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AP GTO Mini Control



User Guide

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Document History

Revision History

Revision Number	Revision Date	Summary of Changes	Author
8.2-3	02/09/2015	Fixed network mask on Use remote network for dome controller emulator. Added better log file entries for error messages. Added a splash screen.	William Rison
8.2-4	02/19/2015	Older version is uninstalled automatically before installing the new version. No longer need to do program remove before updating with new version.	William Rison
8.2-6	02/26/2015	Fixed not knowing RA/DEC and sidereal time when connecting to NCO dome controller. Will send INIT to NCO dome controller if dome position is not known during connect to NCO dome controller. Spelling fix for controller version.	William Rison
8.2-7	03/01/2015	Calc dome position is now done if dome position is unknown when enabling tracking.	William Rison
8.3-0	03/02/2015	Upgraded to .net framework 4.0 client to fix splash screen issue. Changing framework version loses previous settings.	William Rison
8.3-1	03/03/2015	Message box for COM port not found during startup was hidden behind splash screen.	William Rison
8.3-2	03/04/2015	Removed splash screen being shown during startup. Added context menu to show serial ports window.	William Rison

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8.3-3	03/06/2015	Search now issues a mount stop when closed if search is active	William Rison
8.3-4	03/09/2015	AGF dome control DSR switch function will now restart automatic dome tracking under some error conditions.	William Rison
8.4-0	03/13/2015	AGF dome control DSR com port added break support to close and open mount and AGF serial ports.	William Rison
8.4-1	03/18/2015	Fixed problem with AGF DSR port Break signal processing. Park scope now stops tracking.	William Rison
8.4-2	03/31/2015	Changed AGF DSR break messages and speaking. Added PDF document to program output. Access with the About & Help menu item	William Rison
8.4-3	05/05/2015	GTOCP3 tracking button size wrong. Added tooltip.	William Rison
8.4-4	07/29/2015	Fixed logging of meridian status did not stop when Pause checked on command log window. Added Get RA/DEC to Save & Restore RA/DEC window.	William Rison
8.4-5 (not released)	08/10/2015	Enabled autoscroll on main form so the window can be made smaller and scroll bars will appear.	William Rison
9.0-0	08/10/2015	Changed order of controls on main window to make better use of a scrolling window.	William Rison
9.0-1	08/15/2015	Changed spacing on top status line.	William Rison
9.0-2	08/24/2015	Added M (monitor) button to Scope & Dome Position window. Changed main form layout.	William Rison
9.0-3	11/10/2015	Added scope meridian position to dome tracking status line.	William Rison

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9.1-0	11/17/2015	Added a Park 4 position to Park Telescope. Park 4 is set using the Altitude/Azimuth Menu item.	William Rison
9.2-0	3/10/2016	Rearranged main form items. Added functions to Save/Restore RA/DEC form. Now has keyboard control and update entry from current mount position.	William Rison
9.2-1	3/14/2016	Refined shortcut keys for Save/Restore RA/DEC form.	William Rison
10.0-0	8/30/2016	Rearranged Dome Control menu bar. Added Park Dome for both dome controllers. Added option to park dome when tracking duration timer expires.	William Rison
10.0-1	9/2/2016	Save Duration timer Park check box selection.	William Rison
10.0-2	10/25/2016	Changed Domes file and fixed Open Domes file initial directory incorrectly set.	William Rison
11.0	11/18/2016	Added check box to allow GTOCP3 variable rate move to be used on none CP3 mounts. Valid for use when connecting via Serial To ASCOM program and using non AP mounts. * (removed in v11.1) Enlarged some buttons on Search window. Search now starts without a delay and sends proper direction stops while searching. AGF Dome Control added EW switch function can be set side of pier. Bug fixed in Search function. Box search is now corrected.	William Rison
11.1	11/24/2016	Added Dome Control menu button to stop dome tracking on mount timeout.	William Rison
11.2	12/7/2016	Added support for more versions of the GTOCP3 controller.	William Rison

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11.3	2/15/2017	Save/Restore RA/DEC added check box to adjust RA & DEC from J2000 to current day JD	William Rison
12.0	2/21/2017	Added serial COM port2 for ASCOM Focuser Driver input.	William Rison
12.1	2/22/2017	Changed COM port2 to allow all AP commands to be bridged to mount COM port.	William Rison
12.2	2/26/2017	Added menu item on main menu to adjust RA & DEC slew commands from J2000 to current JD that are received from COM port2.	William Rison
12.3	2/27/2017	Added support for SkyChart III connect using LX200 telescope type to COM port2.	William Rison
13.0	2/27/2017	Changed layout. Did away with mini focus and slew. Made focus separate window. Added buttons for Focus, Ra/Dec and Alt/Az to main window.	William Rison
13.0-1	3/9/2017	Fixed COM port2 receiving data problem.	William Rison
13.0-2	3/25/2017	Improve main serial port error checking.	William Rison
13.0-3	3/30/2017	Improve dome tracking error handling with mount timeouts. Fixed show com ports problem with COM port2 combo box.	William Rison
13.0-4	4/5/2017	Always on Top for all Windows did not work for Alt/Az and Focus windows.	William Rison
13.0-5	4/12/2017	Always on Top for all Windows still had some windows not on top.	William Rison
13.0-6	4/19/2017	Improve keyboard control of listbox in Save Restore RA/DEC window.	William Rison
13.0-7	5/15/2017	Automatic Dome Tracking now sets keyboard control after starting.	William Rison
13.0-8	11/1/2017	Comment wrong in OTA EW offset in Dome Control.	William Rison
13.1-0	12/4/2017	Added calibration function to AGF dome.	William Rison

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13.1-1	12/18/2017	Removed 13.0-7 keyboard control bug with automatic startup at windows startup.	William Rison
13.2-0	2/12/2018	Added processing undocumented :G commands sent from AP ASCOM driver using COM2 serial port of program.	William Rison
13.2-1	3/27/2018	Changed tracking rate radio buttons to send tracking rate command if button is already set. Corrected a few document typing errors.	William Rison
13.3-0	4/11/2018	Save & restore dome position between program starts. Restore RA/DEC saved between program starts if Save was ever done.. Added Show for Restore RA/DEC button. Changed font size of status bar. Added Settings to send Stop tracking on a Connect to mount.	William Rison
13.4-0	5/2/2018	Added option to save dome position on shutdown for AGF dome controller. Clear serial port receive buffer on timeouts.	William Rison
14.0-0	5/5/2018	Added network interface for AGF Dome Controller. Removed Bluetooth interface.	William Rison
15.0-0	6/1/2018	Added network interface for AP mount via XPort device. Rearranged and added items to program Menu.	William Rison
15.0-1	6/9/2018	Improve Dome Controller error handling.	William Rison
15.1-0	6/19/2018	Added setting IP port for the XPort device for the AP mount.	William Rison
15.2-0	6/24/2018	Added setting of read buffer purge timeout when connecting to AP mount via XPort network device.	William Rison

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15.2-1	6/30/2018	AGF automatic dome startup DSR switch message fix.	William Rison
15.3-0	7/6/2018	Added options for stopping tracking under program settings. Tracking rate radio buttons will now show what rate is set if a tracking rate command is sent not using one of the radio buttons.	William Rison
15.4-0	7/10/2018	Fix :Gg# and :GC# response timeout getting longitude and date. (AP Manual incorrect on command response) Added variable rate button to Search window.	William Rison
15.4-1	7/30/2018	Improve dome stop on errors.	William Rison
15.5-0	7/31/2018	Add debug logging to Program Settings under main menu. Add to Get Mount Data, ALT, AZ and Set long format. When connecting using the XPort TCP device will not remove AP mount power up data 'Y1' from data received.	William Rison
15.5-1	8/20/2018	AGF Dome position saved and restored between program sessions.	William Rison
16.0-0	9/21/2018	AGF and MoonLite Stepper Motor focus controls added.	William Rison
16.1-0	9/27/2018	AGF focus control window changed to use tabs. Added separate timer for each motor. Remember size of AGF and MoonLite focus windows. Rearranged MoonLite focus window items.	William Rison
16.1-1	9/28/2018	Added keyboard control for AGF and MoonLite focus motors In & Out buttons.	William Rison
16.1-2	10/8/2018	Added [and] keys to control focus motor in and out.	William Rison
16.1-3	10/30/2018	Fix AGF focuser showing wrong count for 1 st timer. Added displaying mount Alt. on dome tracing status line.	William Rison

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16.1-4	11/12/2018	Fix Re-Cal when connected to mount via XPort device. AGF timed focus counter fix.	William Rison
16.1-5	11/23/2018	Fix response to :Bd and :Br commands through 2 nd com port.	William Rison
16.1-6	12/10/2018	Added Show Dome Configuration to Show/Clear menu on Dome Control window. Change resize of dome control form to always show status line at bottom.	William Rison
16.1-7	1/16/2019	Fix Re-Cal with network interface. Change meridian delay limits in Dome Control to match AP hand controller of 6.	William Rison
16.1-8	1/22/2019	Fix issues with custom tracking rates. Added Lunar button and tooltips.	William Rison
16.2-0	1/23/2019	Added Logical Meridian Offset commands as new form.	William Rison
16.3-0	3/13/2019	COM port2 adjust JD now adjusts RA & DEC in both directions.	William Rison
17.0-0	4/5/2019	Added ASCOM telescope as a mount that can be used.	William Rison
17.0-1	5/22/2019	Fix bug with North, South, East, West buttons.	William Rison
17.0-2	5/29/2019	Added bounds checking on some settings.	William Rison
17.0-3	6/5/2019	Added Re-Calibrate when using ASCOM AP driver	William Rison
17.0-4	6/24/2019	Do not give error if AGF dome movement is zero and NCO dome is selected.	William Rison
17.0-5	9/10/2019	CP3 meridian offset saved and restored between program starts.	William Rison
17.1-0	9/26/2019	CP3 meridian offset set on connect changed to a program settings option. AGF Dome Control DSR switch can now use CP3 Meridian offset as an option.	William Rison

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17.1-1	10/12/2019	Change when speak is done for setting meridian offset on startup.	William Rison
17.1-2	10/23/2019	Fix Moonlite focuser speed settings being reversed.	William Rison
18.0-0	11/20/2019	Add support for AGF dome control wheel pulse encoder.	William Rison
18.0-1	12/07/2019	Fix Re-Cal not working when connection is via XPort device.	William Rison
18.0-2	12/30/2019	Added AGF dome debug port support.	William Rison
18.0-3	1/25/2020	Fix program error showing dome controller configuration.	William Rison
18.0-4	3/1/2020	Allow switching position of Centering and Tracking group boxes by double clicking on the group box name. Fix stop tracking past meridian issue.	William Rison
18.0-5	3/23/2020	Allow access to dome controller web page without having to be connected to the dome controller.	William Rison
18.1-0	3/24/2020	Added calc. buttons to GTOCP3 Tracking form. Input is drift in seconds per hour. This can be obtained from Cartes du Ciel (Sky Chart) program.	William Rison
18.1-1	3/31/2020	Fix stop tracking after Park being issued if menu option is unchecked.	William Rison
18.1-2	4/18/2020	Fix Park 1 slew not slewing to correct side of mount.	William Rison
18.1-3	4/26/2020	AGF Dome calibration checks pulse move. Set last dome position always for AGF dome control. Added buttons to AGF dome control calibration.	William Rison
18.1-4	5/16/2020	Allow changes to dome calculations while dome tracking is enabled. Change Re-Cal text message to better describe what it does.	William Rison

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19.0-0	5/28/2020	Change Menu layout. Added Settings and Control window with additional functions.	William Rison
19.0-1	7/4/2020	Added Moonlite focuser Menu item to set Dual Controller.	William Rison
19.0-2	7/6/2020	Add Diagnostics to Menu. Add N S E W indicators to diagnostics window.	William Rison
19.0-3	8/9/2020	Better checking on connect to AGF dome controller to make sure it is working. Put checks in to make sure all windows are on the screen.	William Rison
19.0-4	8/17/2020	Change meridian offset for AGF dome control manual switch to work when not set from main window. Fix dome control tooltip error.	William Rison
19.0-5	9/9/2020	Send set move rate command before moving mount via N S E W buttons if rate has been set. Prevents setting move rate via second com port overriding rate set by AP Mini. Changed dome part positions to very 10 degrees.	William Rison
19.0-6	10/2/2020	Clear meridian offset when parking mount.	William Rison
19.1-0	10/16/2020	Added option to end PHD guiding process when duration or meridian timers expire. Resized Diagnostics window. Dome window design minor changes.	William Rison
19.2-0	10/29/2020	Dome calc. now does ota East / West lateral offset correctly. Added N S E W indicators to Search window.	William Rison
19.3-0	11/4/2020	New Dome calc. code. Based on N. de Hillster article. Added Dome tab to control window.	William Rison
19.3-1	12/16/2020	Fix New Dome calc. code error.	William Rison

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19.4-0	12/18/2020	Added Lock check box for stop tracking past meridian that will keep the checking timer running after the 1 st stop. Added locking by computer and user of the meridian stop timer. Controlled by text file in install directory.	William Rison
19.4-1	1/13/2021	Fix stop PHD2 problem.	William Rison
19.4-2	2/15/2021	Fix allow mount query if disconnected. Fix Park after meridian timer not working.	William Rison
19.5-0	3/9/2021	Change main form layout.	William Rison
19.5-1	3/19/2021	Fix edit current dome file issue.	William Rison
19.5-2	3/20/2021	Close of Dome windows will no longer stop tracking since dome tracking status is now displayed on the main window also.	William Rison
19.5-3	3/22/2021	Dome "C" button displays wrong value for regular dome calc. value.	William Rison
19.6-0	4/14/2021	Removed N. Hilster dome calculations as an option, did not work around the pole.	William Rison
19.6-1	6/1/2021	Fix meridian stop problem when scope is on East side of mount.	William Rison
19.7-0	6/17/2021	Added :GOS# command support. For GTOCP3 Rev. T and later.	William Rison
19.7-1	8/6/2021	First command delay value can now be set using the Settings & Control window. Fixed CP3 rate button not highlighting when pressed.	William Rison
19.7-2	8/25/2021	Better error checking for AGF dome controller errors.	William Rison
19.7-3	9/11/2021	Fix GOS command on connect for some tracking rates not correct.	William Rison
19.7-4	9/25/2021	Change some status line messages.	William Rison

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19.7-5	10/15/2021	Fix J2000 to current JD calculation incorrect for DEC - 00.	William Rison
19.7-6	11/30/2021	Separate sending RA & DEC in J2000 to work.	William Rison
19.8-0	12/07/2021	<p>CP3 tracking rates for RA & DEC can be calculated using H:M:S.s.</p> <p>Added check box for CP3 Cacl. RA tracking rate to allow data from Cartes du Ciel dRA drift to be entered.</p> <p>DEC tracking rate is set for correct side of pier the telescope is on at time of setting the rate.</p> <p>Changed Diagnostics menu name to Oscillate.</p>	William Rison
19.8-1	12/13/2021	Fix Stop Mount for CP3 tracking.	William Rison
19.8-2	12/15/2021	Refine J2000 conversion.	William Rison
19.8-3	2/25/2022	Fix [and] key for focus in and out not sending focus stop upon release.	William Rison
19.9-0	5/8/2022	<p>Reworked Focuser controls.</p> <p>Added ASCOM focusers.</p>	William Rison
19.9-1	5/12/2022	Added limit checking for MoonLite and ASCOM focusers.	William Rison
19.9-2	6/27/2022	Focuser keyboard help file is missing.	William Rison
19.10-0	8/4/2022	<p>Add buttons to save and goto 2 RA/DEC positions to RA/DEC form.</p> <p>Reworked keyboard control to add more functions.</p> <p>KB is activated after auto dome startup is done.</p>	William Rison
19.10-1	8/24/2022	Fix goto RA/DEC button not enabled when using keyboard to save RA/DEC.	William Rison
19.10-2	9/12/2022	Add toggle direction to dome diags.	William Rison
19.11-0	10/31/2022	Add support for AGF dome controller v3.	William Rison

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19.12-0	12/20/2022	Save log files set folder added to Control & Settings, Program Settings tab.	William Rison
19.12-1	1/28/2023	Changed how Dome Calculation Position index is saved. Add log entry after setting on startup.	William Rison
19.13-0	5/15/2023	Change to dome position calculation for telescope offset East and West from center of mount.	William Rison
19.13-1	6/2/2023	Change how auto dome tracking sets dome position at startup with AGF dome controller using DSR switch. If Debug Logging is set under Program Settings the main and dome log windows are shown at program start.	William Rison
20.0-0	12/25/2023	Added support for CP4 controller. Added main form context menu to set slew rates.	William Rison
20.1-0	1/14/2024	Added form to show expansion of :GOS# command. Get mount operating status. Changed order of fields on Program Settings. Save and restore stop timer and meridian timer settings.	William Rison
20.2-0	2/11/2024	Fixe tooltip error for Moonlite focuser. Added clock icon to show up when a stop timer is active.	William Rison
21.0	5/27/2025	Added altitude stop tracking under Settings and Control > Control tab. Removed stop timers lock function and user meridian lock.	William Rison
21.1	10/11/2025	Added control for 2 ASCOM focus motors.	William Rison
21.2	2/12/2026	Changed moving indicator timer for ASCOM focusers.	William Rison

Distribution

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1. System Description & Function

Control of Astro-Physics telescope mounts that have a GTO Servo Controller GTOCP1, GTOCP2 , GTOCP3 or GTOCP4. These controllers are found on the following mounts.

- Mach1, Mach2
- 400GTO
- 600GTO
- 900GTO
- 1100GTO
- 1200GTO
- 1600GTO
- 3600GTO

Program can also be connected to mounts via the Serial To ASCOM program. See <http://miltonhill.us/software> for download and description.

Two different custom observatory dome rotation controllers are supported.

- NCO dome controller (located on the 16' Ash dome at NCO)
- AGF dome controller (located on the 2 meter Sirius dome at MHO)

Note: Observatory dome controllers are not required to control an AP telescope mount.

The program can be set to automatically have a dome controller track the telescope mount.

1.1. Files and Folders

Program can be downloaded from a zip file located at [AP GTO Mini Control download](#)

Software will install to the following locations on the system disk drive:

- Program Files > Telescope Control > AP GTO Mini Control (32bit Windows OS)
- Program Files (x86) > Telescope Control > AP GTO Mini Control (64bit Windows OS)

A desktop shortcut is created with the  icon:

1.2. Environment

Program will run under Microsoft Windows 32bit or 64bit operating systems that support .NET Framework version 4.

Has been successfully run on Windows Xp, 7, 8, 8.1, 10.

Serial COM devices are required to communicate with the Astro-Physics GTO Servo Controller on the telescope mount with controllers earlier than the GOTCP4. The Top RS-232 connector should be used to prevent timeouts but the Bottom RS-232 connector will also work. A few timeouts can be handled by the program.

The following type of Serial Devices have been tested and used:

- Standard built-in serial ports.
- USB to serial adapters, direct to USB with GOTCP4.
- Bluetooth serial adapters.

Starting with the GTOCP4 direct network connections are supported via a LAN or WiFi socket using tcp port 23. There also is a web page to configure the network settings see the Astro-Physics manual for more information.

A network connection is required to communicate with the NCO Dome Controller. Wired and wireless networks are supported.

Network connections to the AGF Dome Controller and Astro-Physics Mounts are also supported using the Lantronix XPort Ethernet to serial RS-232 device and direct Ethernet connections to the GTOCP4 controller. A circuit board must be built for Lantronix XPort device to work and will require 3.3 volt DC power and RS-232 TTL level converter circuitry.

The AGF Dome Controller version 1.4 and later has an XPort device built it as does the XPort Power Controller with RS-232. Both custom made.

2. Program Functions and Main Window

Describes all program functions showing each control grouped by what window is being used.

When the program is started the following splash screen.

2.1. Splash screen



Displayed from the settings sub menu of the main window Menu. Has been disabled during startup.

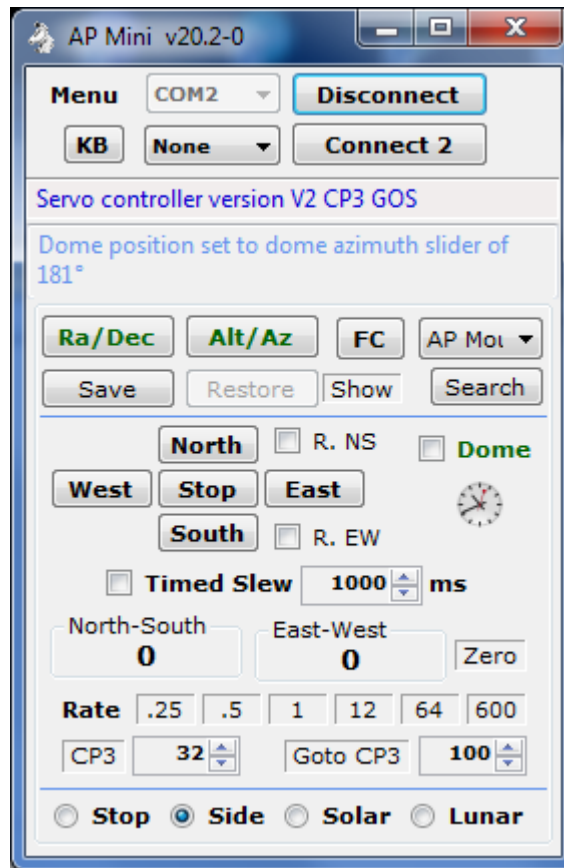
2.2. Main Window

This window appears when the program starts.

