opening the Profile window will also prompt the user to review accumulated data set for acceptance.

V3.7.0.75

1. Added sync COM method RunVcurve to FocusMax.FocusControl

V3.7.0.74

1. Fixed bug where telescope tracking is turned off when telescope window is opened. It will now leave the telescope in its current state (tracking / not tracking)
2. Added code to AcquireStar to verify and initiate telescope tracking and post status to the Log

V3.7.0.73

1. Fixed bug where Vcurve results were not saved
2. Log window will open for new users

V3.7.0.72

1. Fixed bug where Vcurve results were not saved if default MySystem.ini file is loaded by first time user
2. Improvements to Profile Window sizing when comments are added
3. Added routine to auto-center frame in Profile Window

V3.7.0.71

1. Added error trapping if ASCOM registry read error
2. Fixed bug, telescope will now disconnect if telescope and Site location > 1 degree

V3.7.0.70

1. Fixed bug that did allow user to use telescope Chooser
2. Moved Track, Park, Unpark to menu selection on telescope window
3. Telescope now will Unpark but not automatically enable tracking when telescope window is opened unless the telescope is already in use and tracking

V3.7.0.65

1. Fixed bug where command buttons were not enabled if camera & focuser are connected manually
2. Changed number of significant digits from 6 to 4 to Site location to prevent mount disconnect
3. Added AcquieStar return slew if return is enabled and autofocus fails
4. Added registry and ini file True/False to binary 0/1 to resolve Regional Setting translation
5. Added Log message to document if the mount is being sent Topocentric or J2000 coordinates with AcquireStar (Topo is default)

V3.7.0.60

1. Found bug in ASCOM.Astrometry.Transform topoCentric coordinates to Alt & Az which reported incorrect Alt/Az

2. Added routine to transform horizon to Alt/Az

3. Added routine to verify Site information matches telescope location when telescope is first connected. If they do not match then telescope will disconnect with message posted to the Log. This is a safety routine to assure that the telescope does attempt to slew to a location that is may be problematic (such as below the horizon)

4. Added routine to delete selected stars from AcqiureStar routine from registry

5. Added 3, 4 & 5 degree field search to AcquireStar, larger field search increments will reduce time to finding bright star candidates

6. Fixed bug where initial autofocus image would fail if there was no filter wheel reported by MaxIm

V3.7.0.57

1. Fixed bug where backlash setting was not being saved to system.ini

2. Added SiteVerificationEnable which when enabled will verify telescope Alt/Az to calcuated Alt/Az based on AcquireStar Site are within 1 degree. A difference of 1 degree may indicate that the telescope location and Site do not agree and telescope will be disconnected

V3.7.0.55

1. Added application path (APP.Path) to address a bug on some systems that do not report FocusMax.exe version

2. Fixed bug where filter name is not posted to Log

V3.7.0.53

1. Fixed bug in AcquireStar where the telescope may sync to incorrect RA/Dec

2. Added a feature to address a change in Site location. The telescope will disconnect if there is a reported difference > 1 degree between the telescope Alt/Az and calculated object Alt/Az from your Site information.

V3.7.0.52

1. Added routine to verify that the focuser is within the driver MaxTravel setting - if not, then message is posted to Log to manually move focuser into range

2. Fixed small bug that allowed Jog Stop button to be enabled when focuser was not moving

3. Fixed bug where focus convergence is always used when geometric mean is selected in Options

4. Added ability to set pre & post exposure delay to < 1 sec

5. Fixed bug in coordinate transform that allowed RA < 0

6. Implemented geometric mean to calculate target flux based on user defined min/max flux setting which was recommended by Dr. Barry Megdal at the 2012 AIC

7. Added enhancements to improve compatibility with TheSkyX

V3.7.0.51

1. Potential bug fix if No Filter found in MaxIm

2. Fixed bug where AcquireStar shows 0 pointing error after slew and successful plate solve

3. Added Geometric Mean option (Menu/Open/Options) which will use geometric mean in place of arithmetic mean (average)

   The geometric mean, unlike an arithmetic mean, tends to dampen the effect of very high or low values, which might bias the mean if a straight average (arithmetic mean) were calculated.