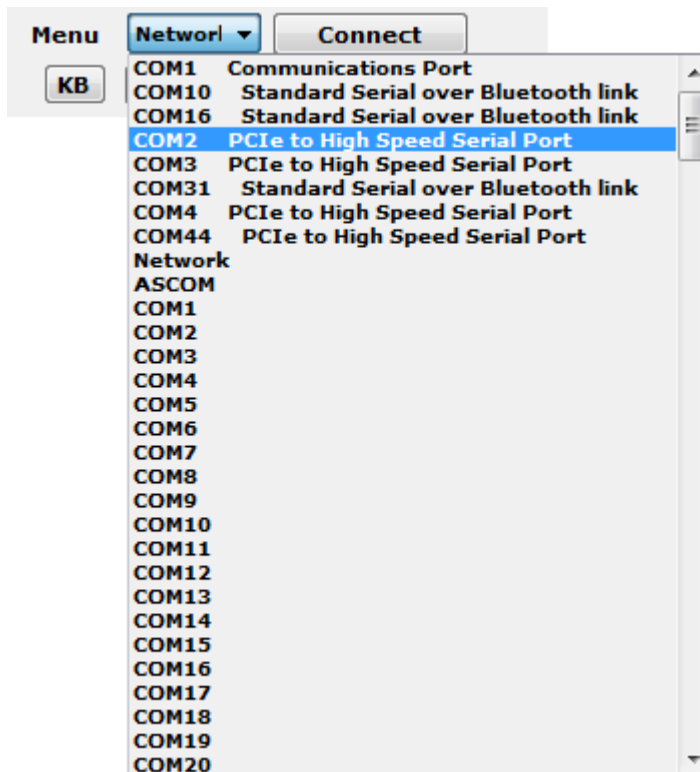
You must select a COM port that is connected to an Astro-Physics GTO Servo Controller to command the mount. The COM port can be a Bluetooth adapter or supported network connection.

The Serial To ASCOM program can also be used to connect to non Astro-Physics mounts. See <http://miltonhill.us/software> for more information.

Note: Use the Top connector on the Servo Controller to prevent timeouts.



2.3. COM Port (at top of form)



Selects the serial port used to communicate with the mount's GTO Servo Controller.

Network **Network** will connect via Ethernet to the mount directly for the CP4 controller or by using a XPort to serial converter box for any controller serial interface.

ASCOM will use any telescope ASCOM driver for the mount connection.

When ASCOM is selected an ASCOM button will appear next to the Connect button. This is used to bring up the ASCOM Chooser to select a telescope driver. After connected the ASCOM button will show the telescope driver chosen.



Note: When ASCOM is selected the following functions are disabled since they are not supported by any ASCOM drivers that I know of.

- Focus to AP mount directly
- Meridian Offset...
- Set Tracking Rate GTOCP3...

- Time and Date
- Re-calibrate

Click on the COM port combo box to display a list of serial ports found on the computer. The list is divided into two sections. The top section show all the COM ports found on the computer with the Windows name associated with the port. The bottom section shows all possible COM ports. The selected COM port will be used when **Connect** is clicked. Network is also an option for Ethernet connections.

2.4. Connect / Disconnect



Opens and closes the serial port or TCP socket communicating with the mount's GTO Servo Controller.

Connect – Button

Open serial port or TCP socket and start communications with the mount.

Sends the following three commands.

Clears the GTO controller buffer

:U# Set long format for RA, DEC and some other command formats.

:V# Gets GTO controller firmware version. Used to determine if a GTOCP2 or GTOCP3 is being used.

If it is determined the GTO controller is a GTOCP3 or GTOCP4 additional functions are enabled.

For GTOCP3 with firmware rev. T and later the mount's tracking rate is obtained.

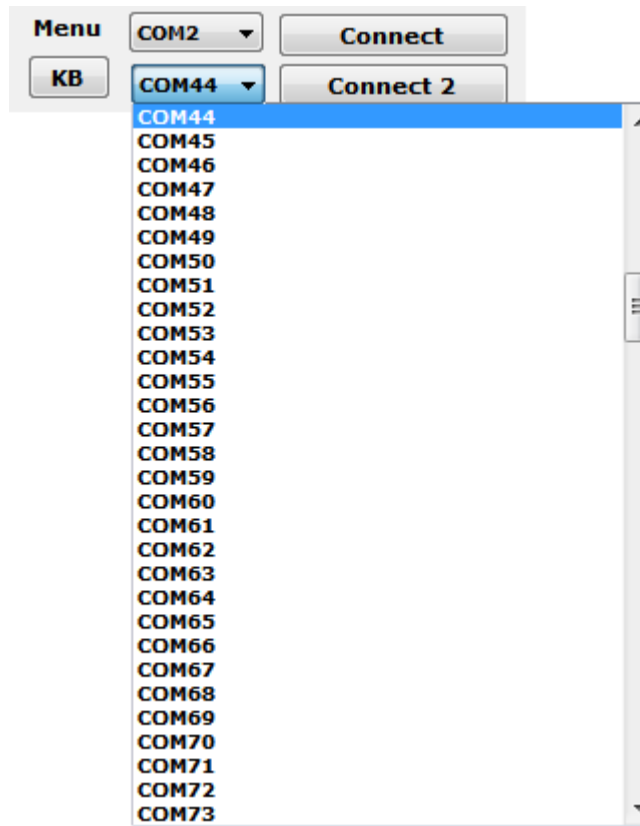
The Connect button will change to **Disconnect** and control functions will be enabled after connecting to the mount.

Disconnect – Button

Closes serial port or TCP socket connected to mount

Note: Will disable dome tracking if enabled.

2.5. COM Serial Port2



Selects the serial port used to communicate with other software such as the ASCOM Focuser Driver AGF_AP_LX200 Virtual absolute focuser driver or MegaStar.

This communications requires 2 COM ports connected via a Null Modem cable or a Virtual serial port connected together. One COM port is used by this program and the other by the program that wants to connect to an Astro-Physics mount.

Click on the COM port combo box to display a list of serial ports found on the computer. The list is divided into two sections. The top section show all the COM ports found on the computer with the Windows name associated with the port. The bottom section shows all possible COM ports. The selected COM port will be used when **Connect 2** is clicked.

2.6. Connect 2 / Disconnect 2



Opens and closes the serial port communicating with the ASCOM Focuser Driver.

Connect 2 – Button

Open serial port2 and start communications with other software.

Accepts and Sends the Astro-Physics GTOCP mount commands.

The Connect button will change to **Disconnect 2** and control functions will be enabled after connecting to the COM port.

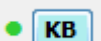
Disconnect 2 – Button

Closes serial port2.

2.7. KB

Sets computer keyboard to control North, South, West, East, In and Out buttons.

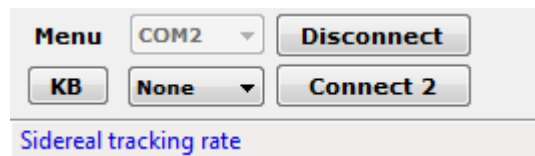
 Not highlighted and not indicator, computer keyboard not in control

 Highlighted with green indicator, computer keyboard keys control mount functions listed above.

- Up Arrow – North button
- Down Arrow – South button
- Left Arrow – West button
- Right Arrow – East button
- PageUp or [Key – In Focus button (AP Mount focuser only)
- PageDown or] Key – Out Focus button (AP Mount focuser only)

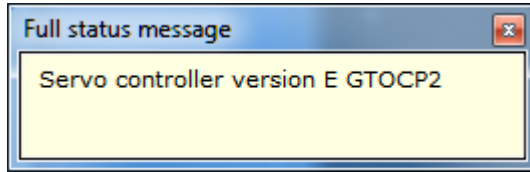
Note: Will disable dome tracking if enabled.

2.8. Status Bar



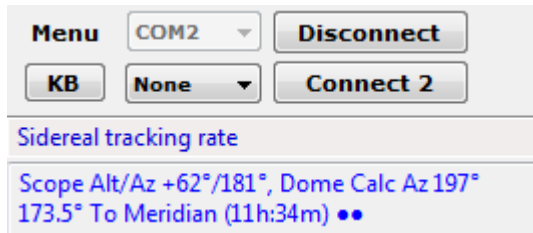
Main windows status bar located below the Menu bar.

Note: Right click on status bar to clear the message.



Left click to display message in a separate window. Useful for long or multiple lines messages.

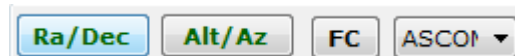
2.9. Dome Tracking Status



Located below Status Bar.

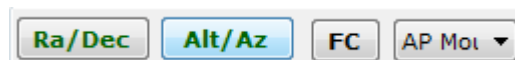
Only contains data when dome tracking is enabled. Show same data as Dome Window status bar.

2.10. Ra/Dec Button



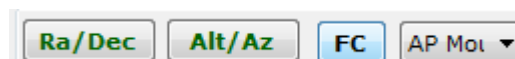
Opens the RA/DEC window to get or slew to an RA and DEC. See section 12.

2.11. Alt/Az Button



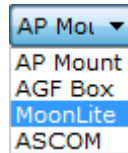
Opens the Altitude & Azimuth window to get or slew to an altitude and azimuth. See section 13.

2.12. Focus Control Button



Opens the Focus window corresponding with the selected focuser. See section 14.

Select Focuser – ComboBox



AP Mount – DropDown

Controls the focus motor plugged into the GTOCP controller of the Astro-Physics mount. See section 14.1.

AGF Box – DropDown

Opens the AGF Focus window to issue focuser movement commands to focus motors that are connected to the AGF Focus Controller box. See section 14.2.

MoonLite - DropDown

Opens the MoonLite Focus window to issue focuser movement commands to stepper motors from MoonLite. *Not Moonlite DC motors.* See section 14.3.

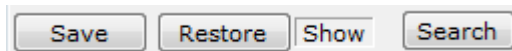
ASCOM – DropDown

Opens the ASCOM Focus window to issue focuser movement commands to any ASCOM absolute stepper motor focuser, such as the ZWO EAF. See section 14.4.

Focus Control Keyboard Usage – Window

Shows keyboard usage keys for focuser and mount control. See section 14.5.

2.13. Save, Restore and Search



Save – Button

Saves the mount's current RA/DEC position then enables the Restore button. The saved position is maintained between program starts and can be viewed using the Show button.

Restore – Button

Slews the mount to RA/DEC position saved using the Save button. Unless another slew to RA/DEC has been issued after the Save. In this case the Restore slews to the last RA/DEC slew.

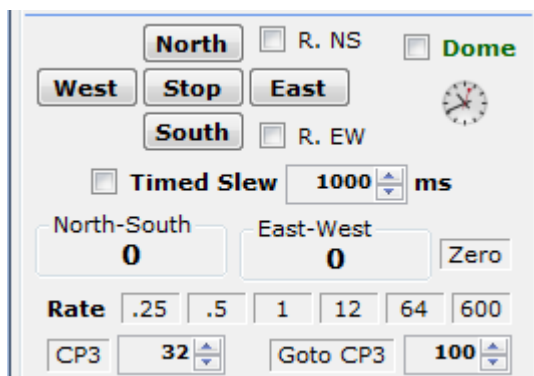
Show – Button

Shows the RA/DEC that will be used with the Restore button.

Search – Button

Opens the Search window to start and stop a expanding square area search. See section 0.

2.14. Centering/Guide/Slew



Note: When the program starts all rates are set at what the Hand Controller is set for. This is not shown in AP Mini.

North, South, West & East – Buttons

Moves the mount in the desired direction at the speed set by the Rate buttons with options selected below.

R. **NS** – Check box

When checked will reverse the North and South buttons. (North will slew South and South will slew North) .

R. **EW** – Check box

When checked will reverse the East and West buttons. (East will slew West and West will slew East).

Timed Slew – Unchecked

Holding the direction button down will slew the mount in the desired direction. Releasing the button stops slewing.

Timed Slew – Checked

Click direction button to start timed slew in desired direction. Slew will stop after indicated **number of ms** (milliseconds, 1000 = 1 second) next to Timed Slew check box or when the **Stop** button is clicked.

ms – numeric up/down

Milliseconds to move mount when **Timed Slew** is checked when pressing a N S E W button.

North-South – Counter

Milliseconds mount has moved using the North & South buttons. North is positive and South is negative.

East-West – Counter

Milliseconds mount has moved using the East & West buttons. East is positive and West is negative.

Zero – Button

Will zero the North-South and East-West counters. These counter indicate the time the mount has moved using the North, South, West & East buttons in milliseconds.

Rate – **.25 .5 1 12 64 600** – Buttons

Click on desired number to select the North, South, West & East button slew rate. All rates are times sidereal. When a rate is selected the number button background will change color. The color can be set using Menu > Settings > Color > Set mouse hover colors...

CP3 or CP4 – (GTOCP3 servo controller only)

Set between 1 and 256 to select the North, South, West & East button slew rate, then click **Set**. Button background will change to indicate rate has been set.

Use numeric up/down box to right of button to set value.

Goto CP3 or Goto CP4 – (GTOCP3 servo controller only)

Set between 1 and 1200 to select the goto slew rate. This rate is used when slewing using **RA/DEC** and **Altitude/Azimuth** functions. This affects command received from both serial ports on the mount, so if another program is using the other serial port and issues a goto command the mount will slew using this set rate.

Use numeric up/down box to right of button to set value.

Dome – Check box

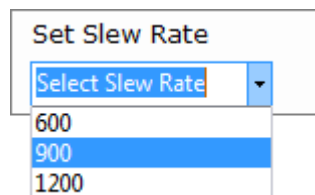
Enable/Disable dome tracking. Same as **Dome Tracking** check box in *Dome Control* window.

If not connected to a Dome Controller will bring up the Dome Control window.

Clock Icon – Picture button

If visible a stop timer is enabled. See section 4.3 Click on picture to bring up **Settings and Control** window to the **Control** tab.

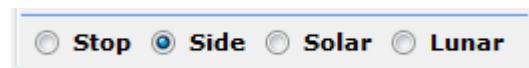
2.15. Context Menu (right mouse button)



Selects the mount slew rate. After selecting must press **Set Slew Rate** to send the command.

Status line will show the slew rate after **Set Slew Rate** is pressed.

2.16. Tracking Rates



Tracking rates of mount.

Stop – Radio button

Stop tracking, sends :RT9# to mount. This stops the mount from moving.

Note: Stop Mount Tracking timers can set this button.

Side – Radio button

Set sidereal tracking rate, sends :RT2# to mount.

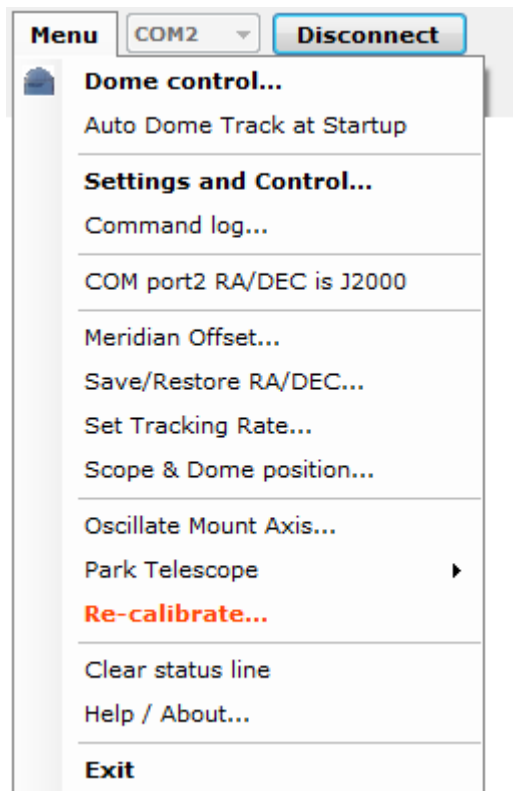
Solar – Radio button

Sets solar tracking rate, sends :RT1# to mount.

Lunar – Radio button

Sets lunar tracking rate, sends :RT0# to mount.

3. Menu > Main Menu



Shows the functions menu. Used to access other windows that perform additional functions.

Dome control...

Opens the Dome Control window for controlling NCO and AGF dome controllers. See section 10.
Note: Icon show the currently selected dome controller.

Auto Dome Track at Startup

When **checked** the program will try to do the following so that automatic dome tracking will start without any operator inputs.

- Connect to mount's GTO Servo Controller using current COM port.
- Get mount's Altitude and Azimuth.
- Get the mount's RA, DEC, Sidereal time, Side of mount, Latitude, Altitude and Azimuth.
- Connect to currently selected Dome Controller.
- Send INIT command to NCO dome controller if dome position is unknown. *NCO Dome Controller only.*
- Calculate dome azimuth.
- Move dome to calculated azimuth for NCO dome controllers. Set dome to calculated azimuth for AGF dome controllers (dome must be positioned to correct azimuth before starting the program).

- Enable automatic dome tracking.

If any of the above functions fail automatic dome tracking will not start and an error message is logged and displayed on the status line.

Settings and Control...

Opens a window with tabs for **Control** of mount stop tracking, **COM and Network**, **Program Settings** for various options, **Mount Data** queries, **Help and About**. See section **Error! Reference source not found..**

Command log...

Opens a window that show all commands sent and responses received from the mount along with any status and error messages generated by this program. See section 5.

COM port2 RA/DEC is J2000

When checked RA & DEC commands to and from COM port2 will be adjusted for J2000. Slew commands from COM port2 will be converted from J2000 to the current JD. Query RA & DEC commands from COM port2 will be converted from the current to J2000 before being sent to COM port2.

This will allow programs that use J2000 coordinates such as MegaStar 5 to work correctly with the mount.

Meridian Offset...

Open the Meridian Offset window to allow setting an East or West meridian offset in hours, minutes and seconds. Unlike the Hand Controller meridian delay this function will not change the reported altitude and azimuth of the mount. Meridian Delay in Dome Control must be set to 0 when using this offset. See section 6.

Note: Meridian Offset only is supported with the GTOCP3 controller Rev. S and later and GTOCP4.

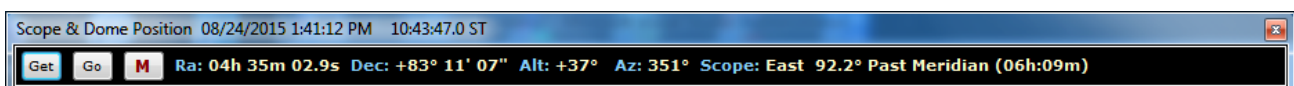
Save/Restore RA/DEC...

Open the Save & Restore RA/DEC window to allow saving of RA, DEC and Name of anything. Can be saved and read from files with an extension of .oap. See section 7.

Set Tracking Rate...

Opens the Tracking window to allow setting of custom tracking rates for both RA and DEC axis on mount's with a GTOCP3 or GTOCP4 Servo Controller. Custom rates can be saved and read from a rate file with an extension of .tr3. See section 8.

Scope & Dome position...



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Opens the mount and dome position window. See section 9.

Oscillate Mount Axis... > Sub menu

Opens the mount Oscillate mount axis window. See section 17.

Park Telescope > Sub menu

Slew mount to one of three predetermined positions. If successful both mount and dome tracking is stopped.

Position 1



Position 2



Position 3



Position 4



Is set using the **Set as Position Park4** button in the Altitude / Azimuth window. See section 13.5.

Note: A Program Settings option can be used to stop tracking when parking the mount.

Re-calibrate...

Performs the same function as the Hand Controller keys RA/DEC REV then 9.

On GTOCP4 Hand Controllers hold down the RE CAL key and press NEXT >.

Must be used with caution!

Sends :CMR# to mount, result is displayed on Re-calibrate window status line. See section 18. Returns the following if successful.

Coordinates matched. #

Clear status line

Clears the status line at the bottom of the main window.

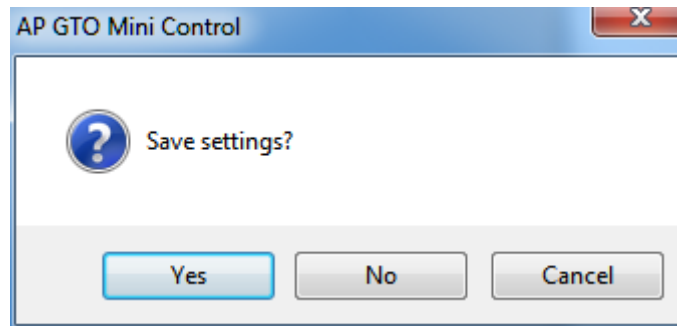
Help / About...

Shows the about and help Settings and Control window tab. Has access to PDF User Guide. See section 4.7.

Exit

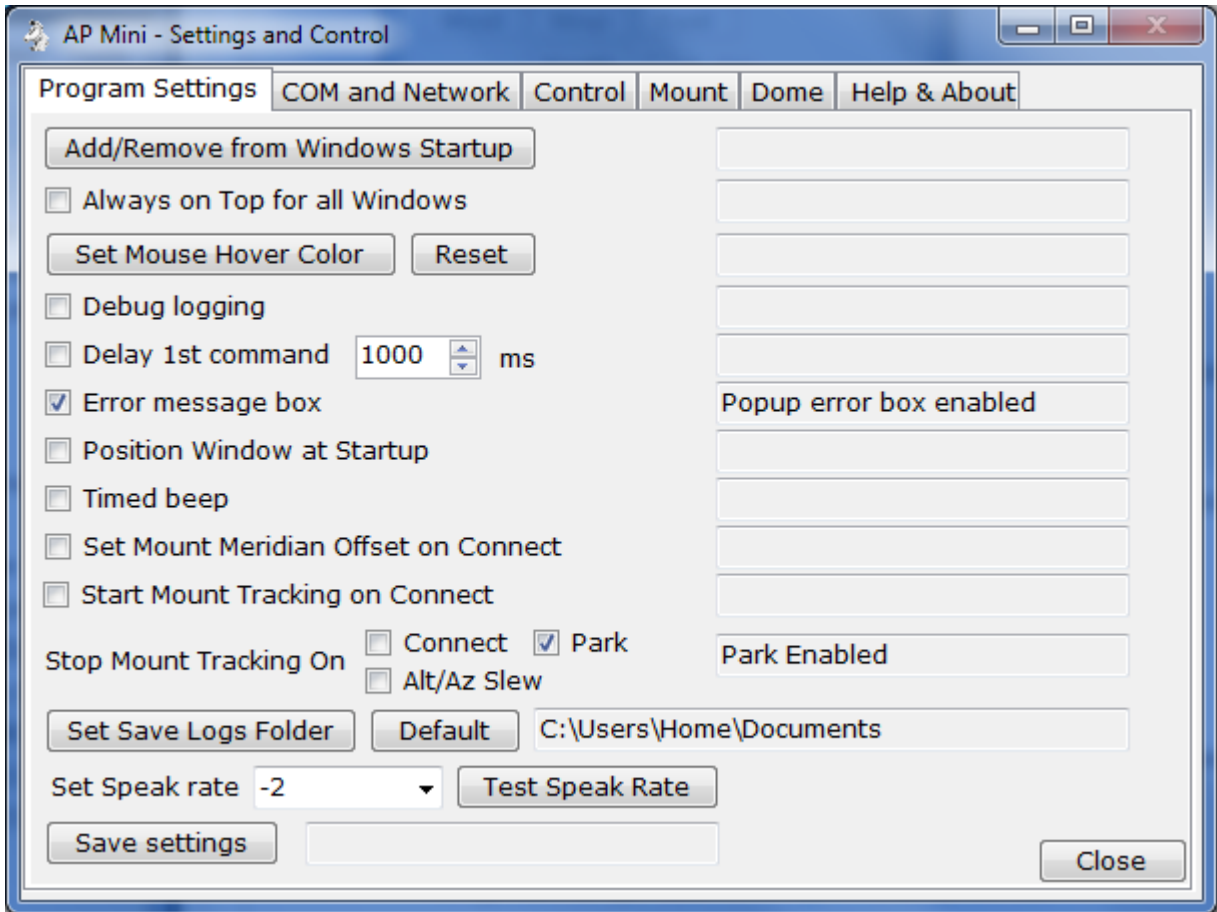
Opens a dialog message box for exit save setting and exit program options.

- Yes – Save setting and exit program.
- No – Do not save settings and exit program.
- Cancel – Continue running the program, does not exit.



4. Settings and Control – Window tabs

Functions and settings to control AP Mini. Windows tabs are show below.



4.1. Program Settings – Tab

Add/Remove from Windows Startup

Will add or remove settings to the Windows Registry to start AP GTO Mini Control when Windows is started. Main window status line will indicate if the program is added or removed from Windows startup.

Always on Top for all Windows

Program windows will remain on top of other windows.

Set mouse hover color

Opens the Windows color mixer window to set the color. The color will be used for button mouse hover color for the Rate and Zero buttons. The key down color for the North, South, West & East buttons and focus In and Out buttons. And the Keys button when active.

Reset

Resets the mouse hover and button down colors to program defaults.

Debug Logging

Command log and Dome log forms are shown at program startup. Command log shows additional information for debugging.

Delay 1st command

Will delay the very first command sent to the mount by 1 second. Only needed for some Bluetooth serial devices that are slow to connect.

Delay time in milliseconds

Time to delay first command 0 to 5000 milliseconds.

Error message box

Will display a popup message box with additional error information in it for program and mount errors.

Position Window at Startup

The Scope & Dome position will open when the program is started. See section 9.

Timed beep

Timed functions are enabled, moving with North, South, West, East, In & Out buttons a beep is given with the movement completes.

Set Meridian Offset on Connect

The current Meridian Offset is sent to the mount after a Connect. See section 6.

GTOCP3 with Rev. S and later only or GTOCP4.

Start Mount Tracking on Connect

The Sidereal tracking command :RT2# is sent to the mount after a Connect.

*Will turn off **Stop Mount Tracking on Connect** if set.*

Stop Mount Tracking On

Stop tracking command :RT9# is sent to the mount for the following:

Connect When connecting to the mount.

*Will turn off **Start Mount Tracking on Connect** if set.*

Park Mount is parked, see section 3.

Alt/Az Slew After slewing to an Alt/Az coordinate. See section 13.

Set Save Logs Folder

Sets the command logs save on exit folder. Brings up the folder browser dialog to select the folder. Text box to right will be updated when set.

Default

Sets the command logs save on exit folder to the default of MyDocuments.

Speak rate

Set speak rate for voice messages. Speak rate from 2 to -5. Higher numbers will speak faster. Default is -2.

Test speak rate

Will speak a test message at the selected rate.

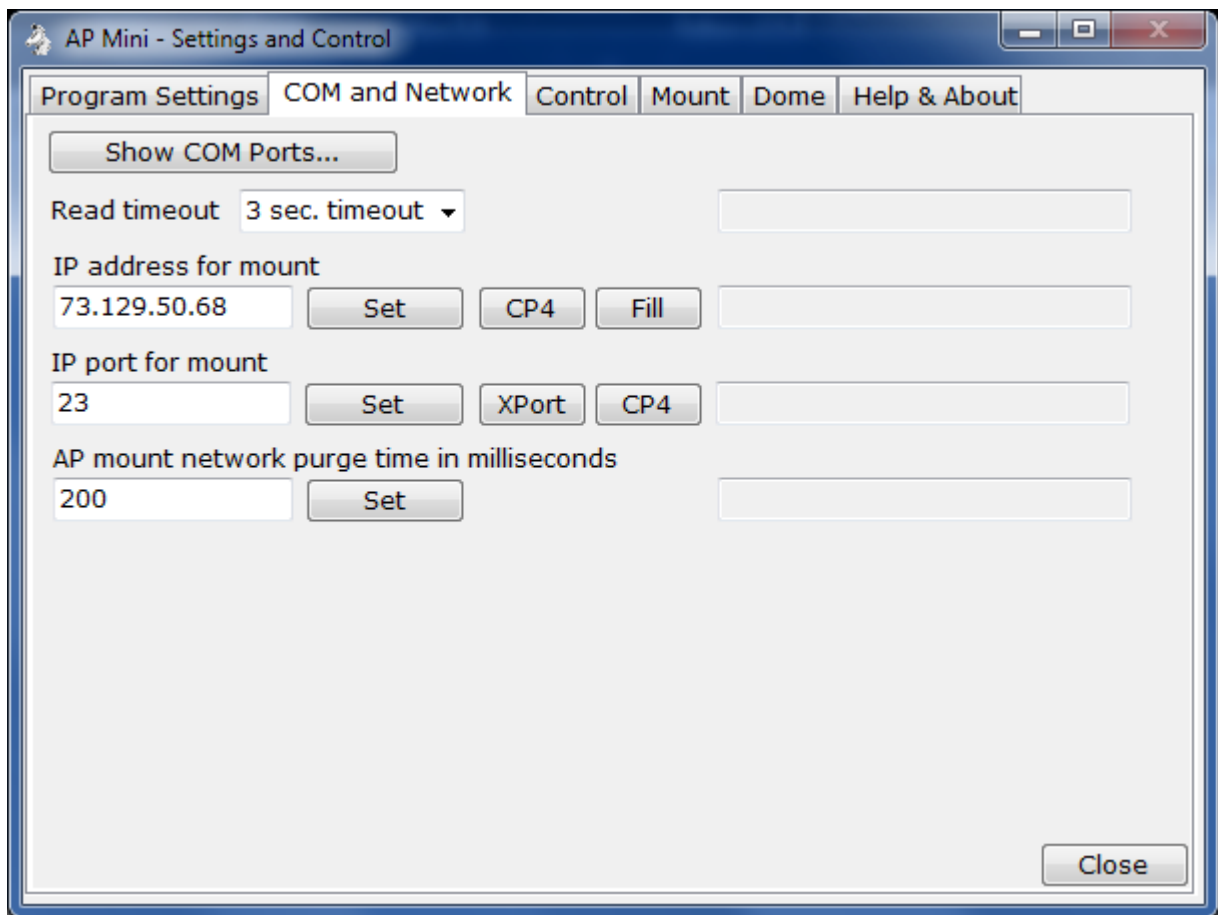
Save settings

Saves program settings to config file used during program startup.

Close

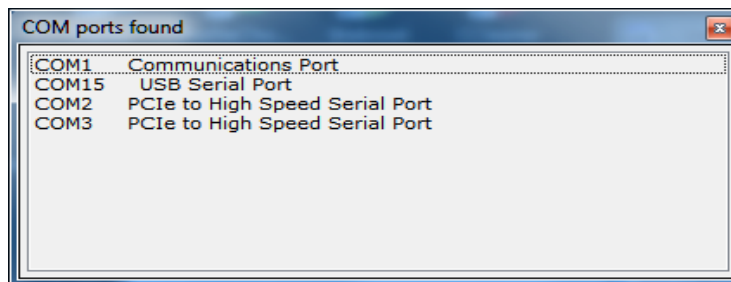
Close window.

4.2. COM and Network – Tab



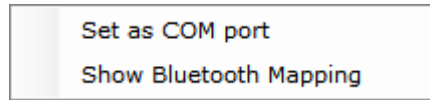
Show COM Ports...

Shows window listing all COM serial ports found on the computer.



Double click on an entry to make it the current COM port. If already connected you must disconnect and then connect to open the newly selected COM port.

Right click on an entry to display the context menu.



Set as Com Port – Sets entry as the current COM port, same as double click.

Show Bluetooth Mapping – Displays the file AP Mini Bluetooth Serial Devices.txt located in the My Documents folder using Notepad. This file optional and must be created for each computer. Its purpose is to document specific Bluetooth configurations as a reference only.

Read timeout

Timeout values for reads from mount. 1 to 10 seconds, default is 3 seconds.

IP address for mount

TCP IP address in the text box below to use when **Network XPort** is selected as the COM port for the connection to the AP mount. Use ip address 127.0.0.1 to connect to the software network emulator for the AP mount, a separate program from Milton Hill Observatory.

Set

Sets the IP address provided.

CP4

Queries a CP4 controller for it's Ethernet I/P address. *Must be connected via a serial port for this to work. Once the query is done use the **Fill** button to fill in the text box.*

Fill

Fills the **IP address for mount** with the ip address obtained from the **CP4** query button.

IP port for mount

TCP IP port in the text box below to use when **Network XPort** is selected as the COM port for the connection to the AP mount. Use ip address 7777 to connect to the software network emulator for the AP mount, a separate program. The default is port 7777.

Set

Sets the IP port provided.

XPort

Fills the IP port text box to 7777.

CP4

Fills the IP port text box to 23.

Note: The XPort Ethernet device must be used to communicate with the mount via an Ethernet network unless using the CP4's Ethernet or wifi ports.

AP mount network purge time in milliseconds

When connecting to the AP mount using a Network XPort device the mount's power up data is not purged. This means when AP-Mini connects and requests the firmware version power up data is also

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received by the program. This value is the TCP/IP read timeout in milliseconds to read and purge this data so the get version command will not see it. Data received is displayed in the command log.

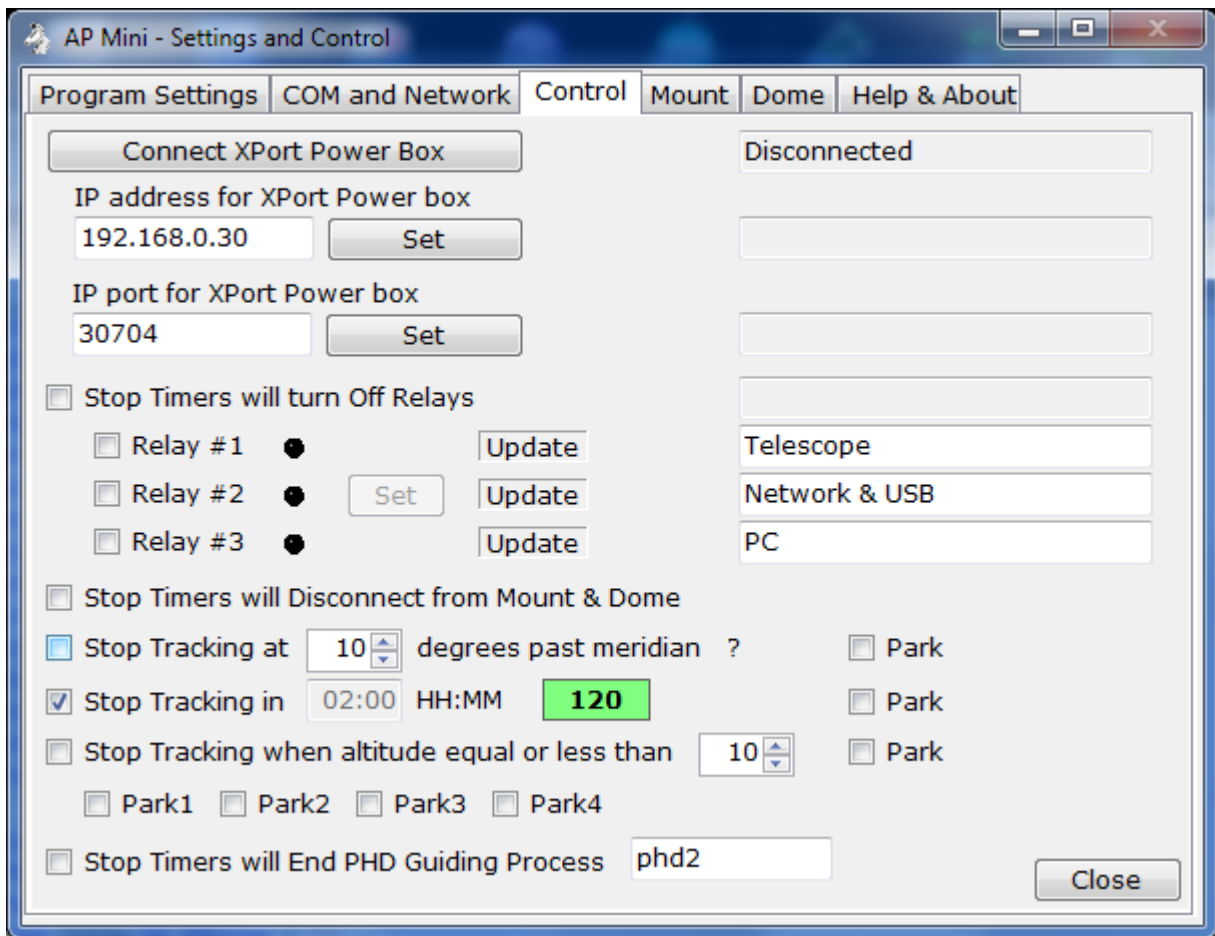
Set

Sets the IP purge time.

Close

Close window.

4.3. Control – Tab



Connect XPort Power Box

Connect or disconnect to the XPort network power relay box using the IP address provided. This is a custom unit that can control 120v AC power relays and also is the network control box for the AP mount.

When Connected the three relays states will be shown.

IP address for XPort Power Box

TCP IP address of the XPort network power box. *This can be the same as the XPort TCP IP to serial port of the mount address. Different ports are used for the two connections.*

Set

Sets the IP address.

IP port for XPort Power Box

TCP IP port of the XPort network power box. Default is 30704.

Set

Sets the IP port.

Stop Timers will turn off Relays

The Stop Tracking timers will also cause the indicated relays of the XPort Power Box to be turned Off.

Relay #1 Each relay has 3 color indicators with it.

Relay #2 Black = unknown (program is not connected to XPort Power Box)

Relay #3 Green = On, Red = Off

Set

Used to set relays On or Off.

The three relays can be named with the text box to the right of the relay check box.

Update must be clicked on to change the name. These names are only used to identify what each relay is connected to.

Stop Timers will Disconnect from Mount & Dome

When a past meridian or duration stop tracking timer expires the dome and mount will be disconnected after stopping the mount and optionally parking the telescope.

If **Stop Timers will turn off Relays** is checked and the Power Relay Box is connected the Power Relay Box will be disconnected.

If any Park options are set the program will wait for the mount to stop moving before disconnecting.

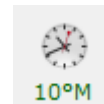
A **Stop Park** button is displayed to allow this to be aborted.

Stop Tracking at nn degrees past meridian

Telescope is on the **West** side of the mount. Tracking will be stopped when the mount tracks past the meridian by the **number of degrees indicated to the left of the check box**. Valid values are **0 to 30**. Each degree is equal to 4 minutes of tracking at sidereal rate.

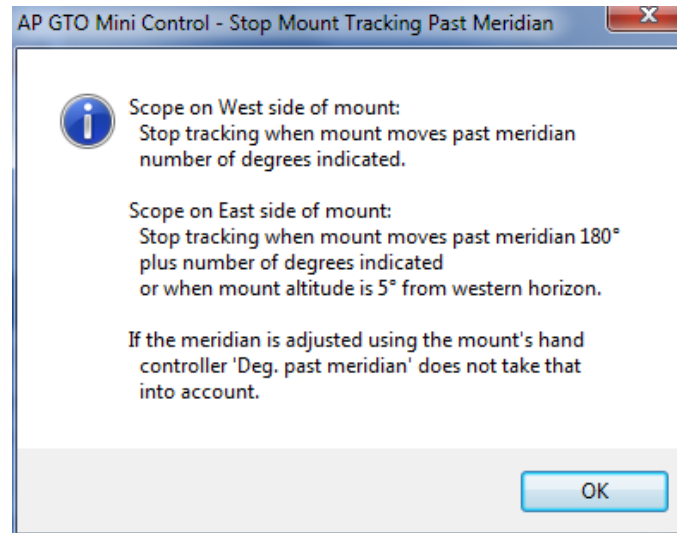
Telescope is on the East side of the mount. Tracking will be stopped when the mount tracks 180° plus the number of degrees indicated or when the mount's altitude is 5° from the horizon.

Clock picture with number of degrees past meridian to stop is displayed on main window.



Note: If the meridian is adjusted using the mount's hand controller you must take it into account when using this function.

- ? Display information window about Stop Mount Tracking Past Meridian.



Park

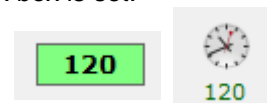
If Park1, Park2, Park3 or Park4 is also checked the mount will park to the checked park position after tracking is stopped.

Stop Tracking in nn:nn HH:MM

Mount tracking will stop in set hours and minutes from when this check box is set.

Count down timer in minutes is displayed on this form and on the main form.

Clock picture with time in minutes to stop is displayed on main window.



Park

If Park1, Park2, Park3 or Park4 is also checked the mount will park to the checked park position after tracking is stopped.

Stop Tracking when altitude equal or less than nn degrees

Mount tracking will stop when mount's altitude is equal or less than specified number of degrees.

Clock picture with number of degrees past meridian to stop is displayed on main window.



Park

If Park1, Park2, Park3 or Park4 is also checked the mount will park to the checked park position after tracking is stopped.

Park1 Park2 Park3 Park4

Mount park position to slew to when Park is check for stop tracking timers.

Stop Timers will End PHD Guiding Process

When checked the duration and meridian timers will end the PHD Guiding process on the PC.