V3.7.0.50

1. Added ability to transform J2000 to TopoCentric and back. Added check box to Telescope Window that Topocentric Coordinates are required (default is checked)

2. Changed Step Increment label name on Vcurve window to 'Move Increment' to reduce confusion with 'Steps'.

3. User defined subframe size is now used for both 1x1 and 2x2 binning during AutoFocus and FindStar routine

4. Reworked telescope connect/disconnect buttons to match style found on FocusMax main window/setup tab.

5. Added code to overwrite the 'F' from the MaxIm simulator camera image array which is sometimes found in bottom right hand corner. The 'F" will still be visible in the MaxIm document but the underlying array is overwritten based on an average pixel value from 3x5 cells.

6. Added ability to write focuser COM port value to registry when system.ini is loaded

    This is useful if more than 1 focuser of same model is installed and the driver does not allow multiple instances to be open

    This work around and assumes that the focuser writes the com port to registry

    Requires two system.ini entries to be manually added:

    o   ProfileFocuserComPortKey = each focuser uses a different key to identify com port - see ASCOM Profile Explorer for key name

    o   FocuserComPort = desired com port - use the same format as found in ASCOM Profile Explorer

    Examples (from ASCOM Profile Explorer):

    MoonLite: SerialPort = COM1

    Optec: LastUsedCOMPort = COM1

    RoboFocus: No registry entry - data is saved in ini file BUT new RoboFocus Server driver allows for multiple instances to be open

    FLI: no registry entry

V3.7.0.42

1. Set 1x1 to 4x4 to Target Star binning combo - some camera drivers are not returning the correct MaxBin value

2. Fixed bug that caused Jog command button on FocusMax window to strobe when Jog window was open

3. Eliminated several Log messages related to relative focuser moves

4. Eliminated first time user start message to select imaging SW

5. Fixed bug where Temp Comp check box would become enabled even if the focuser is not capable of supporting Temperature Compensation

6. Fixed bug that did not allow COM method Focuser.Link from making a connection to the camera

7. Adjusted Log entries sequence

8. Fixed bug where waiting for image available would time out if focuser was not connected

9. Telescope name is now posted in text box before the connection is made not after

V3.7.0.36

1. Fixed bug if ASCOM util.WaitForMilliseconds is busy (as in waiting for download) and another call is made to WaitForMilliseconds then the system may become non-responsive.

V3.7.0.35

1. Changed subframe width from 100 to 50 for newly created system.ini files

2. Set default auto adjust subframe width to off - see Options

3. Added code to update focuser position during move if permitted by focuser driver

4. Enlarged Focuser Position text box to accommodate FLI Atlas full travel 105,000 steps

5. Eliminated VerifyPinPointInstall checkbox from Options - use button on AcquireStar PP Setup

6. Fixed bug 'Test Full PinPoint' button on PP Tab in AcquireStar Setup did not properly write PP version number to registry

7. Fixed bug in setting up Vcurve parameters for focuser's with long range of travel (Atlas focuser)

8. Fixed bug that prevented Temperature Log from opening

9. Changed temperature rounding to 2 decimals in Log at the conclusion of autofocus run

10. Fixed bug on method FocusAtStarCenterAsync to eliminate 'Select Star' from initiating

11. Fixed bug on method FocusAtStarCenterAsync to eliminate message posted to Log that operation did not initialize

12. Added bin 4 to PinPoint setup for Starlight Express camera MC25, MaxIm reports max bin=3 but will bin 4 (bin=3 is not supported)

V3.7.0.25 Beta

1. Added one time check for PinPoint install:

    If user installs full version then pressing new button "Test Full PinPoint install" on AcquireStar/ PinPoint Tab will test for full version

    This should eliminate the PinPoint popup message generated by PinPoint if only PP LE is found

2. Fixed bug where Focus Start always defaulted to HFD

3. Corrected double entry in Traffic Log when focuser position is polled

4. Changed Base exposure time from 1.0 to 0.5 sec on Setup Tab when a new system.ini file creation

5. Binned Target star position on CCD is now displayed in Log (not 1x1)

6. Added ability to turn off auto-adjust subframe and use only user defined Frame Width on Setup Tab

7. Added improvements to center star in subframe image - see Adjust_XY_StarCenter

8. Added Max Pixel and Pixel Count to Log when target star is found and subframed. This will be useful in determining if any pixel is saturated.