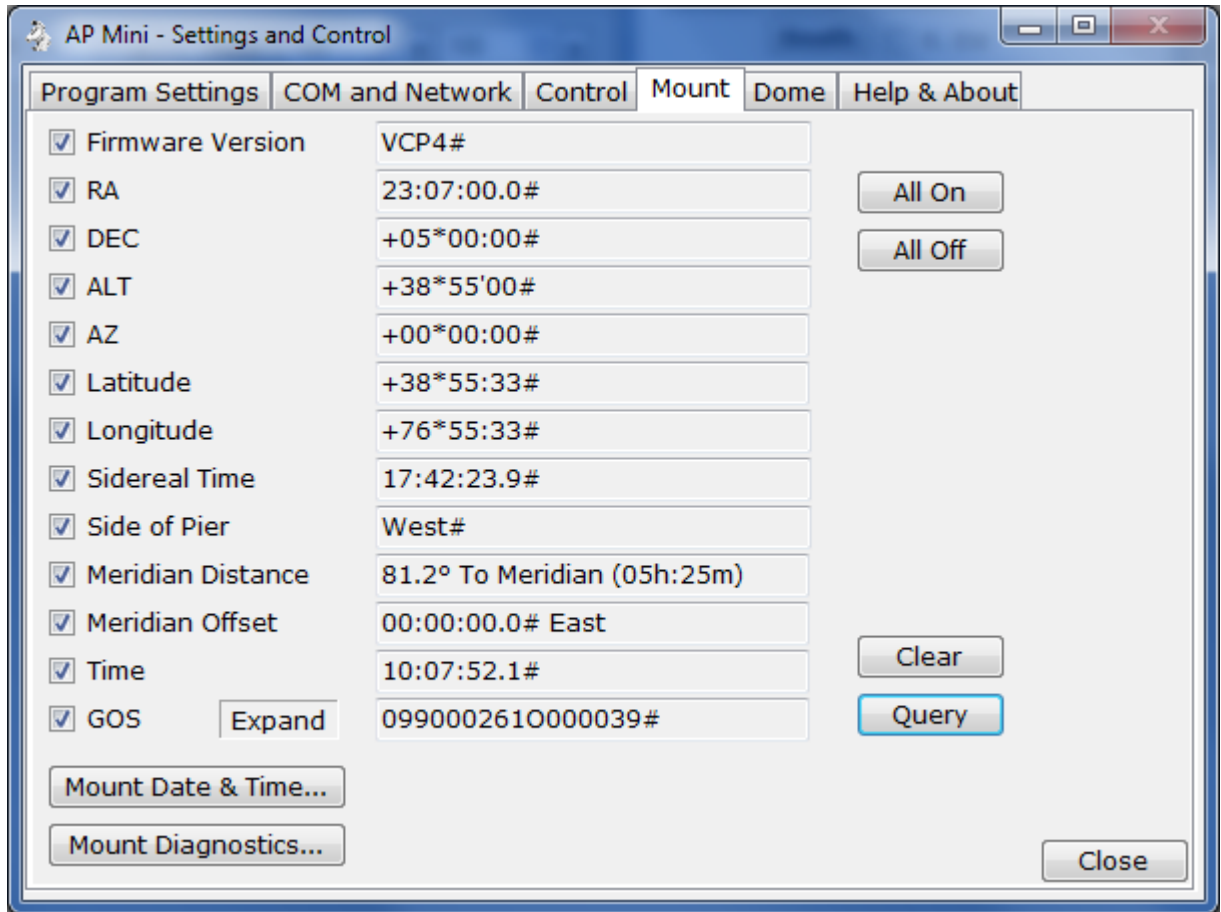
Process name – text box.

Name of PHD Guiding process, default is 'phd2'.

Close

Close window.

4.4. Mount Data – Tab



Issues commands to mount to get specific information from the mount.

All On

Checks all items.

All Off

Unchecks all items.

Clear

Clear all query results.

Query

Get all checked items from the mount.

Firmware Version

Gets the mount's GTO Servo Controller version.

Sends :V#

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The program looks at the returned version and tries to determine the model of the controller, GTOCP1, GTOCP2, GTOCP3 or GTOCP4.

RA

Gets current RA from the mount. Sends :GR#

DEC

Get the current DEC from the mount. Sends :GD#

ALT

Gets the current ALT from the mount. Sends :GA#

AZ

Gets the current AZ from the mount. Sends :GZ#

Latitude

Gets the site latitude from the mount. Sends :Gt#

Longitude

Gets the site longitude from the mount. Sends :Gg#

Sidereal Time

Gets the sidereal time from the mount. Send :Gt#

Side of Pier

Show what side of the mount the telescope is on. Sends :pS#

Meridian Distance

Shows the mount's distance to or past the meridian.

Meridian Offset

Show mount logical meridian offset. Negative is West, positive is East. *GTOCP3 Rev. S and later or a GTOCP4 only supports this function.* Does not show Hand Controller Meridian Delay.

Time

Get the local time from the mount. Sends :GL#

GOS

Get Operating Status from mount. Sends :GOS#

Expand

Brings up form expanding result of command. See section 4.5

Time and Date...

Open the Time and Date window. Setting the time and date are only in effect until the mount is powered off. To make a permanent change you must use the Hand Controller. See section 16.

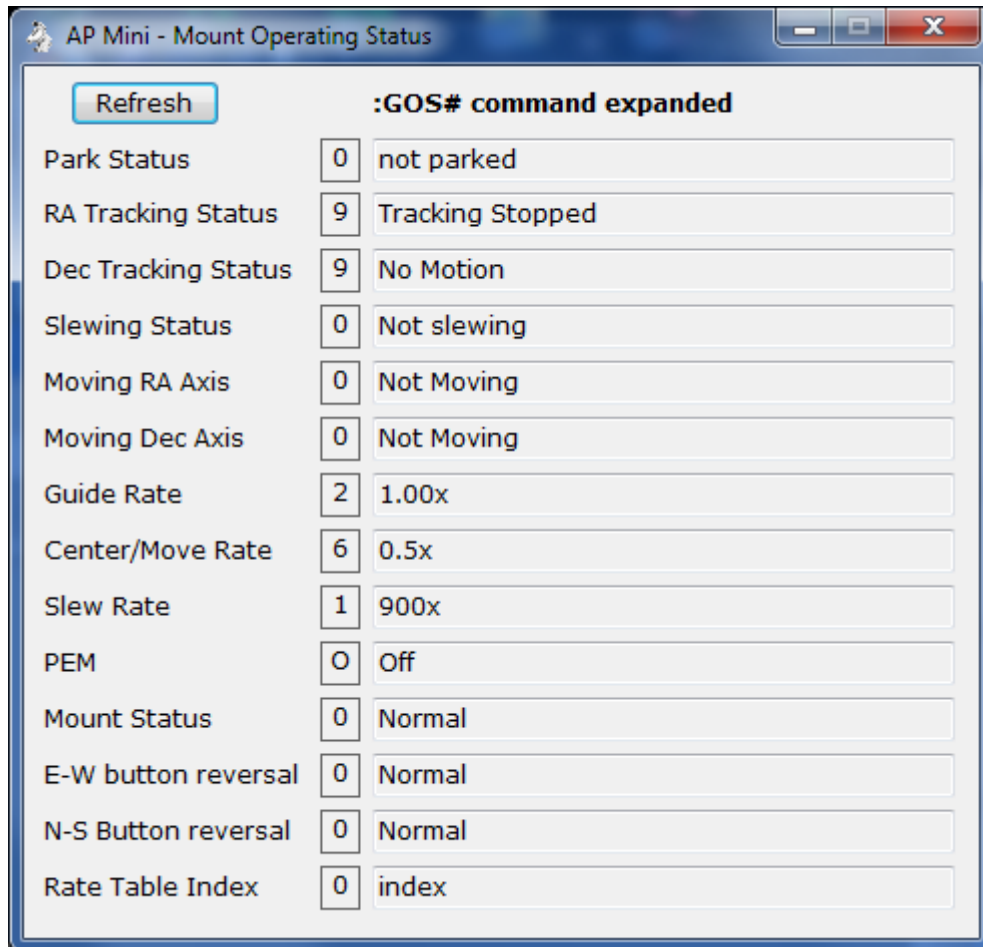
Mount diagnostics...

Open the Mount Diagnostic window. Runs either the RA or DEC servo motors for x number of milliseconds with or without any delay. The motor is run in one direction then the other. This can be used to adjust an axis worm if needed. See section 17.

Close

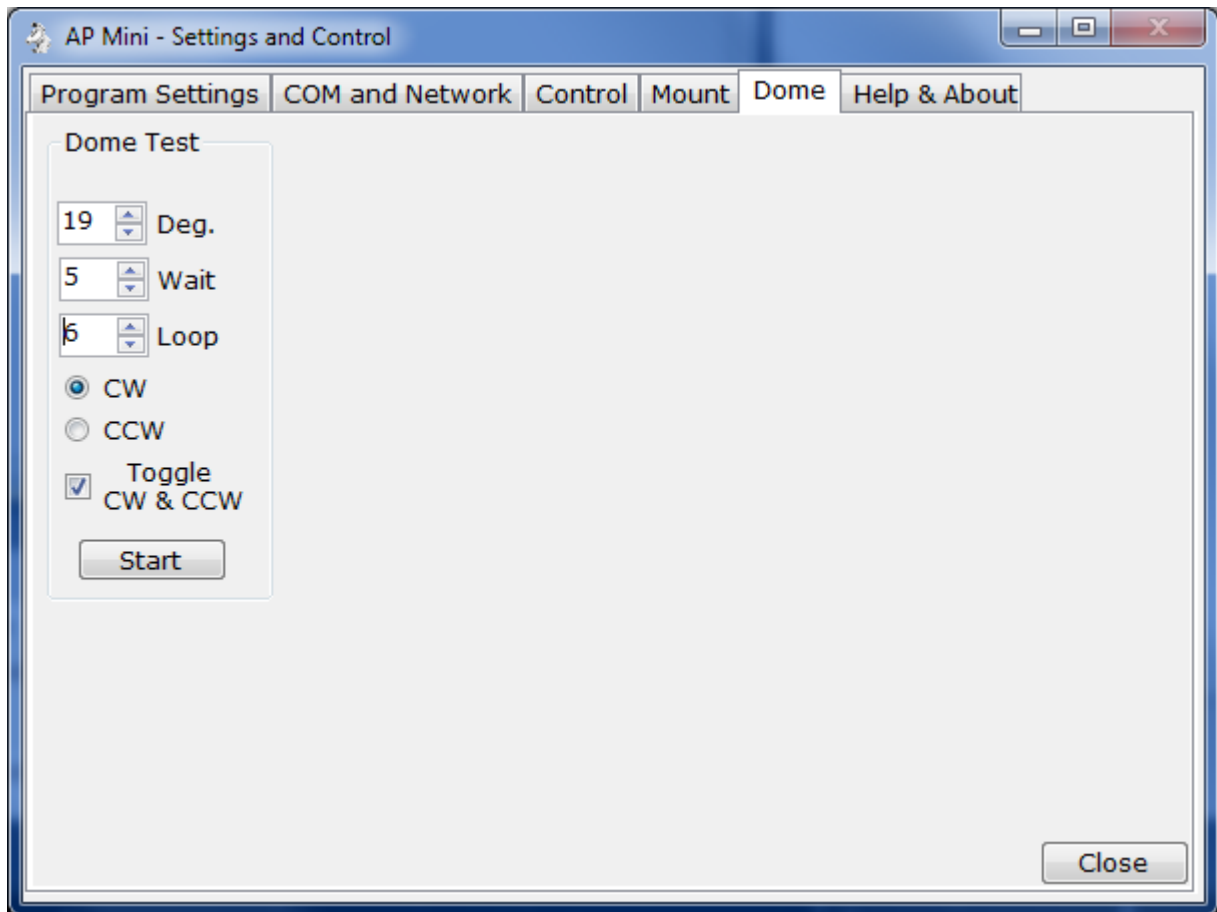
Close window.

4.5. Mount Operating Status



Expands the result of the :GOS# command.

4.6. Dome – Tab



Dome Testing.

Deg. Degrees to move dome.

Wait Seconds to wait after a move.

Loop Number of times to run test.

CW Move dome clockwise.

CCW Move dome counter clockwise.

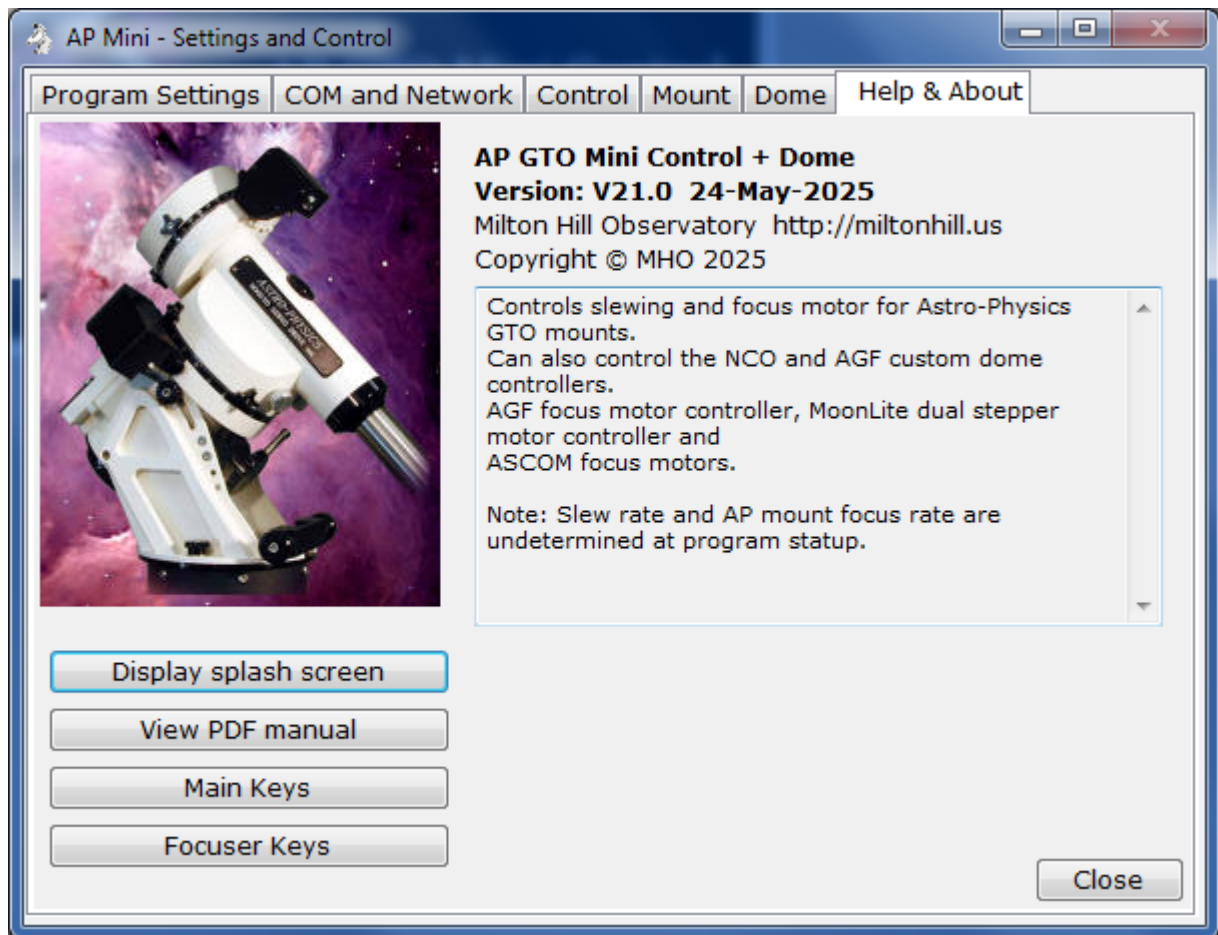
Toggle CW & CCW The dome will alternate between moving clockwise and counter clockwise between loops when checked.

Start Begin test. Will change to **Stop** while test is running.

Close

Close window.

4.7. Help & About – Tab



Information about AP Mini control program.

Display splash screen

Show window with data about the software, see section 2.1.

Main Keys

Displays keyboard keys for the main window.

Focuser Keys

Displays keyboard keys for focuser control windows.

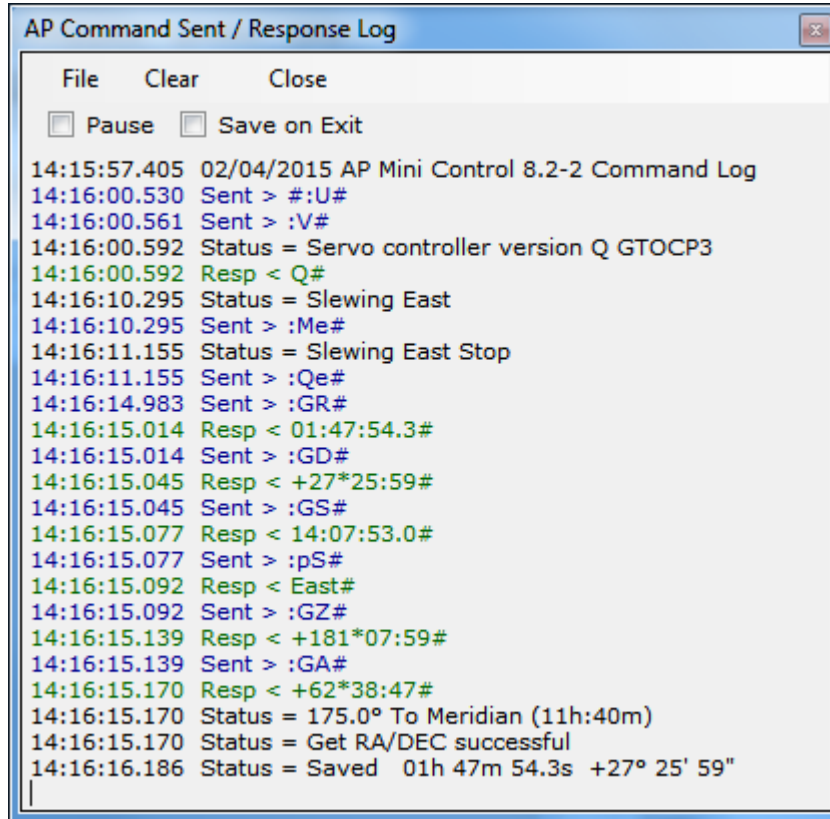
View PDF manual

Displays the PDF user manual for AP Mini using your default PDF viewing program.

Close

Close window.

5. Command Log – Window



Shows status messages, error messages, commands sent and responses from the AP telescope mount.

All entries are time stamped and color coded.

- Black = Status and informational messages.
- Dark Red = Error messages.
- Blue = Commands sent to the AP mount.
- Green = Responses received from the AP mount.
- DarkViolet = Commands received from COM port2.
- DarkMagenta = Responses sent to COM port2.

Pause – Check box

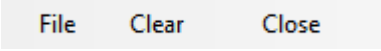
When **checked** logging is suspended.

Save on Exit – Check box

When **checked** the log is saved to the **My Documents** or the folder set using **Settings and Control, Program Settings**. Filename is generated as:

AP-Mini_Command_Log yyyy-mm-dd_time.rtf where yyyy = year, mm = month, dd = day, time = hours minutes seconds. Example: AP-Mini_Command_Log 2015-02-04_135125.rtf

The file is saved in Rich Text Format.



File Clear Close

Clear – Menu button

Clears all log entries and starts a new log. The log is not saved.

Close – Menu button

Closes the log window.

5.1. File – Menu bar

Log entries functions

Save – Button

Opens a file save dialog box to allow you to save the log to a file.

Copy RTF – Button

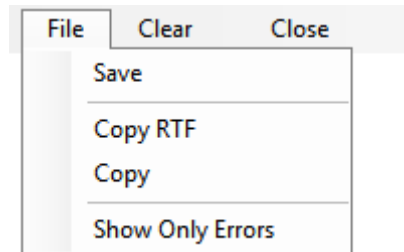
Copies all log entries to the **clipboard** in RTF (Rich Text Format).

Copy – Button

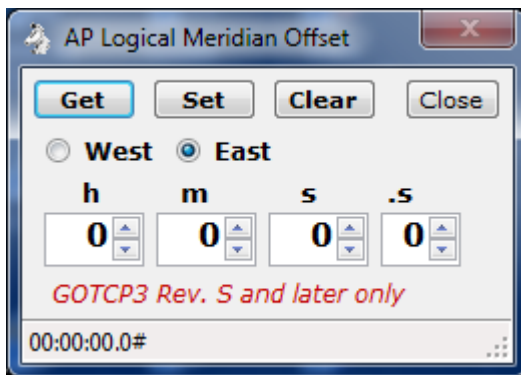
Copies all log entries to the **clipboard** in plain text format.

Show Only Errors – Button toggle

When checked will only show error entries in the log.



6. Meridian Offset - Window



Note: Supported by GOTCP3 controller Rev. S and later only or a GOTCP4 controller. Use *Hand Controller* to set meridian delay for other controllers.

Used to set a Logical Meridian Offset to the mount. When using this method to change the meridian reporting of altitude and azimuth is not changed so no Meridian Delay is required with Dome Control.

Setting of Meridian Offset is not saved between power cycles of the mount.

The settings of this control are saved between program starts and applied to the mount.

Get – Button

Gets the current meridian offset from the mount and fills the controls with it.

Set – Button

Sets the mount meridian offset to the values given.

Clear – Button

Sets the mount meridian offset to none.

East – Radio Button

Meridian offset is East.

West – Radio Button

Meridian offset is West.

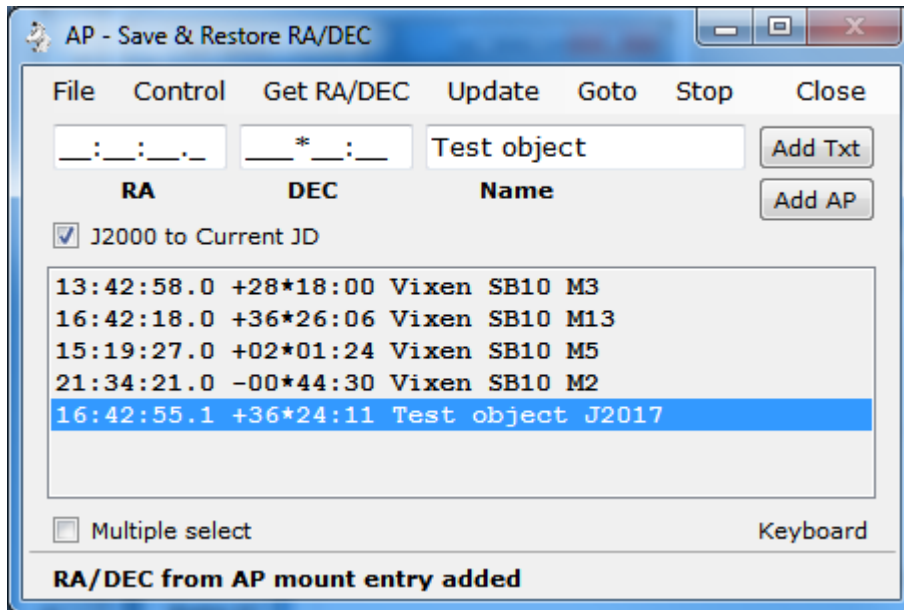
h m s .s – Numeric Up Down

Meridian offset values in hours, minutes, seconds and tenths second. East West buttons determine the direction of the meridian offset.

Status – Status bar

Displays status messages. Right click to clear.

7. Save & Restore RA/DEC - Window



RA & DEC can be Named and saved to an .oap file.. The RA & DEC can be obtained from the mount or entered in the RA, DEC & Name text boxes.

RA – Text box

RA to add to the list format is HH:MM:SS.S the text box is formatted so you just enter the numbers.

DEC – Text box

DEC to add to the list format is +-DDD*MM:SS the text box is formatted so you just enter the sign and numbers.

Name – Text box

Any name you want to associate with the RA DEC entry.

Add Txt – Button

Add a new entry to the list using the RA, DEC & Name text boxes.

Add AP – Button

Add a new entry to the list using the mount's current RA & DEC and the Name text box. Will query the mount for its RA & DEC.

RA DEC Name – List box

List of RA, DEC & Name entries added using the Add Txt and Add AP buttons for read from an .oap file.

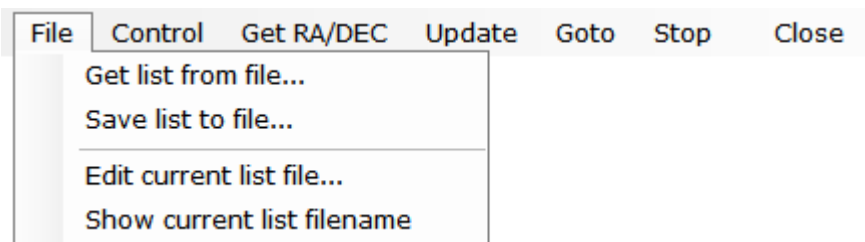
Multiple select – Check box

When checked will allow multiple list box entries to be selected. This would be used to manage the list.

Status – Label

Displays status messages.

7.1. File – Menu



Save & Restore RA/DEC entries functions

Get list from file... – Button

Opens a file open dialog box to allow you to read a Save & Restore RA/DEC file.

Save list to file... – Button

Opens a file save dialog box to allow you to save the current RA, DEC, Name list to a file.

Edit current list file... – Button

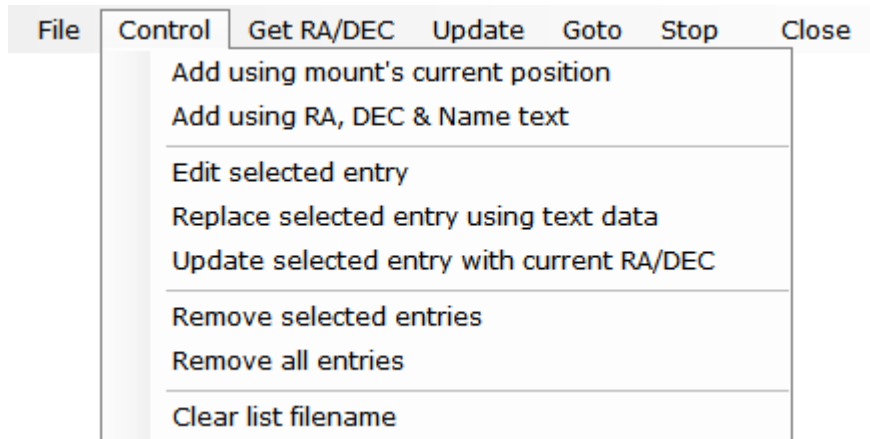
Opens Notepad to edit the current RA, DEC, Name list file.

Show current list filename – Button

Displays the currently opened RA, DEC, Name list file on the status line.

Note: RA, DEC, Name list files have the file type of .oap

7.2. Control – Menu



Controls entries in the Save & Restore RA/DEC list box.

Add using mount's current position – Button

Add an entry to the list using the mount's **RA & DEC** with then Name provided in the **Name** text box. Sends :GR# and :GD# commands to the mount.

Add using RA, DEC & Name text – Button

Add an entry to the list using the RA, DEC and Name text boxes.

Edit selected entry – Button

RA, DEC & Name text boxes are updated with the currently selected list entry.

Replace selected entry using text data – Button

Currently selected list entry is updated with the values in the RA, DEC & Name text boxes.

Update selected entry with current RA/DEC – Button

Currently selected list entry's RA & DEC are updated using the mount's current position. The name of the entry is not changed. A get RA/DEC is issued to the mount.

*Performs same function as Menu bar **Update** button.*

Remove selected entries – Button

Selected list entries are removed from the list.

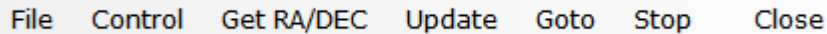
Remove all entries – Button

All list entries are removed. List is cleared.

Clear list filename – Button

The saved RA/DEC filename is removed.

7.3. Menu Bar – Buttons



File Control Get RA/DEC Update Goto Stop Close

Buttons located on the menu bar.

Get RA/DEC – Button

Gets the mount's current RA & DEC and sets the RA & DEC text boxes.

Update – Button

Currently selected list entry's RA & DEC are updated using the mount's current position. The name of the entry is not changed. A get RA/DEC is issued to the mount.

Goto – Button

Slews the mount to the selected RA, DEC & Name list entry.

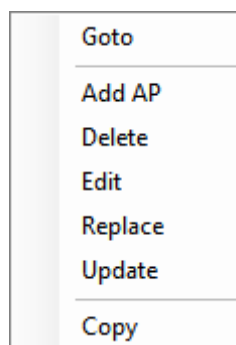
Stop – Button

Send a stop slew command to the mount.

Close – Button

Closes the window.

7.4. Context Menu – Popup



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Menu is displayed when the Right Mouse Button is held down over a RA, DEC & Name entry.

Goto – Button

Slews the mount to the selected RA, DEC & Name list entry.

Add AP – Button

Add a new entry to the list using the mount's current RA & DEC and the Name text boxes. Will query the mount for its RA & DEC.

Delete – Button

Selected list entry is removed from the list.

Edit – Button

RA, DEC & Name text boxes are updated with the currently selected list entry.

Replace – Button

Currently selected list entry is replaced with data in the RA, DEC & Name text boxes.

Update – Button

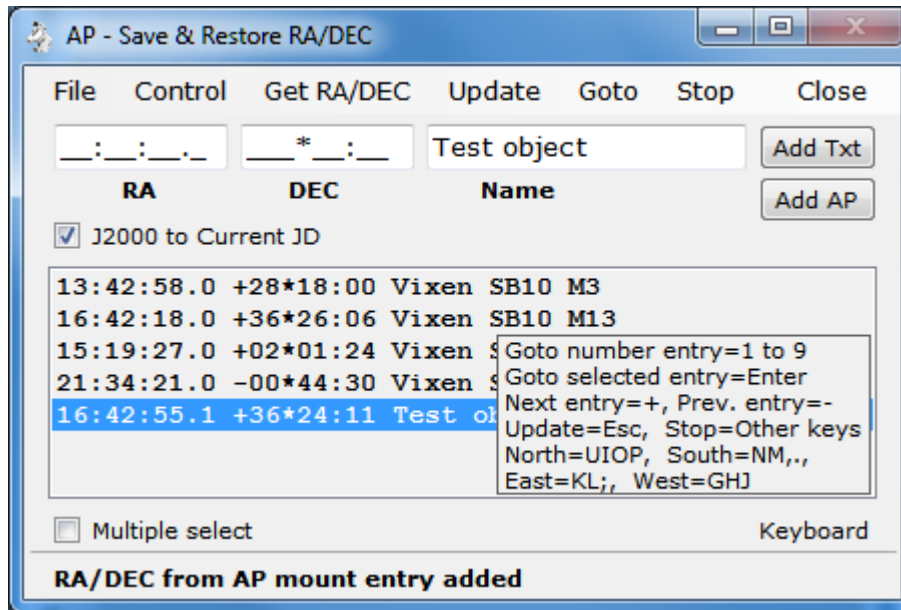
Currently selected list entry's RA & DEC are updated using the mount's current position. The name of the entry is not changed. A get RA/DEC is issued to the mount.

Copy – Button

Copies the selected entry to the clipboard.

7.5. Keyboard Control

Three functions of the currently selected list entry can be controlled by keys on the keyboard. Click on 'Keyboard' to display keyboard help.



1 to 9 – Key = Select list entry by position number then Menu Bar Button > **Goto**

The list entry corresponding to the number key 1 to 9 is selected then a slew to that entry's RA/DEC is issued to the mount. This will only work for the first 9 entries.

Enter – Key = Menu Bar Button > **Goto**

Slews the mount to the selected RA, DEC & Name list entry.

+ (Plus) Key = Select next item in list, will wrap if at end.

- (Minus) Key = Select previous item in list, will wrap if at beginning.

Esc – Key = Menu Bar Button > **Update**

Currently selected list entry's RA & DEC are updated using the mount's current position. The name of the entry is not changed. A get RA/DEC is issued to the mount.

U, I, O, P – Keys Held Down = North move

Sends a command to move the mount North. Mount moves at the current move rate until the key is released.

N, M, (comma), (period) – Keys Held Down = South move

Sends a command to move the mount South. Mount moves at the current move rate until the key is released.

K, L, (semicolon) – Keys Held Down = East move

Sends a command to move the mount East. Mount moves at the current move rate until the key is released.

G H J – Keys Held Down = West move

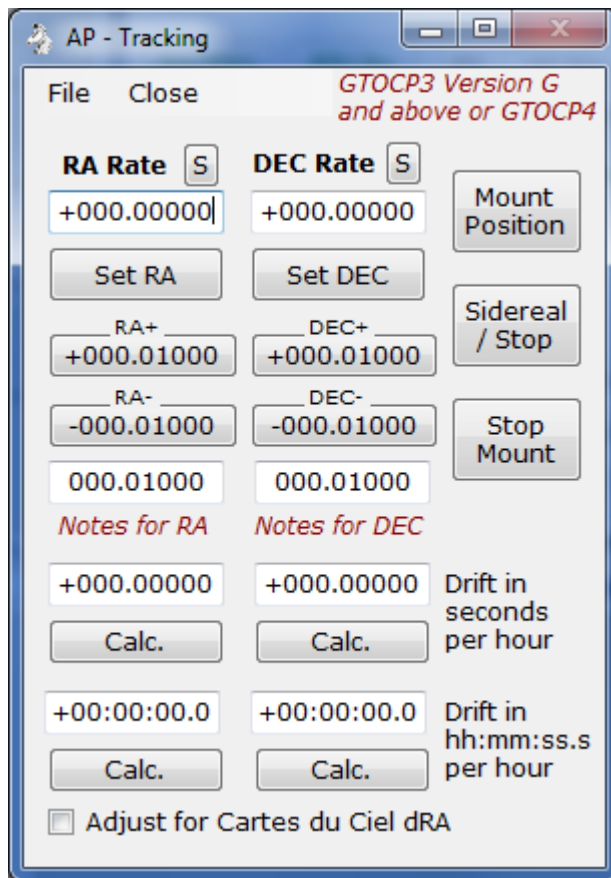
Sends a command to move the mount West. Mount moves at the current move rate until the key is released.

Space bar and all other – Keys = Menu Bar Button > Stop

Send a stop slew command to the mount.

The Arrow keys, Home, End, etc. keys work in the standard way to navigate in the list box.

8. Tracking - Window



Set custom tracking rates for the RA and DEC axis of them mount.

Note: Must be using a GTOCP3 or GTOCP4 Servo Motor Controller

RA Rate – Text box

Custom RA rate as +- times sidereal rate.

S – Button

Sets the RA Rate text box to zero.

Set RA – Button

Sends :RRsn.nnnnn# command to the mount. Where rate is the value in the RA Rate text box.

RA+ +nnn.nnnnn – Button (shows value of RA adjust text box)

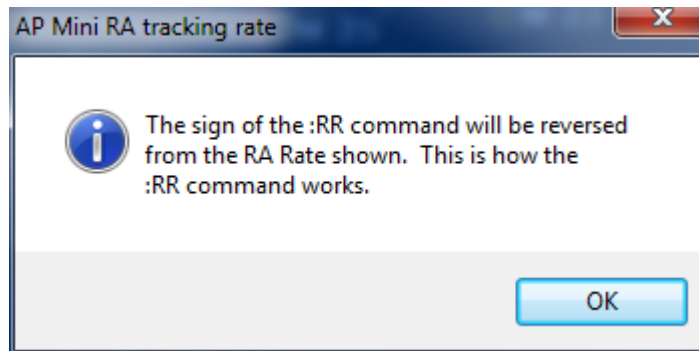
Will increment the RA Rate text box by the value in the RA adjust text box.

RA- -nnn.nnnnn – Button (shows value of RA adjust text box)

Will decrement the RA Rate text box by the value in the RA adjust text box.

Notes for RA – Label

Click to show message box with more information about the RA rate settings.



RA adjust – Text box

Value used with the increment and decrement RA button.

RA drift – Text box

Value of RA drift rate in seconds per hour.

Calc. – Button

Calculates the value for RA Rate using the **RA drift** text box above the button and fills in the RA Rate text box. *No commands are sent to the mount. Use the **Set RA** button to set the mounts tracking.*

RA drift h:m:s.s – Text box

Value of RA drift in hours : minutes : seconds per hour.

*This value for an object such as a Comet or the Moon can be obtained from program Cartes du Ciel (Skychart) by a right mouse click on object and selecting the About menu button. A popup box is then displayed showing this value among others. Input the **dRA** value.*

Note: Make sure the Adjust for Cartes du Ciel dRA check box is checked before clicking the Calc. button.

Calc. – Button

Calculates the value for RA Rate using the **RA drift h:m:s.s** text box above the button and fills in the RA Rate text box. *No commands are sent to the mount. Use the **Set RA** button to set the mounts tracking.*

Adjust for Cartes du Ciel dRA – Check box

Check when using **dRA** value from Cartes du Ciel (Skychart) in the **RA drift h:m:s.s** text box.
The calculated RA drift value is the RA drift h:m:s.s value times 15.

DEC Rate – Text box

Custom DEC rate as +- times sidereal rate.

S – Button

Sets the DEC Rate text box to zero.

Set DEC – Button

Sends :RDSn.nnnnn# command to the mount. Where rate is the value in the DEC Rate text box.

DEC + +nnn.nnnnn – Button (shows value of DEC adjust text box)

Will increment the DEC Rate text box by the value in the DEC adjust text box.

DEC- -nnn.nnnnn – Button (shows value of DEC adjust text box)

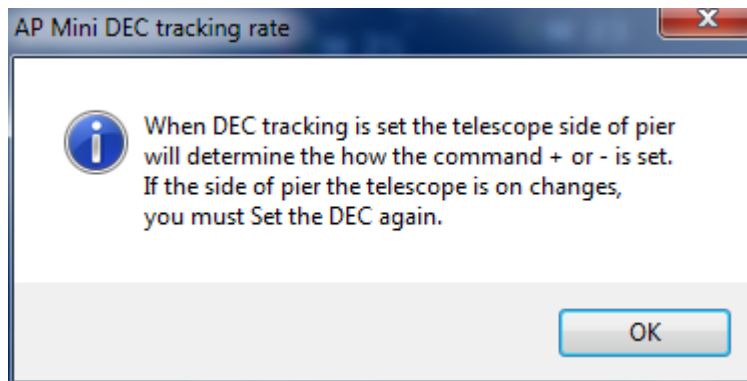
Will decrement the DEC Rate text box by the value in the DEC adjust text box.

DEC adjust – Text box

Value used with the increment and decrement DEC button.

Notes for DEC – Label

Click to show message box with more information about the DEC rate settings.



DEC drift – Text box

Value DEC drift rate in seconds per hour.

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*This value for an object such as a Comet or the Moon can be obtained from program Cartes du Ciel (Skychart) by a right mouse click on object and selecting the About menu button. A popup box is then displayed showing this value among others. Input the **dDec** value.*

Calc. – Button

Calculates the value for DEC Rate using the **DEC drift** text box above the button and fills in the DEC Rate text box. *No commands are sent to the mount. Use the **Set DEC** button to set the mounts tracking.*

DEC drift h:m:s.s – Text box

Value of DEC drift in hours : minutes : seconds per hour.

*This value for an object such as a Comet or the Moon can be obtained from program Cartes du Ciel (Skychart) by a right mouse click on object and selecting the About menu button. A popup box is then displayed showing this value among others. Input the **dDec** value.*

Calc. – Button

Calculates the value for RA Rate using the **DEC drift h:m:s.s** text box above the button and fills in the RA Rate text box. *No commands are sent to the mount. Use the **Set DEC** button to set the mounts tracking.*

Mount Position – Button

Updates the Scope & Dome Position window with the mount's current position. Opens the windows if not already open. See section 9.

Sidereal / Stop – Button

Sets the mount's RA axis to sidereal rate and stops the DEC axis from tracking. Sends commands :RR+0.00000# , :RD+0.00000# , :RT2# to the mount.

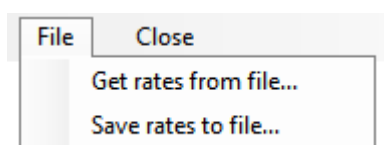
Stop Mount – Button

Sets the mount to stop tracking. Sends commands :RR+0.00000# , :RD+0.00000# , :RT9# to the mount.

Close – Button

Closes the GTOCP3 Tracking window.

8.1. File – Menu



Read and save custom tracking rates to a file.

Note: Custom tracking rate files have the file type of .tr3

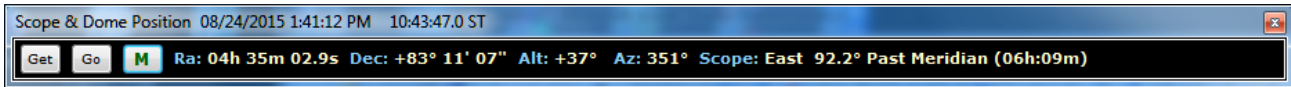
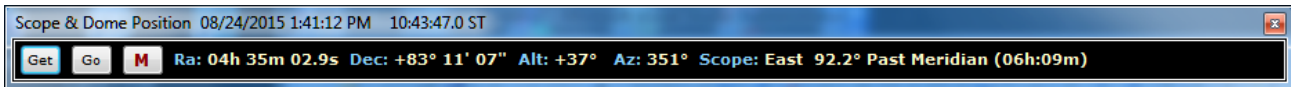
Get rates from file... – Button

Opens a file open dialog box to read a custom rates file.

Save rates to file... – Button

Opens a file save dialog box to save the current custom rates to a file.

9. Scope & Dome Position – Window



Shows the mount and dome position in a window. The **M** button color show the current monitoring state.

Note: If dome tracking is enabled the window is updated automatically after querying the mount and dome controller.

Get – Button

Queries the mount and dome controller, if connected, and updates the window.

Go – Button

Opens the **RA/DEC window** to allow a goto RA/DEC to be done. See section 12.

M - Button

Toggles monitor mode. Tooltip will tell you what mode will be set when clicked.

M is green the mount is queried every 3 seconds and the window updated. Queries are disabled if dome tracking is enabled or the mount is disconnected from the program.