9. Added banner to Log to include System.ini name, FMx version, and camera name with each major FocusMax operation (Focus, Find, AcquireStar, Vcurve)

10. Fixed bug where Vcurve data was not saved to Profile

11. Added ability for user to set noise factor to model seeing when using Simulator camera

12. Fixed bug where Vcurve button would strobe when Vcurve window is open

13. Disabled Exposer & Solve button on PinPoint Tab if telescope is not connected

14. Fixed small bug with telescope 'dead zone' degrees was not converted correctly to hours

15. Added ability to change AcquireStar field search from star catalog to 0.25,0.5, 1, 2 degrees

16. Added ability for user to create a text file that flags stars to exclude with AcquireStar

17. File name must be AcquireStarAvoid.txt with structure:

    'ID |RA |Dec |Mag

    'GSC 3097-0115|17:52:09.2|42:51:25.8|7.11 ==> Any line starting with ' will be ignored. Do not delete this line

    'GSC 3097-1310|17:54:01.4|42:38:49.3|6.62 ==> sample - you may delete this line

    Above file will be created in the system.ini folder

V3.7.0.20 Beta

1. Updated AcquireStar to use telescope RA & Dec and not perform PinPoint plate solve of current telescope position if Final Pointing update is not enabled.

2. Set any window to be 'on-top' when opened if FocusMax main window is set to 'On-Top' by the user

3. Pressing Enter after updating parameter on Vcurve window will update all relevant parameter entries

4. Eliminated overwriting MySytem data when Vcurve is run in FirstLight Wizard

5. Added code to terminate operation if cannot set cameraX,Y binning

6. Fixed focuser connect button strobe

7. Added camera name to log

8. Added min/max exp to Log

9. Added code to turn of Select Button if CCDSOft is the selected imaging SW

10. Fixed missing Min Exp setting on Setup Tab on startup

V3.7.0.16 Beta

1. Eliminated writing telescope focal length to registry after every successful plate solve.

2. Fixed bug in converting telescope FL from cm to mm

3. Eliminated missing slopes alert window to run FirstLight Wizard or Vcurve

4. Set AutoFocusFluxMin = 40 and AutoFocusFluxMax = 100 for Simulator.ini so that user can select simulator focuser and camera (MaxIm only) without having to adjust MIn/Max Flux settings. This will allow the user to run Vcurves, autofocus and perform most FocusMax functions.

5. Added updated Help and Tutorials to distribution package

V3.7.0.14 Beta

1. **Added all new Help based on this release**

2. **Added all new Tutorials based on this release**

3. **Added FocusMax.org web link to Help**

4. Added AcquireNumberStar to AcquireStar Setup Tab to allow the user to set the number of stars that will be selected based on the user defined parameters before the telescope slews to the first target star.

5. Added property FocusMax.FocusControl.AcquireNumberStar (Integer) = [Integer]

6. Eliminated enable checkbox on image flush feature found on Options window

7. Fixed bug that saved Vcurve and focus images even though it was disabled.

8. Set cursor hourglass when unloading to indicate that FocusMax is busy (writing data to ini)

9. Format Min/Max exposure on Setup tab to 0.00

10. Added Option to change Font and Font Size for users who experience font scaling issues in Windows 7

11. Added ability for user to define Font and Font size in Options - several users reported that the font are not scaling properly on some Win 7 Pro computers.

12. Eliminated Revision History from Menu/Help and rolled into new Help file

13. Added Tutorials and Discussion Group hyperlink to Help

14. Added CCD Central Region to command button Find (Star) – this will restrict the region on the chip for star selection.

15. Added feature to incrementally move the focuser if driver MaxIncrement < total move distance.

    Example:

    Current position=25000
    Driver MaxIncrement = 1000 (not realistic but for illustration purposes)
    Desired position = 28000
    Focuser will require (28000-25000)/1000 = 3 moves to achieve final position
    This should address some focuser drivers that limit full range movement in one contiguous move.

16. Added method to optimize subframe size based on measured HFD value which will improve ability to

detect & measure star in subframe.

17. Eliminated potential bug with regional settings when automatically calculating Vcurve parameters

18. Added AutoUpdateVcurveParameters = 0,1 (Boolean) to system.ini which will bypass automatic Vcurve parameter update when cursor leaves center, half width, initial, or final position fields

   o To turn off Vcurve parameter update system.ini [User] set AutoUpdateVcurveParameters = 0 (1 = default)

   o Added 'Update' to Vcurve menu if user disables AutoUpdateVcurveParameters (=0). This will allow the user to manually recalculated setup parameters before Vcurve run.