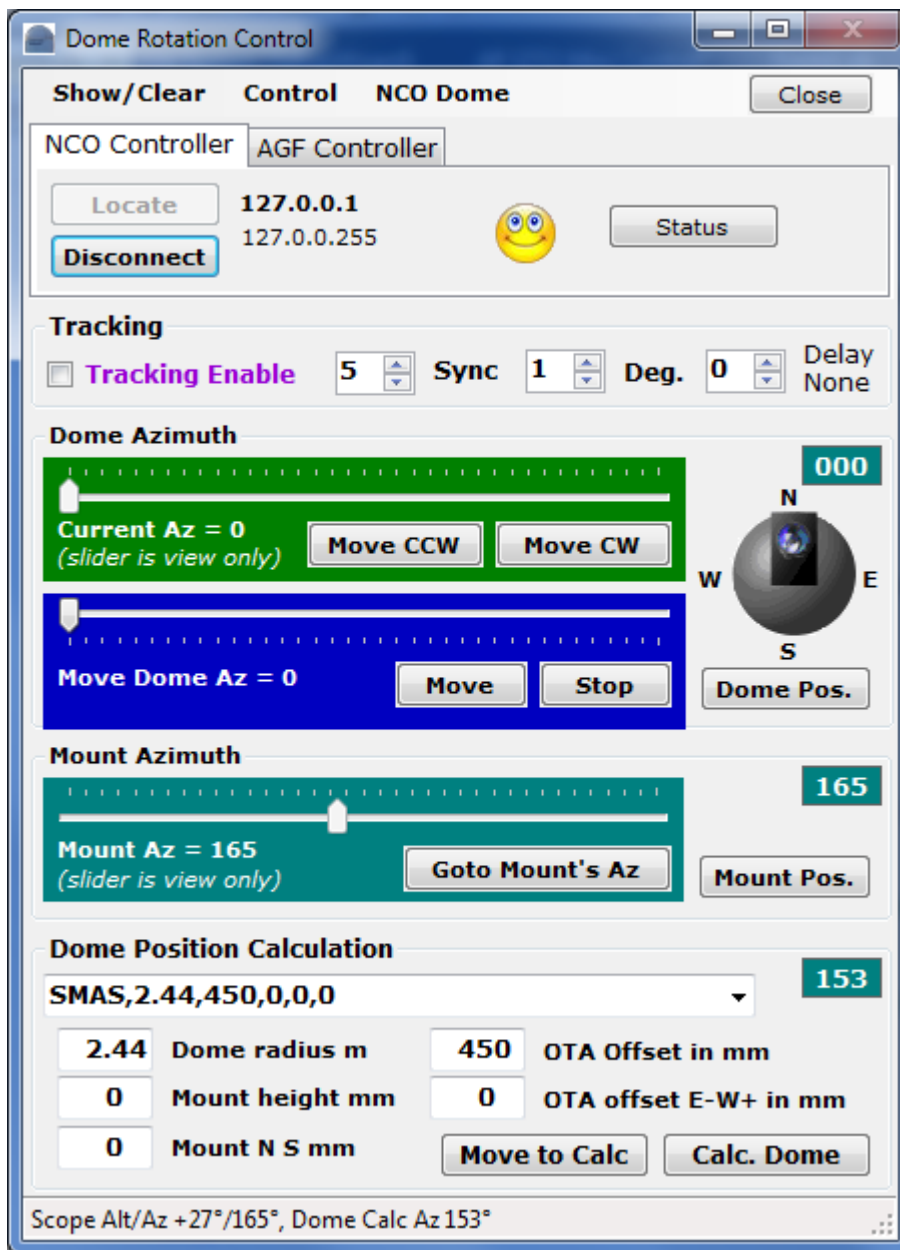
M is red no mount queries are being done. Press Get button to update the window.

The following data are shown:

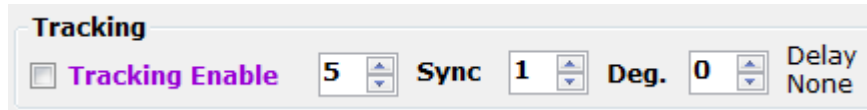
- Ra: – RA from mount.
- Dec: - DEC from mount.
- Alt: - Altitude degrees from mount.
- Az: - Azimuth degrees from mount.
- Scope: - Side of pier telescope is on and distance to/from meridian information.
- Dome: Azimuth of dome. *Only shown if dome controller is connected and tracking is enabled.*
- Moved: Direction mount has moved since last update. *Only shown if mount has moved to different RA/DEC and dome tracking is disabled.*

10. Dome Control Window

Controls observatory domes using the NCO dome controller microprocessor or AGF dome controller. The NCO Controller is currently in use at the Nanjemoy Creek Observatory and controls the 16 foot ASH Dome. The AGF Controller is in use at the Milton Hill Observatory.



10.1. Tracking Enable



Tracking Enable – Check box

When **checked** will start automatic dome tracking of the mount's azimuth using the **Calc. Az** position.

Sync – Number

Seconds between queries of mount and dome controller to determine if dome needs to be moved. Range is 1 to 10.

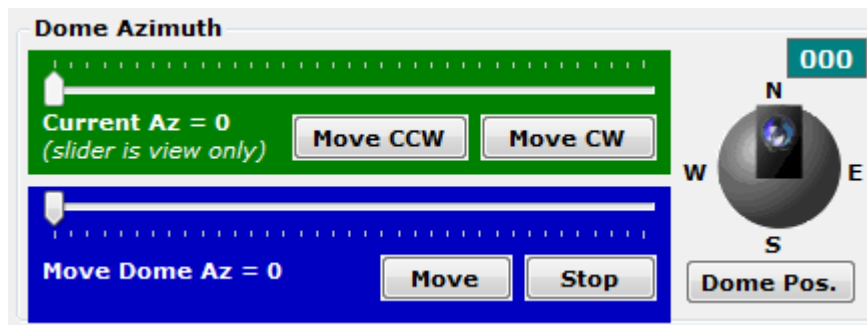
Deg. – Number

Number of degrees mount must move before the dome is moved to match the mounts azimuth. Range is 1 to 10.

Delay – Number

Hours East or West the meridian is delayed set using the Astro-Physics Hand Controller. Dome tracking will be off if this does not match the Hand Controller. Text to left of number will indicate the amount and direction of the meridian delay. Range is -6 East to +6 West.

10.2. Dome Azimuth – Controls



Manual movement of the observatory dome.

movement of the

Dome Azimuth – Slider bar (read only)

Shows current dome azimuth.

Move CCW – Button

Click and hold to move dome Counter Clock Wise.

Move CW – Button

Click and hold to move dome Clock Wise.

Move Dome Az – Slider bar

Used to set the dome to any azimuth. Must click **Move to Az** to send command to the dome controller.

Move to Az – Button

Sends command to move dome to position set by **Move Dome Az** slider bar.

Stop – Button

Sends command to stop dome movement.

Dome graphic – Picture

Show the current dome position as obtained from the dome controller.

Dome Pos. – Button

Gets the current dome position from the dome controller and updates the **Current Az** slider and dome picture. *For NCO dome controller only.*

10.3. Mount Azimuth – Controls



Telescope mount azimuth functions.

Mount Azimuth – Slider bar (read only)

Shows the mount's azimuth.

Goto Mount's Az – Button

Sends command to dome controller to move dome to azimuth indicated in the **Mount Az** slider.

Mount Pos. – Button

Gets mount's azimuth and updates Mount Az slider.

10.4. Dome Position Calculation

Dome Position Calculation

SMAS,2.44,450,0,0,0,0 153

<input type="text" value="2.44"/>	Dome radius m	<input type="text" value="450"/>	OTA Offset in mm
<input type="text" value="0"/>	Mount height mm	<input type="text" value="0"/>	OTA offset E-W+ in mm
<input type="text" value="0"/>	Mount N S mm	<input type="button" value="Move to Calc"/> <input type="button" value="Calc. Dome"/>	

The geometry of the dome and telescope location on the mount are entered here and used in the **Calc. Az** function to determine the azimuth of the dome opening for a given dome and telescope combination.

Dome Mount Presets – Combo box

Presets can be edited with the Dome Files menu and are provided for the NCO and MHO observatories. Select **SMAS,2.44,450,0,0,0,0** for NCO.

Preset entry format, separated by a comma:

- Name of preset, can be anything.
- Dome radius in meters.
- Telescope ota offset from center of mount RA axis
- Telescope ota offset East - or West + from center of mount RA axis
- Mount height above dome base (can be negative)
- AGF controller movement in degrees per second. Set to 0 for NCO controller.
- Mount RA and DEC axis intersection North or South from center of dome (v19.0 and newer)

Move to Calc – Button

Move the dome to the last **Calc. Az** position. Does not query the mount.

Calc. Dome – Button

Issues commands to the mount to get its position and then calculates where the dome should be positioned using data provided in the **Dome Position Calculation**. Does not move the dome. Updates **Calc. Az**.

Dome radius in m – Text box

The radius of the observatory dome in meters.

OTA offset in mm – Text box

Distance from center of RA axis to center to telescope optical tube in millimeters.

Mount height mm – Text box

Height of mount from base of dome in millimeters. Usually 0.

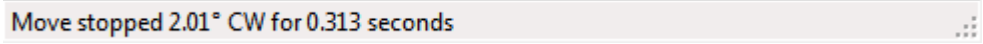
OTA offset E-W+ in mm – Text box

Distance East - or West + from the RA axis to the center of the telescope optical tube in millimeters.

Mount N S mm – Text box

Distance of intersection of RA and DEC axis from center of dome.

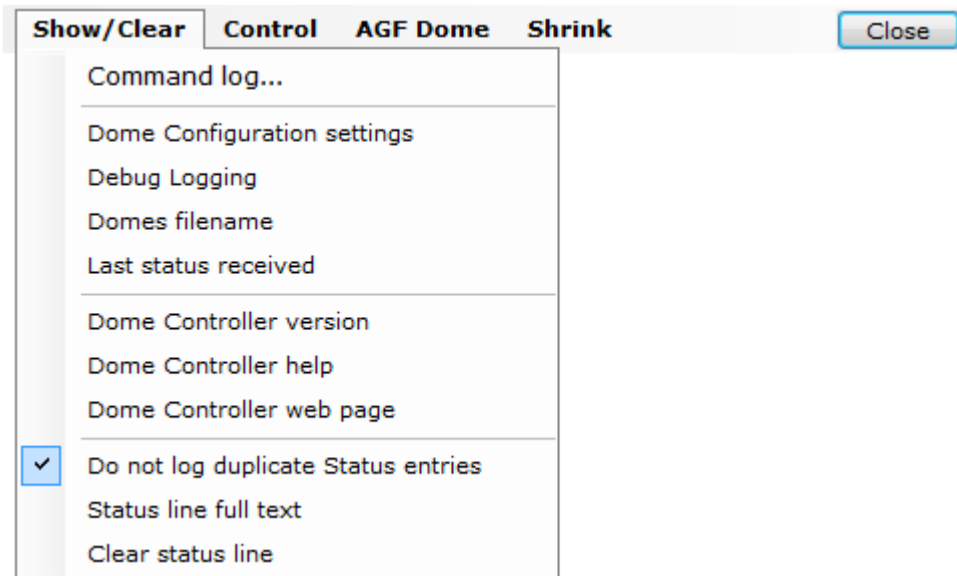
10.5. Status Line – Text



Move stopped 2.01° CW for 0.313 seconds

Displays status and error message from the dome control window.

10.6. Show/Clear – Menu



Common dome control functions and options.

Command log... - Button

Open dome controller command log window. See section 11.

Debug Logging – Button

When **checked** will provide additional information to the Command log showing parameters used to do the dome position calculation.

Domes Configuration settings – Button

Displays the current Dome Position Calculation settings on the status line and log.

Domes filename – Button

Displays the current domes file being used on the status line.

Last status received – Button

Displays the last status request received from the NCO dome controller. *Returns none for AGF dome controllers.*

Dome Controller version – Button

Sends the command to get dome controller version and returns the result in the status line.

Dome Controller help – Button

Displays the NCO dome controller help web page from the controller.

Dome Controller web page – Button

Displays the NCO dome controller web page from the controller or the XPort configuration web page for the AGF dome controller.

Do not log duplicate Status entries – Button

When **checked** if in tracking mode duplicate entries from polling the dome controller will not be entered into the dome command log.

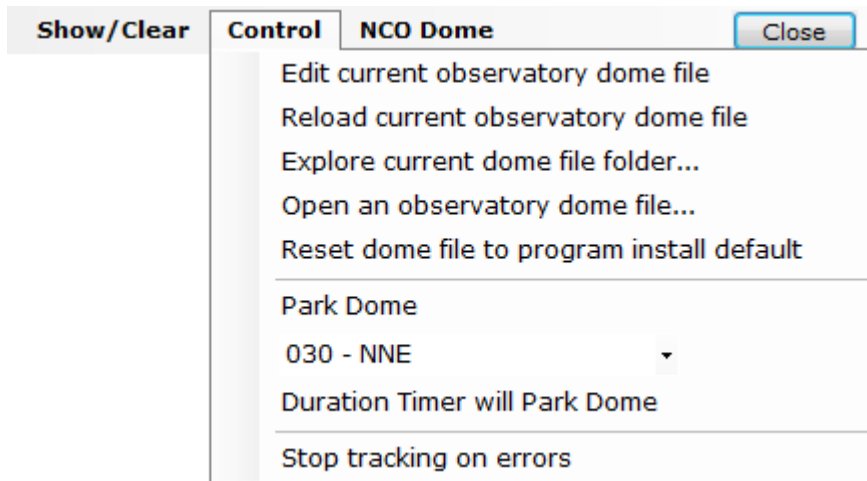
Status line full text – Button

Displays a window that contains the status line's full text. Used if status line is truncated or has multiple lines.

Clear status line – Button

Clears any text that is displayed in the status line.

10.7. Control – Menu



Observatory domes file management. Defines dome and telescope combinations for setting different configurations.

Park dome settings and management.

Edit current observatories dome file – Button

Opens the current domes file in Notepad for editing. The first part of the default file has comments documenting the format of the entries. Sample:

```
! AP GTO Mini Control Observatory Domes file
! Format is 3 values for each line separated by a comma
! Value 1 = Name of observatory (can be anything)
! Value 2 = Dome radius in meters
! Value 3 = Telescope ota offset from center of mount RA axis
! Value 4 = Telescope ota offset East + or West - from center of mount RA axis
! Value 5 = Mount height above dome base (can be negative)
! Value 6 = Dome rotation rate deg. / sec. (only used by AGF). Set to 0.00 for
NCO
! Value 7 = Mount RA and DEC axis intersection North or South from center of
dome (v19.0 and newer)
None,0.00,0,0,0,0,0
SMAS,2.44,450,0,0,0,0
MHO,1.15,445,0,0,6.00,100
```

Reload current observatory dome file – Button

Opens the current observatory dome file. Useful when editing the current dome file.

Open a observatory domes file... - Button

Opens a file open dialog windows to allow a new domes file to be used.

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Reset domes file to program install default – Button

Opens the domes file from the program install folder.

Park dome – Button

Move dome to selected park position given in the combo box below this button.

Park Positions – Combo Box

Azimuth to move dome to. increments.

000 - North
010
020
030 - NNE
040
050
060 - NE
070
080
090 - East
100
110
120 - SE
130
140
150 - SSE
160
170
180 - South
190
200
210 - SW
220
230
240 - SWW
250
260
270 - West
280
290

Divided into 10 degree

Duration Timer will Park Dome - Button

When checked and the **Dur.** check box is also checked on the Main Menu the dome will be moved to the selected park position when the time expires. If tracking is enabled it will be disabled before moving the dome.

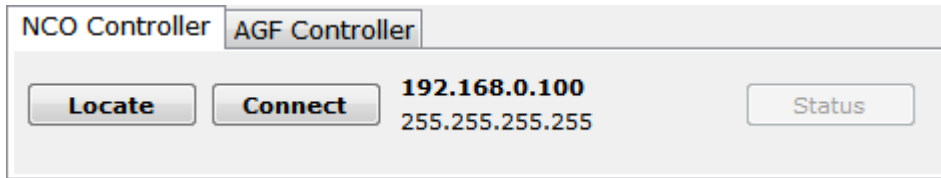
Park Dome
090 - East
 Duration Timer will Park Dome

Tracking Rate & Stop
 Stop Side Solar Lunar
10 Deg. past meridian ?
01:00 Dur. P1 2 3 4

Stop tracking on timeouts – Button

When checked dome tracking will stop if there is a timeout or write error communicating with the dome controller.

10.8. NCO Controller – Tab



Must be selected to connect to a NCO dome controller. The NCO dome controller uses a standard Ethernet network TCP/IP V4 protocol to communicate.

Locate – Button

Sends a UDP packet to port 7778 and then listens for a response for 30 seconds. The response will have the IP address of the NCO dome controller which is then set to use with the Connect button.

Connect / Disconnect – Button

When **Connect** will start TCP/IP communications with the NCO dome controller using the IP address shown to the right of the button. The button will then change to **Disconnect** and will close the TCP/IP connection to the dome controller when clicked. The IP address and network mask can be set using the **NCO Control** menu. If the connect is successful a face icon will appear and cycle to indicate proper communications is going on.



IP address and **network mask** is shown to the right of the Connect / Disconnect button.

Status – Button

Shows dome controller status on status line at bottom of window. The first part of the status is what was sent back from the dome controller and the second part is the response formatted to display. Status is formatted as follows:

1. OK 0 = Dome motor Off, OK1 = Dome motor On
2. nn = Dome current azimuth
3. nn = Dome goto azimuth
4. 0 = No errors, 1 = RFID timeout, 2 = RFID not in table
5. 0 = Emulator mode Off, 1 = Emulator mode On

```
OK0,10,10,0,0 Motor: Off, Az: 10, Goto Az: 10
```

Close – Button

Hides the window and will disable tracking if it is enabled. Does not disconnect from the dome controller.

10.9. NCO Dome - Menu

Settings to for the NCO dome controller.

Send Dome INIT command – Button

Sends INIT to the NCO dome controller, waits 6 seconds and returns the response.

Use Localhost to locate Dome Controller emulator program- Button

When **checked** will use this computer to find the NCO dome controller emulator program instead of the computer's network. Uses network mask 127.0.0.255.

Use remote network to locate Dome Controller emulator program – Button

When **checked** will use the network interface being used by the computer to locate the NCO dome controller emulator program. Uses network mask 255.255.255.255.

Note: Dome Controller emulator program is a software program that will emulate the NCO dome controller and must be installed separately. It is not currently available for download.

Use network mask below to locate Dome Controller – Button

When **checked** the network mask in the text box below this button will be used when the Locate button is clicked to send out the UDP packet to find the dome controller on the network.

Network mask – Text box

Any valid network mask. The default network mask is 255.255.255.255 for the entire network.

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Use IP address below for Dome Controller – Button

When **checked** the IP address in the text box below this button will be used to connect to the NCO dome controller.

IP address – Text box.

TCP/IP address of the NCO dome controller on the network.

Dome Controller emulator mode, On/Off – Button

Will turn the NCO dome controller's Emulator Mode On and Off. Button is **checked** when emulator mode is on. Sends command **MODE 0** to turn off emulator mode and **MODE 1** to turn on emulator mode.

Calibrate Dome web page... - Button

Connects to the NCO dome controller's calibration web page.

Set web browser to internal – Button

When **checked** all web pages are displayed in a window from this program. When **unchecked** the computer's default web browser is used to display web pages.

10.10. AGF Controller – Tab

Must be selected when using an AGF Dome Controller for dome rotation.

Connect / Disconnect – Button

When Connect will open the serial COM port indicated in the combo box to the right of the button. Sends :V# to the AGF dome controller and displays the response in the status line at the bottom of the window. When Disconnect will close the COM serial port.

Move Deg. / sec. – Text box

Number of degrees the dome moves in 1 second. Will be determined by what dome motor and gear being used. Is also set using the Dome Position Calculation parameters.

COM – Combo box

Selects the serial COM port used to talk to the AGF dome controller. The top entries in the combo box show all COM serial ports found on the computer. The bottom part list all valid COM serial ports.

DSR – Check box

Check when using control signals on the DSR serial COM port to control the Enable dome tracking function. DSR COM port is set by using the **AGF Control** menu. See section 10.10.

The wiring of the DSR Manual Switches are shown in section 0.

Set to Dome – Button *

Sets the dome position to match the Move Dome Az slider. Does not move the dome.

Set to Mount – Button *

Sets the dome position to match the Mount Az slider. Does not move the dome.

Set to Calc – Button *

Sets the dome position to the **Calc. Az** value. Does not move the dome.

Note: * One of these buttons must be clicked to set the dome position before starting tracking.

10.11. AGF Dome – Menu

The screenshot shows a control interface for the AGF Dome. At the top, there are buttons for 'Show/Clear', 'Control', and 'AGF Dome', along with a 'Close' button. The main area contains the following settings:

- 3 sec. agf timeout (dropdown menu)
- Pulse encoder
- Manual Switch DSR Serial Port (dropdown menu showing COM1)
- EW Switch does CP3 Meridian Delay
- Initialize AGF dome controller
- Get dome position from AGF
- Get extended status
- Use IP address below for Dome Controller (text box containing 192.168.0.31)
- Debug mode (dropdown menu showing COM2)
- Get dome wheel sensor bias
- Set dome wheel bias (text box containing 0)
- Emulator mode
- Start com diagnostics

Settings for the AGF dome controller.

3 sec. agf timeout – Combo box

Time out for serial COM port connected to AGF dome controller. Values are from 1 to 10 seconds. Default is 3 seconds.

Pulse encoder – Check Button

If **checked** AGF dome controller will use dome motor wheel encoder pulses to determine dome movement.

If **unchecked** will use either controller timer or program timer to move dome.

Manual Switch DSR Serial Port – Label

Label for serial COM ports combo box below used for a manual switch attached to the COM port to control, dome tracking and meridian delay. See section 10.12.

Note: If Auto Dome Track at Startup is set DSR switch will keep last dome position when set to Enabled.

COM – Combo box

Serial COM port that has the manual DSR switch connected to it. The top entries in the combo box show all COM serial ports found on the computer. The bottom part list all valid COM serial ports.

EW Switch does CP3 Meridian Offset – Check Button

If checked the Manual Switch Box East / West switch uses the CP3 Meridian Offset value. See section 6.

Initialize AGF dome controller – Button

Sends :I# to AGF dome controller to reset all relays. **Returns Initialize pins 0-13 LOW.**

Get dome position from AGF – Button

Sends :G# to AGF dome controller to get the dome position, used for pulse moves. This is a software position only.

Get extended status – Button

Sends :X# to AGF dome controller to get additional status information.

Use IP address below for Dome Controller – Button toggle

Set the IP address in the text box below this button to the AGF Dome Controller Network connect address of the XPort Ethernet device. (Part of the AGD Dome Controller v2.0 control board)

IP address – Text box.

TCP/IP address of the AGF dome controller on the network.