19. Added VcurveMaxSigma (default 3) to system.ini to allow user to set sigma limit for data exclusion when fitting Vcurve lines. Decreasing VcurveMaxSigma will increase sensitivity and exclude more points during regression fit.

20. Added iterative process to increase subframe size to locate target star when using Select (star) function. This will be useful if the user misses and does not click directly on a star in the image when using MaxIm.

21. Fixed a bug where illegal value of MaxBinX,Y = -21653 is returned when the camera is polled and not yet ready.

22. Added graphics color options of red, green and blue which will be useful for laptop users who use a red filter (user request) - see Menu/Options

23. Added support for UCAC3 star catalog for AcquireStar

24. Added Vcurve run Binning, Total points and Good points to Profile Comments column. This will be useful in helpful when reviewing Profile data.

25. Small enhancements when running in Simulator mode - HFD is always measured relative to midpoint of focuser travel.

26. Several bug fixes to address when and what buttons are active during FocusMax operations

27. Added On-Top to Vcurve window

28. Changes to date & time routines to address potential international character set issue

29. Added FocusMax version to log for Auto-focus and Vcurve runs

30. Removed Pause and Profile button from Vcurve window - they were redundant to main FocusMax window.

31. Eliminated Frame Width in Vcurve which was redundant with main FocusMax window.

32. Added Vcurve parameters to Log

33. Added focus position and max HFD to Log for FirstLight Wizard which are used to estimate the slope

34. Added save Vcurve and Autofocus images when FocusMax is shut down and re-enabled when initialized. Added note to the Log that images are being saved to user defined directory.

35. Bumped Rev to 3.7.0.00

V3.6.0.80

1. Added FocusMax version to log for auto-focus and Vcurve runs

2. Added MaxIm camera number to Log

3. Enhanced Find star function to use the user defined CCD Central Region setting - previous, any star in FOV was a candidate

4. Changed default auto-connect Camera and Focuser to No (see Options)

5. Fixed a bug if no focuser is connected then it is difficult to open and select focuser in the Focuser Chooser due to focuser polling rate

6. Added user defined focuser polling rate to Menu/Options for 1 - 5 sec for focuser that have trouble with 1 sec polling (default = 1)

7. Moved Backlash enable, steps, and direction from registry to ini file in case more than 1 focuser is being used

8. Eliminated Popup Message

9. Fixed bug related to sorting VCurve data with new data format

10. Added the following scripting FocusControl methods & properties:

   o FocuserBacklashEnabled(Boolean) = [Boolean]
   o FocuserBacklashDirection(String) = [String] (In/Out)
   o FocuserBacklashSteps(Long) = [Long]
   o FocuserGuardBandSteps(Long) = [Long]
   o AutoFocusFluxMin(Long) = [Long]
   o AutoFocusFluxMax(Long) = [Long]
   o AutoFocusExpMin(Single) = [Single]
   o AutoFocusExpMax(Single) = [Single]
   o Delay(Double)
   o SendToLog(String)

V3.6.0.77

1. Fixed bug where Temperature Compensation will be turned off when under host control and FocusMax instance has been destroyed

2. Fixed bug where an error message would be generated if there was no ASCOM focuser selected and FocusMax is being shut down

3. Fixed bug if auto-connect camera = false then imaging software will not be loaded until selected by user

4. System ini ImageDownloadTimeout changed to CameraImageTimeout (default = 15 sec). This must be manually changed for cameras with slow image download times.

5. Added additional error trapping during image acquisition

6. Added debug window and system ini entry DebugMode = 0,1 (False,True) which must be manually changed – this is designed to debug specific user issues. There is no log file generated but text can be copied to the clip board

V3.6.0.71

1. Fixed bug - FocusMax was not saving MaxIm Subframe state before initiating autofocus run

V3.6.0.70

1. Fixed bug in Vcurve plot to eliminate error message

2. FirstLight Wizard:

   o Added ability for user to change Vcurve HFD setting (default 40) which will be useful if focuser has with limited travel.

   o Fixed a bug that would lockup system if absolute focuser move is > max travel or < min travel with backlash compensation

3. Changed user defined option CameraDownloadTimeout to CameraPostExpDelay (Options window)

4. Added ini entry ImageDownloadTimeout to allow user to set the delay > 15 sec default when waiting for image to download. This value must be manually changed in the ini file (default = 15 sec).