Debug mode – Button toggle

If **checked** dome controller will send debug commands to the Basic Stamp 2 programming COM port for the AGF dome controller v2 or Arduino USB port for AGF dome controller v3.

This requires the programming cable be connected to the controller BS2 board only.

Debug COM – Combo box

Serial COM port that is connected to the AGF Dome Controller board debug connector. If Debug Mode is On additional controller status messages are sent to this COM port. For AGF dome controller v3 using the Arduino UNO this is the USB port of the UNO.

Get dome wheel sensor bias – Button

Gets the dome wheel sensor bias from AGF dome controller.

Set dome wheel bias – Button

Sets the dome sensor bias to number of degrees in the text box below. *This value is lost after power off of the AGF dome controller. Default is 0.*

Dome wheel bias in degrees – Text box

Number of degrees to set dome wheel bias to. After this many degrees is rotated one degree is subtracted from the movement.

Emulator mode – Button toggle

If **unchecked** sends :E1# to the AGF dome controller. This tells the dome controller not to move the dome but respond to normally to all dome movement command.

If **checked** sends :E0# to the AGF dome controller that turns off emulator mode.

Start com diagnostics – Button toggle

If **unchecked** will test the serial COM port connected to the AGF dome controller by sending a version request every 5 seconds. Also turns of **Emulator mode**.

If **checked** will stop the diagnostic and turn off **Emulator mode**.

10.12. AGF DSR Manual Switches

AGF Dome Control Manual Switch DB9 Pinouts

Tracking Enable/Disable Switch

DSR pin 6

DTR pin 4

Pins shorted = Tracking enabled

Pins open = Tracking disabled

East West Meridian Delay Switch (used with AP hand controller)

RTS pin 7 common pin

CTS pin 8 to RTS pin 7 = No meridian delay

RI pin 9 to RTS pin 7 = West 1 hour delay

CD pin 1 to RTS pin 7 = East 1 hour delay

Switch used C&K Components A10303RNZQ

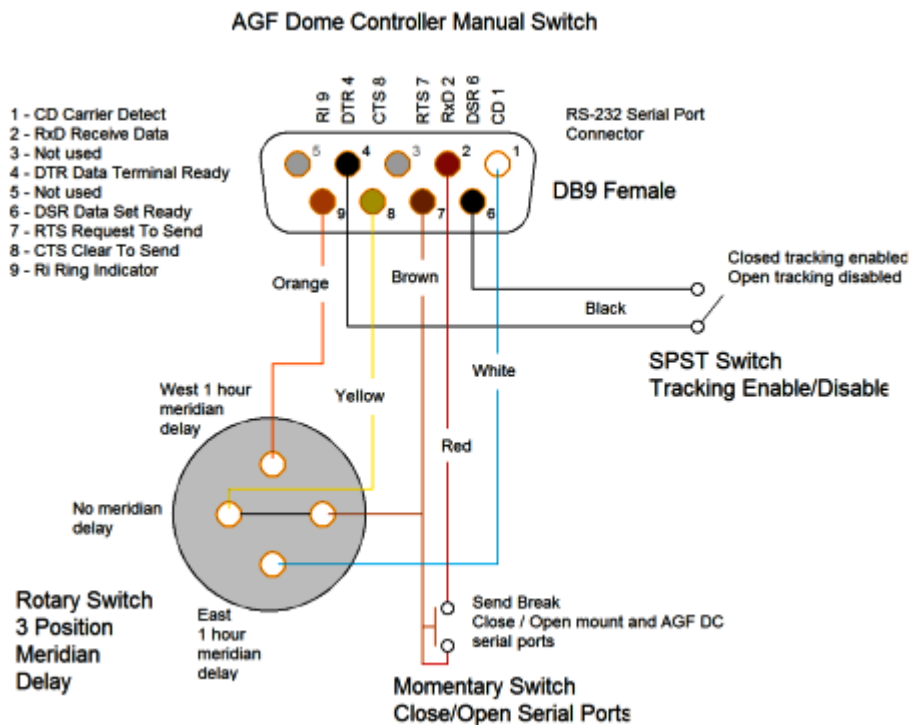
DigiKey No. CKN9822-ND

Rotary switch 3 position

Open/Close Mount and AGF Dome Controller serial ports

RX pin 2 to RTS pin 7 = Momentary short sends break

AP GTO Mini Control version 8.4 and above.



10.13. AGF Dome Controller – Commands

AGF Dome Controller Command Summary for Firmware v2.1 (Basic Stamp 2)

Command	Function	Response (terminated with CR)
:I#	Initialize AGF Dome Controller.	Init. Done v2.0 3-DEC-2019
:V#	Get Firmware version and Input Interface.	AGF Dome Control v1.4 3-DEC-2019 Using USB interface AGF Dome Control v2.0 3-DEC-2019 Using Network interface
:E1#	Enable emulator mode, dome will not move.	Emulator On (Motion command responses are appended with “ Emulator”.
:E0#	Disable emulator mode, normal operation.	Emulator Off
:Qe#	Stop CW movement.	Stop east
:Qw#	Stop CCW movement.	Stop west
:Q#	Stop movement any.	Stop all
:Me#	Start moving dome CW.	Guide east
:Mw#	Start moving dome CCW.	Guide west
:Tennnnn#	Move dome CW for nnnnn milliseconds.	Guide east n ms
:Twnnnnn#	Move dome CCW for nnnnn milliseconds.	Guide west n ms
	<i>Uses dome motor wheel pulse detection sensor.</i>	
:Rennn#	Move dome CW for nnn degrees.	Rotate east n deg
:Rwnnn#	Move dome CCW for nnn degrees.	Rotate west n deg
	<i>Requires programming cable to be connected.</i>	
:D1#	Enable debug mode, additional output sent to controller’s debug/programming port.	Debug On
:D0#	Disable debug mode.	Debug Off

Notes:

Toggle switch on side of control box selects USB or XPort Network interface.

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All responses are sent with a termination character of CR (decimal 13).

Serial port is set at 9600 baud 8 bit no parity one stop bit and no handshake.

The TCP port for the XPort is 7777.

AGF Dome Controller Command Summary for Firmware v3.0 and above (Arduino UNO)

Command	Function	Response (terminated with CR)
:I#	Initialize AGF Dome Controller.	Init. Done v3.0 4-Oct-2022
:V#	Get Firmware version and Input Interface.	(A) AGF Dome Control – Arduino 4-Oct-2022 v3.0 [USB] (A) AGF Dome Control – Arduino 4-Oct-2022 v3.0 [XPort]
:E1#	Enable emulator mode, dome will not move.	Emulator On (Motion command responses are appended with “EMULATOR” and motor does not move.
:E0#	Disable emulator mode, normal operation.	Emulator Off
:Qe#	Stop CW movement.	Stop east
:Qw#	Stop CCW movement.	Stop west
:Q#	Stop movement any.	Stop all
:Me#	Start moving dome CW.	Guide east
:Mw#	Start moving dome CCW.	Guide west
:Tennnnn#	Move dome CW for nnnnn milliseconds.	Timed east n ms
:Twnnnnn#	Move dome CCW for nnnnn milliseconds.	Timed west n ms
	<i>Uses dome motor wheel pulse detection sensor.</i>	
:Rennn#	Move dome CW for nnn degrees.	Rotate east n deg
:Rwnnn#	Move dome CCW for nnn degrees.	Rotate west n deg
	<i>Must use the XPort interface for this to work correctly.</i>	
:D1#	Enable debug mode, additional output sent to controller’s USB port.	Debug On
:D0#	Disable debug mode.	Debug Off
:Bnnn#	Set pulse dome bias.	Dome pulse bias set to n deg

:A#	Get pulse dome bias.	Dome pulse bias is n deg
:X#	Get extended status	Internal data and status
:G#	Get dome position, pulse moves only.	Dome position is n deg
:Snnn#	Set dome position, pulse move reference only.	Dome position set to n deg

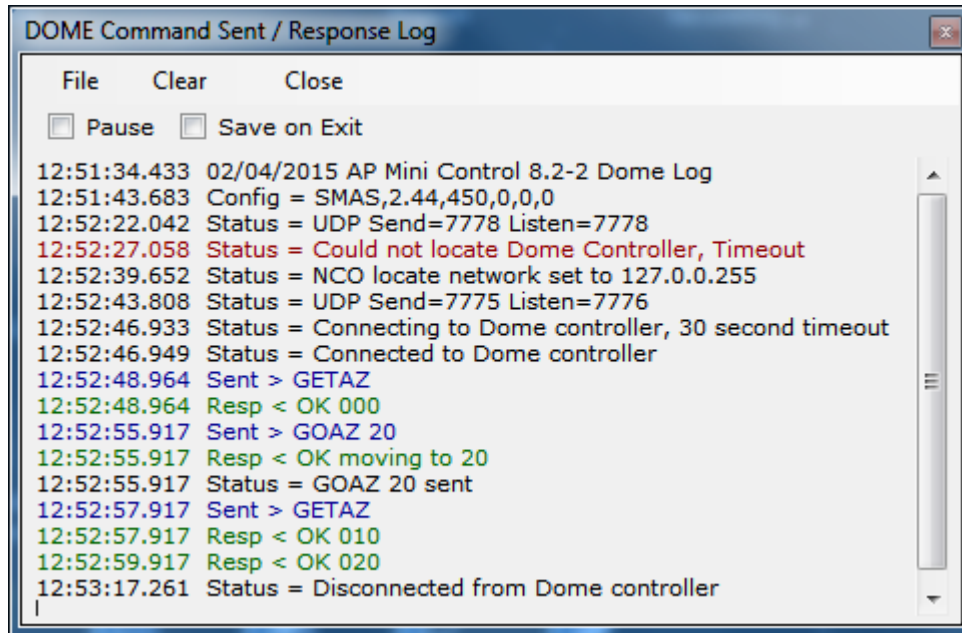
Notes:

All responses are sent with a termination character of CR (decimal 13).

Serial port is set at 9600 baud 8 bit no parity one stop bit and no handshake.

The TCP port for the XPort is 7777.

11. Dome Command log – Window



Shows status messages, error messages, commands sent and responses from the dome controller.

All entries are time stamped and color coded.

- Black = Status and informational messages.
- Dark Red = Error messages.
- Blue = Commands sent to the dome controller.
- Green = Responses received from the dome controller.

Pause – Check box

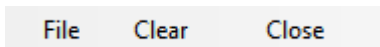
When **checked** logging is suspended.

Save on Exit – Check box

When **checked** the log is saved to the **My Documents** or the folder set using **Settings and Control, Program Settings**. Filename is generated as:

AP-Mini_Dome_Log yyyy-mm-dd_time.rtf where yyyy = year, mm = month, dd = day, time = hours minutes seconds. Example: AP-Mini_Dome_Log 2015-02-04_135125.rtf

The file is saved in Rich Text Format.



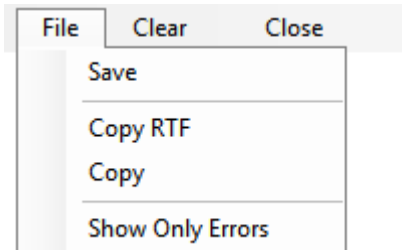
Clear – Menu button

Clears all log entries and starts a new log. The log is not saved.

Close – Menu button

Closes the log window.

11.1. File – Menu bar



Log entries functions

Save – Button

Opens a file save dialog box to allow you to save the log to a file.

Copy RTF – Button

Copies all log entries to the **clipboard** in RTF (Rich Text Format).

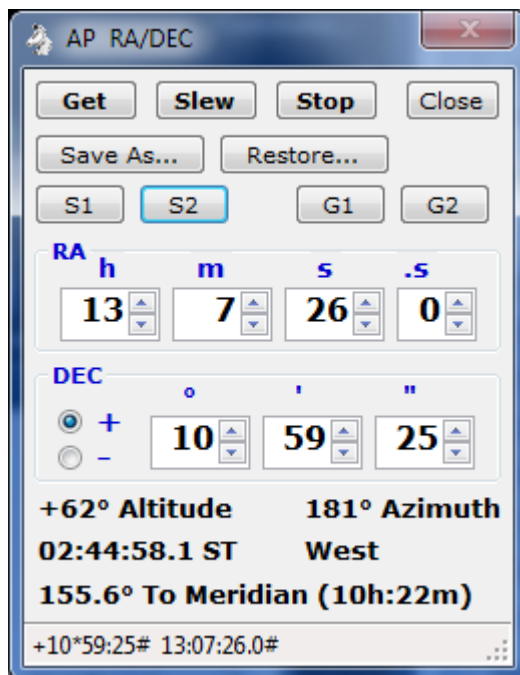
Copy – Button

Copies all log entries to the **clipboard** in plain text format.

Show Only Errors – Button toggle

When checked will only show error entries in the log.

12. RA/DEC Window



Control mount using RA & DEC and obtain mount's position.

12.1. Functions – Buttons



Controls mount slewing and save / restore RA/DEC to a file.

Get – Button

Sends the following commands to the mount and formats the response to fill in the RA DEC number boxes and labels.

- :GR# - Get RA from mount.
- :GD# - Get DEC from mount.
- :GS# - Get Sidereal time from mount.
- :pS# - Get side of mount telescope is on.
- :GZ# - Get Azimuth from mount.
- :GA# - Get Altitude from mount.

Slew – Button

Slew mount to RA & DEC shown in the RA & DEC number boxes. Sends the following commands mount.

- :Sr hh:mm:ss.s# - Set RA (numbers filled from RA number boxes.) Returns 1 if success.
- :Sd +dd*mm:ss# - Set DEC (+ or – then numbers filled from DEC number boxes.) Returns 1 if success.
- :MS# - Slew the mount to set RA & DEC. Returns 0 if success.

Save As... – Button

Opens a save file dialog box to so the displayed RA/DEC can be saved to a file.

Restore... – Button

Opens an open file dialog box to read a saved RA/DEC file and the RA & DEC number boxes with the values saved in the file.

12.2. Save & Goto – RA and DEC



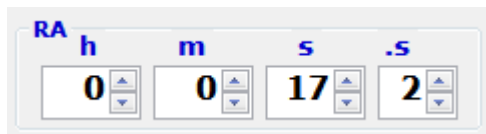
S1 & S2 – Buttons

Save RA & DEC as position #1 or #2. Will enable the Gn goto button.

G1 & G2 – Buttons

Goto RA & DEC saved as position #1 or #2. *Will be disabled if a save has not been done.*

12.3. RA – Number boxes



Displays the RA from the mount when the **Get** button is clicked.

Used to format the :Sr command when the **Slew** button is clicked.

h – Numeric

RA hours, range is 0 to 23.

m – Numeric

RA minutes, range is 0 to 59.

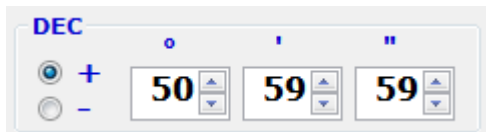
s – Numeric

RA seconds, range is 0 to 59.

.s – Numeric

RA tenths of seconds, range is 0 to 9.

12.4. DEC – Number boxes



Displays the DEC from the mount when the **Get** button is clicked.

Used to format the :Sd command when the **Slew** button is clicked.

Sign – Radio buttons

Select **+** when DEC is positive.

Select **-** when DEC is negative.

° – Numeric

DEC degrees, range is 90 to 0.

' – Numeric

DEC minutes, range is 0 to 59.

" – Numeric

DEC seconds, range is 0 to 59.

12.5. Mount Position – Text

+77° Altitude	06° Azimuth
23:51:33.0 ST	East
2.2° To Meridian (00h:09m)	

Shows the mount's position when the **Get** button is clicked.

± nn° – Altitude.

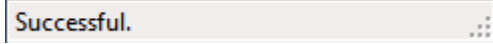
nn° – Azimuth.

hh:mm:ss.s ST – Sidereal time.

East or **West** – Side of mount telescope is on.

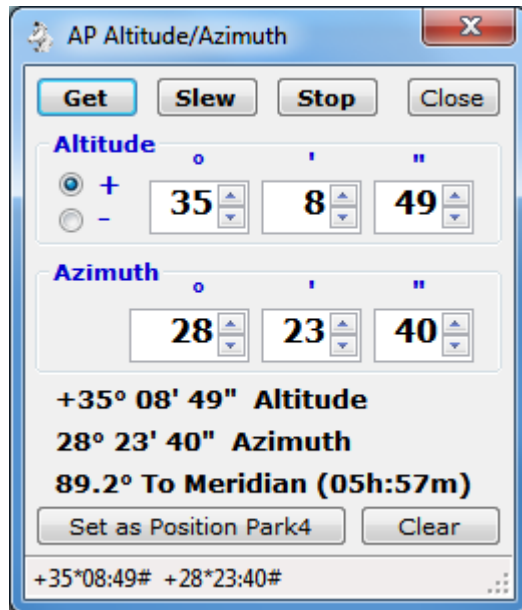
nn.n° To or Past Meridian (nnh:nnm) – Degrees to or past meridian. If degrees are To the meridian also show time until meridian crossing in hour : minutes.

12.6. Status Line – Text

A screenshot of a status line window. The window has a light gray background and a thin border. Inside, the word "Successful." is displayed in a black, sans-serif font. To the right of the text, there are three small, dark gray dots arranged in a triangular pattern, indicating that the text can be scrolled.

Shows status messages from the RA/DEC window.

13. Altitude/Azimuth Window



Control mount using Altitude & Azimuth and obtain mount's Alt. Az. position.

Note: A 'Program settings' option can be used to stop tracking after slewing to Alt/Az.

13.1. Functions – Buttons



Controls mount slewing.

Get – Button

Sends the following commands to the mount and formats the response to fill in the Altitude & Azimuth number boxes and labels.

- :GZ# - Get Azimuth from mount.
- :GA# - Get Altitude from mount.

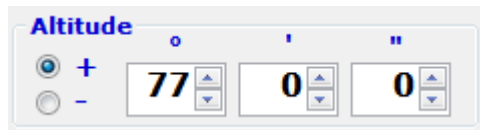
Slew – Button

Slew mount to Altitude Azimuth shown in the Altitude & Azimuth number boxes. Sends the following commands mount.

- :Sz ddd*mm:ss# - Set Azimuth (numbers filled from Azimuth number boxes.) Returns 1 if success.

- :Sa +dd*mm:ss# - Set Altitude (+ or – then numbers filled from Altitude number boxes.) Returns 1 if success.
- :MS# - Slew the mount to set Altitude & Azimuth. Returns 0 if success.

13.2. Altitude – Number boxes



Displays the Altitude from the mount when the **Get** button is clicked.

Used to format the :Sa command when the **Slew** button is clicked.

Sign – Radio buttons

Select + when Altitude is positive.

Select – when Altitude is negative.

° – Numeric

Altitude degrees, range is 90 to 0.

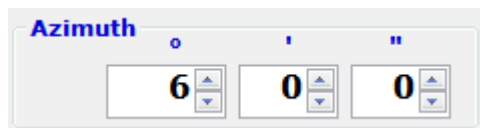
' – Numeric

Altitude minutes, range is 0 to 59.

" – Numeric

Altitude seconds, range is 0 to 59.

13.3. Azimuth – Number boxes



Displays the Azimuth from the mount when the **Get** button is clicked.

Used to format the :Sz command when the **Slew** button is clicked.

° – Numeric

Azimuth degrees, range is to 359.

' – Numeric

Altitude minutes, range is 0 to 59.

" – Numeric

Altitude seconds, range is 0 to 59.

13.4. Mount Altitude, Azimuth and Meridian position – Text



Shows the mount's Altitude, Azimuth and Meridian position when the **Get** button is clicked.

$\pm nn^\circ nn' nn''$ – Altitude.

$nn^\circ nn' nn''$ – Azimuth.

$nn^\circ \text{To / From Meridian (nnh:nnm)}$ – Degrees to or from meridian, time in hours : minutes to meridian at sidereal tracking rate.

13.5. Set / Clear Position Park 4

Set as Position Park4 – Sets the **Custom ALT/AZ** position Park 4 to the indicated Altitude and Azimuth in the of this window.

Clear – Clears the **Custom ALT/AZ** position Park 4.

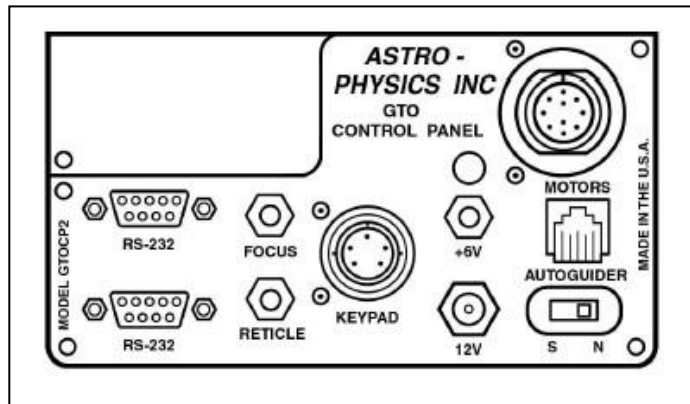
13.6. Status Line – Text



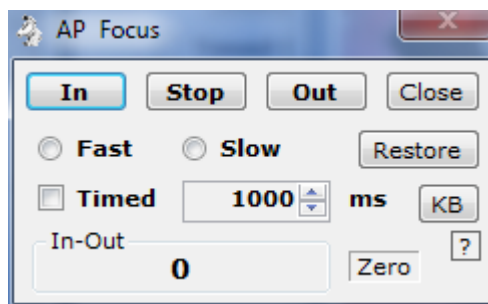
Shows status messages from the Altitude/Azimuth window.