5. Added code to turn off native focuser temp comp if enabled when FocusMax shuts down

6. Enabled Focus Routine 'Return to Start Position' feature on Features Tab which was turned off during new feature development and not re-enabled

7. Added ability to limit min & max end of travel position of focuser (default = 5 steps) to limit (guard band) focuser from hitting a hard stop at end of travel.

8. Changed image calibration option to one checkbox to enable this feature (was MaxIm / CCDSoft). This feature would be useful for users that have hot pixels or pixel clusters that FocusMax sees as stars. See end of this document for instructions on how to use with MaxIm.

V3.6.0.60

1. 'Fixed bug that did not convert original system.ini format to new format.

2. Original format:
3. Y date time PID left_slope right_slope 0.0000 0.0000 X X (data delimiter = space)
4.
5. New format:
6. Y|date|time|PID|left slope|right slope|comments (data delimeter = |)

V3.6.0.58

1. Fixed bug when host program creates an instance of FocusMax.FocusControl resulting in "could not create object..." on some OS and pc's

2. Fixed a bug that turns Optec native temperature compensation off when FocusMax closes

V3.6.0.49

1. Added automatic backup of active ini file at start up which will be found in the same directory - file name will be XXX.bak

2. Log will open on desktop as default if a new user and will remain on desktop until user turns it off using Menus/Set Windows Arrangement/Save

3. Fixed bug that moved filter wheel to position 0 during auto-focus run

4. Fixed AcquireStar bug to stop catalog search if catalog or catalog path is not defined

V3.6.0.46

1. Fixed bug that generated an error when writing combo entries at startup

V3.6.0.45

1. Fixed bug to return -999 if is there is no focuser temp probe and host initiates Get Temperature which avoids windows modal message box

2. Fixed Bug to eliminate an error posted in the Log when switching between MaxIm & CCDSoft

3. Fixed bug with international regional setting '.' vs ','

4. All numerical data is dynamically converted from/to '.' or ',' based on international regional settings

5. Minor change to FirstLight Wizard setup messages

6. Deactivate communication with Optec When unloading FocusMax to allow hand unit to operate - also turns off Temp Comp mode

V3.6.0.30

1. Added full support for international users to recognize '.' & "," as decimal separator

2. Changed Vcurve data delimiter from ',' to '|' – pressing Profile button will reformat the system ini file

3. Added MaxImApp.LockApp = True to prevent MaxIm from closing when scripted and instance destroyed

4. Turn off native focuser temp comp if on when shutting down

V3.6.0.22

1. Fixed application revision level to match Vista/Win7 file version - example: new version 3.6.0.22 will show old version 3.6.22.

2. Scripting property Revision will return the old VB6 version APP.Major"."APP.Minor"."APP.Revision to maintain compatibility with existing applications.

3. Bug fix to automatically connect focuser & imaging software if Focus, Select, Find, Expose button is pressed and they are not connected.

4. Disable Select button if CCDSoft is loaded

5. Added property FocusMax.FocusControl.IsBusy (boolean), returns true if FocusMax is performing an operation (auto-focus, Vcurve, etc)

6. Pressing Stop button or using COM method Halt will stop all operations (AcquireStar, auto-focus, telescope slew, Vcurve etc.)

V3.6.12

1. Added auto-connect to Options window (Menu/Open/Options) to enable/disable focuser, camera and telescope connection during startup. Setting focuser auto-connect off will allow the user with multiple focuser to select a different system ini file which will not create a physical link to the focuser until the Connect button is pressed. Note, a script may be written to automate this process.

V3.6.10

1. Added Manifest as a resource file to set Vista/Win 7 administrative rights & implemented XP style controls

2. FocusMax no longer loads MaxIm/CCDSoft using shell command which Peter Simpson found may spawn an additional copy.

3. Added new method to detect user profile path which will allow directories to be automatically created in locations other than C:\users\XX\documents\FocusMax

4. Added new method to set directory path which will start with current default path not C:\

5. FocusMax is now compiled for distribution using Inno Setup.

MANY thanks to Peter Simpson for trouble shooting, providing suggestions concerning Vista & Win 7 install issues, testing distribution file on XP & Win 7 (x32/x64) machines and providing a starter script for the new installer. His kind help and guidance is much appreciated!!

V3.6.2

1. Another bug fix to address error when opening Profile when there is empty or missing data in system ini under [Data].

2. Added ability to save window sizes and positions which can be found on Menu Set

V3.6.1

1. Bug fix to address error when opening Profile when there is empty or missing data in system ini under [Data].

V3.6.0

1. Added Temperature Compensation checkbox on Setup tab which will allow user to enable native focuser temp comp.

2. Fixed bug that prevented Profile rows from being deleted, changed highlight color to red

3. Added Vcurve filter and focuser position to Log

4. Eliminated Windows arrangement and Startup Windows from FocusMax menu. All open windows and positions are saved when FocusMax is closed will be restored at startup

5. Minimizing FocusMax will minimizes all open windows – windows are restored when FocusMax is clicked on Windows task bar

6. Moved focuser name (myFocuserID) to system.ini which allows a user to load focuser & focus parameters from a script. This will be useful for users who operate several telescopes and use different system files. Here is a script for this

```
Dim FM
Set FM = CreateObject("FocusMax.FocusControl")
wscript.echo "Current system = " & FM.SystemFileName
FM.SystemFileName = "C:\Users\Steve\Documents\FocusMax\MySystem.ini"
```

```
wscript.echo "Loaded system = " & FM.SystemFileName
```

7. Eliminated skew as a user input on Features Tab; set skew = 1 (which can be changed in system ini) and works behind the scenes to eliminate rogue data points during auto-focus run

V3.5.21 Beta

1. Moved PopUpMsg timer interval to Options

2. Disabled the OptecTCF.Focuser driver hand control unit after loading FocusMax and re-enable after exiting FocusMax or pressing focuser Disconnect button

V3.5.14 Beta

1. Eliminated legacy code for RoboFocus.exe support and other drivers that pre-date ASCOM platform

2. Eliminated focuser link delay from Options

3. Added new feature – Traffic Log which will post focuser ASCOM commands issued by FocusMax or a host

4. Bug fixes relating to Temp comp

5. Added code to turn on telescope tracking when telescope is loaded if necessary

6. Fixed bug when running in simulator mode and final focus would fail due to final HFD > max user setting

7. Added code to stop polling focuser if FocusMax is busy with auto-focus or generating Vcurve

8. Bug fixes with OptecTCF driver

9. Added new method to determine if focuser IsMoving

10. Added autofocus after Vcurve – focuser will move to previous position if not enabled

11. Eliminated all save & restore position & sizes for CCDSoft & MaxIm

12. Change TempLog to show only position, temp & identify autofocus data

V3.5.0 Beta

1. Added new feature that will adjust exposure time based on min/max flux window. If the target star is found within the flux window, then FocusMax will begin the auto-focus routing, if not, then it will adjust the exposure time accordingly. There is a setting for min/max exposure time, FocusMax will abort the auto-focus run if exceeded

2. Eliminated Dim Star feature which is now rolled into item #1 above

3. Fixed a bug related to determining Windows user profile and creating default directory

4. Added filter name to Log

5. Added methods and properties for AutoFocusFluxMax, AutoFocusFluxMin, AutoFocusExpMax, AutoFocusExpMin, FocuserTempComp and deleted DimStar Class routines

6. Recoded all routines that use the older ASCOM Helper – FocusMax now requires ASCOM Platform V5.5.1 (minimum)

7. Added ASCOM Platform version to Log at startup

8. Added focuser position and temperature compensation state to Log at startup

V3.4.40

1. Corrected bug where incorrect user directory structure is created on XP systems

2. Added 1x1 thru 4x4 binning for initial target star selection image. This will be useful for color cameras that cannot bin 3x3

3. Option to allow use to turn off Popup Message (see Options)

4. Eliminate writing PinPoint horizontal & vertical image scale (arc-sec/pixel) to registry when image is plate solved. Discovered a few instances where false plate solve lead to inability for PP to solve subsequent images

5. Fixed spiral search bug and added Log output of current plate solved position after spiral search

6. Eliminate camera flush when Stop button is pressed to stop all camera activity ASAP

7. Added revision history file to menu Help

V3.4.34

1. Update AcquireStar method to map increasing sky search grid for target stars under defined user constraints.

2. Changed default DimStarFlux from 10,000 to 20,000

3. Corrected a bug in arc-cos function

V3.4.30

1. Added Vista/Win7 user directory structure

2. Added MaxIm subframe image calibration which should be useful for cameras with hot pixels – see instructions below

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