14. Focus Window

Control a focus motor connected to the AP mount's Focus connector.



14.1. AP Mount Focus – Controls



Controls a focus motor connected to the **FOCUS** connector on the GTO Servo Controller. Must be a 12VDC motor. The Meade 1201 Microfocuser will only work on a CP3 controller using Fast.

In, Out & Stop – Buttons

Moves focus motor in desired direction at speed set by Fast or Slow selection with options below.

Close – Button

Hides the windows and retains current settings.

Fast – Radio Button

Sends set focus speed to Fast to the AP mount.

Slow – Radio Button

Sends set focus speed to Slow to the AP mount. *Some focus motors will not work with this settings on GTOCP3 controllers.*

Restore – Button

If the In-Out counter is not zero will move the focus motor in the appropriate direction for the required

Timed Focus – Unchecked

Hold the **In** or **Out** button down to move focus motor in desired direction. Release button to stop movement.

Timed Focus – Checked

Click **In** or **Out** button to start timed focus motor movement in desired direction. Movement will stop after indicated **number of ms** (milliseconds, 1000 = 1 second) next to Timed Focus check box or when the **Stop** button is clicked.

Timer value – Numeric Up – Down

Timed focus value in milliseconds. Used when **Timed Focus** is checked.

KB – Button

Activates the Main window KB button to allow keyboard control of the focus motor connected to the mount and NSEW mount movement. For key commands see Section

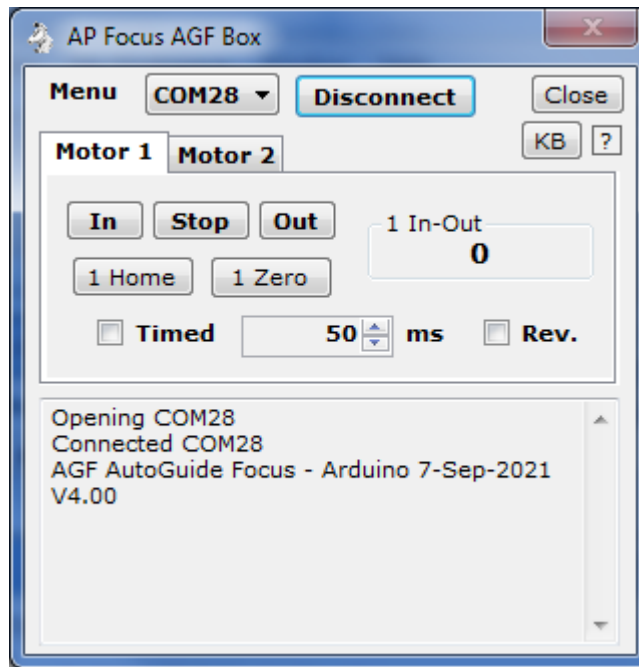
Zero – Button

Will zero the In-Out counter. This counter indicates the time the focus motor has moved using the In and Out buttons in milliseconds.

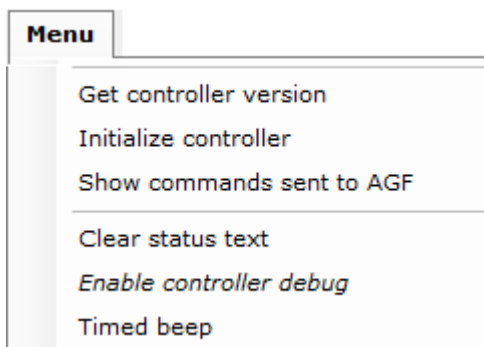
in-Out – Counter

Milliseconds focus motor has moved using the In and Out buttons. Out is positive and In is negative.

14.2. AGF Focus – Controls



Controls focus motors connected to the **AGF FOCUS Controller Box**. Must be a 12VDC motor



Get controller version – Menu Button

Returns the software and version of the AGF Focus Controller box.

Initialize controller – Button

Sends :l# to initialize the controller.

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Show commands sent to AGF – Menu Button

AGF commands are logged to and from the controller.

Clear status text – Menu Button

Status and command log area is cleared.

Enable controller debug – Menu Button

AGF controller debug data is displayed with AGF commands.

Timed beep – Menu Button

Beep is sounded when move In and Out timer expires for timed moves.

COMn – Drop Down Combo Box

Selects the serial (USB) port of the AGF Focus Controller.

Connect / Disconnect – Button

Opens or closes the selected COM port of the AGF Focus Controller.

Close – Button

Hides the windows and retains current settings.

KB – Button

Keyboard control of focus motor and mount movement. If Timed is not checked motor will be activated until the key is released. Button will change background color and show green indicator when active.

? – Button

Shows keyboard help window. See section

Focus Motors 1 & 2

In and Out – Buttons

Moves focus motor in desired direction.

Stop – Buttons

Stops focus motor if moving.

Home – Buttons

Moves the focus motor back to the 0 position.

Zero – Buttons

Zeros the In-Out counter.

Timed – Check box

When checked the In & Out buttons will run the focus motor for the set time.

Timed – Numeric Up Down

Time in milliseconds to run a focus motor when Timed is checked.

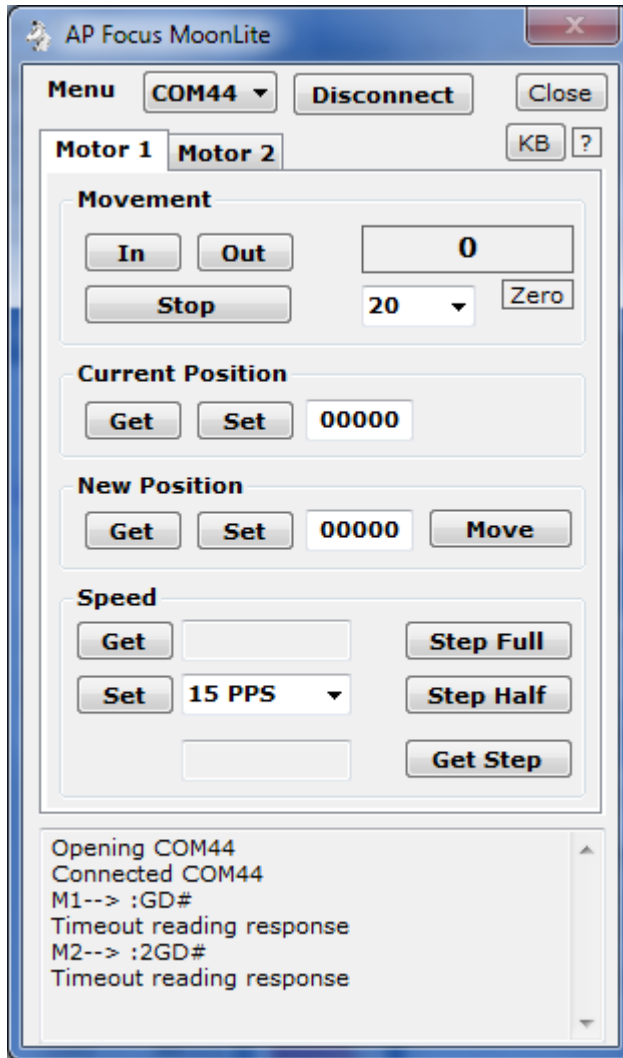
Rev. – Check box

When checked the In & Out buttons are reversed. This allows correct focuser movement is connected to a belt drive focus motor in some configurations.

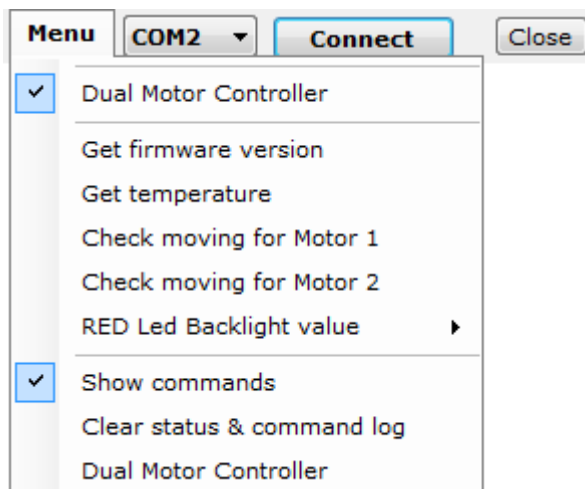
Status – Text box

Displays status and commands to and from the AGF Focus Controller.

14.3. MoonLite Stepper Motor Focus – Controls



Controls MoonLite Stepper motors connected to the **MoonLite Controller Box**.



Dual Motor Controller – Menu Check Button

When checked Dual Motor Controller will be used to control 2 focus motors.

Get firmware version – Menu Button

Returns the firmware version of controller.

Get temperature – Menu Button

Returns current temperature of the probe.

Check moving for motor 1 – Button

Returns moving status of motor 1.

Check moving for motor 2 – Button

Returns moving status of motor 2.

RED Led Backlight value – Sub Menu

Get – Button

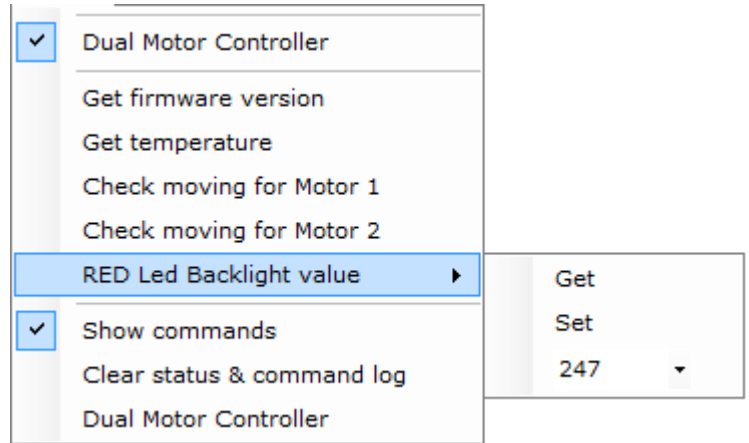
Returns controller backlight value.

Set – Button

Set controller backlight value of combo box below.

0-255 – Combo Box

Controller RED Led backlight value.



Show commands – Menu Check Button

If checked commands to and from the MoonLite controller are displayed. If unchecked only status messages are displayed.

Clear status & command log – Menu Button

Status and command log area is cleared.

COMn – Drop Down Combo Box

Selects the serial (USB) port of the MoonLite Focus Controller.

Connect / Disconnect – Button

Opens or closes the selected COM port of the MoonLite Focus Controller.

Close – Button

Hides the windows and retains current settings.

KB – Button

Keyboard control of focus motor and mount movement. If Timed is not checked motor will be activated until the key is released. Button will change background color and show green indicator when active.

? – Button

Shows keyboard help window. See section

Motor Tabs for Motor 1 and Motor 2

Movement

In – Button

Moves the focuser in by the value set in increment combo box.

Out – Button

Moves the focuser out by the value set in increment combo box.

Stop – Button

Stops the focuser movement if moving.

Increment – Combo Box

Sets the In and Out focuser buttons movement size. Any number can be entered or a preset number can be selected from the combo box.

0 – Textbox

In and Out movement counter.

Zero – Button

Zeros the In-Out counter.

Current Position

Get – Button

Returns the current position of the focuser motor and displays result in the text box to the right.

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Set – Button

Sets the current position of the focuser motor to the value in the text box to the right. Does not move the motor.

New Position

Get – Button

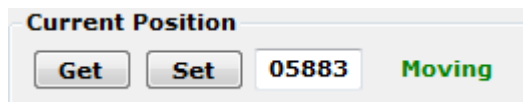
Returns the new position of the focuser motor and displays result in the text box to the right.

Set – Button

Sets the new position of the focuser motor to the value in the text box to the right. Does not move the motor.

Move – Button

Moves the focuser motor to the new position indicated. The current position is updated and 'Moving' is displayed until the focuser stops or a stop command is issued.



Speed

Get – Button

Returns the speed in PPS of the motor and displays result in the text box next to the button.

Set – Button

Sets the speed in PPS of the motor to the value indicated in the combo box to the right of the button.

Step Full – Button

Sets the motor step to full.

Step Half – Button

Sets the motor step to half.

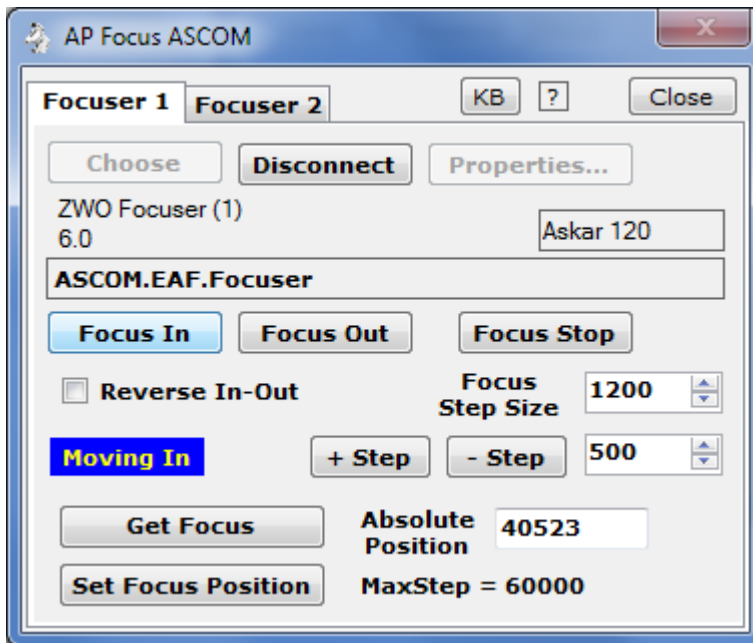
Get Step – Button

Returns the motor step value and displays result in text box to the left of the button.

Status – Text box

Displays status and commands to and from the MoonLite Focus Controller.

14.4. ASCOM Focus – Controls



Controls ASCOM absolute stepper motor focusers.

Focuser 1 – Tab

Controls for focus motor 1.

Focuser 2 - Tab

Controls for focus motor 2.

Close – Button

Closes windows, does not disconnect from focuser.

KB – Button

Keyboard control of focus motor and mount movement. Button will change background color and show green indicator when active.

? – Button

Shows keyboard help window. See section

Focus motors 1 & 2 controls.

Choose – Button

Open ASCOM chooser to select a focuser.

Connect / Disconnect – Button

When **Connect** will open ASCOM focuser and enable controls.

When **Disconnect** disconnects from focuser.

Properties... - Button

Opens ASCOM settings window for selected focuser to allow setting of focuser values.

Focuser name – Text label

Show name of focuser from ASCOM chooser.

Focuser version – Text label

Show version of ASCOM driver.

Reference Name for focus motor – Text box.

Any name to better describe the telescope the focus motor is attached to. *Default is blank.*

ASCOM driver – Text label

Name of ASCOM driver connected.

Focus In – Button

Moves focuser **In** number of steps indicated by **Focus Step Size**.

Focus Out – Button

Moves focuser **Out** number of steps indicated by **Focus Step Size**.

Focus Stop – Button

Stops focus motor if moving.

Reverse In-Out – Checkbox

Changes direction of **Focus-In** and **Focus-Out** buttons.

Focus Step Size – Number Up-Down

Sets the step size for focuser movement.

Moving – Indicator

Shows focuser moving In or Out. Not visible when focuser is stopped.

+ Step – Button

Increases step size by amount set in box to the right.

- Step – Button

Decreases step size by amount set in box to the right.

Get Focus Position – Button

Gets the focuser position and fill in the **Absolute Position** value.

Set Focus Position – Button

Sets the focuser position to the **Absolute Position** value.

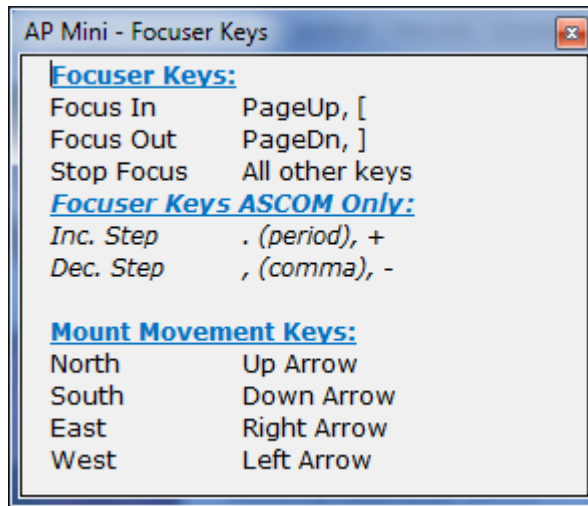
Absolute Position – Numeric value

Position of focuser.

MaxStep = - Numeric value

Maximum position of focuser obtained from ASCOM focuser driver.

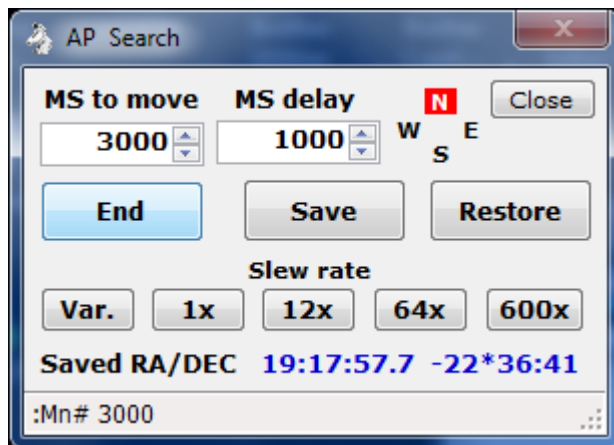
14.5. Focuser Control – Keyboard usage



Keyboard usage for focus motors and mount movement.

The mount movement keys will only work when connected to the telescope mount.

15. Search – Window



Does a square pattern search beginning North then East, South and West. Until the End button is pressed.

Close – Button

Closes the Search window.

MS to move – Numeric value

Milliseconds to move mount at current move rate in each direction. This will increase with each completion of a square search sequence.

MS delay – Numeric value

Milliseconds to wait after each direction of movement.

Begin / End – Button

Starts and stops the search. Button changes to **End** while searching.

Save – Button

Gets and saves the current RA and DEC of the mount. The **Restore** button is then enabled.

Restore – Button

Slews the mount to the RA and DEC obtained by the **Save** button.

Slew rate – Buttons Var 1x 12x 64x 600x

Sets the mount slew move rate to the indicated time sidereal rate. Var is the GTOCP3 variable slew rate from the main menu and is only valid for GTOCP3 and above controllers.

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RA/DEC – Label

RA and DEC from **Save** button. Will display 'None Saved' if the Save button has not been pressed.

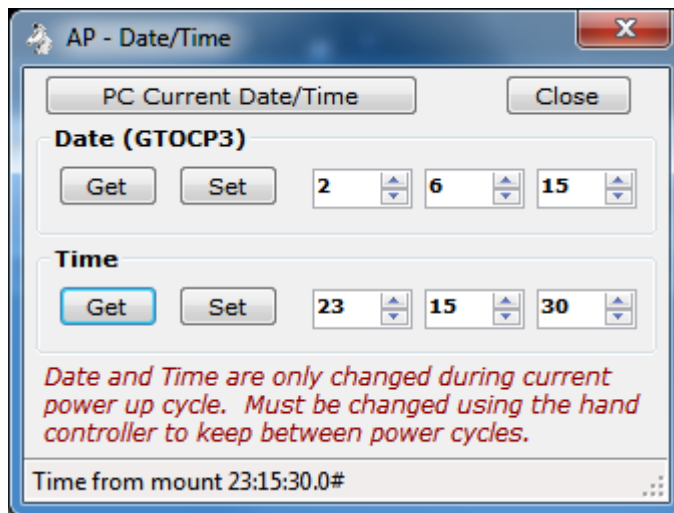
Status – Text

Displays status messages.

N S E W – Indicators

Will change to white with red background when mount is moving in indicated direction.

16. Time and Date – Window



Set the Date and Time in the GTO Servo Controller.

Note: This will set the date and time in the Servo Controller only. It does not affect the date and time in the Hand Controller, so a power cycle will not keep the settings set by this window. The date can only be set on a GTOCP3 servo controller.

PC Current Date/Time – Button

Fills in the Date and Time number boxes with the computer's date and time.

Close – Button

Closes the Date/Time window.

Date (GTOCP3)

Get – Button

Sends :U# and :GC# to get the date from a GOPCP3 servo controller mount. The date is returned in the format MM/DD/YY#.

Set – Button

Sends :SCmm/dd/yy# to the mount with mm dd yy filled from the number boxes to the right. A response of 32 spaces, followed by a #, followed by 32 spaces, followed by a # is returned.

n – Number

Date month, 1 to 12.

n – Number

Date day, 1 to 31

n – Number

Date year, 0 to 99.

Time

Get – Button

Sends :U# and :GL# to get the local time from the servo controller in long format. The time is returned in the format HH:MM:SS.S#.

Set – Button

Sends :SLhh/mm/ss.0# to the mount with hh mm ss filled from the number boxes to the right. A response 1 is returned. Tenths of second is always set to 0 for this program.

n – Number

Time hour, 0 to 23.

n – Number

Time minutes, 0 to 59

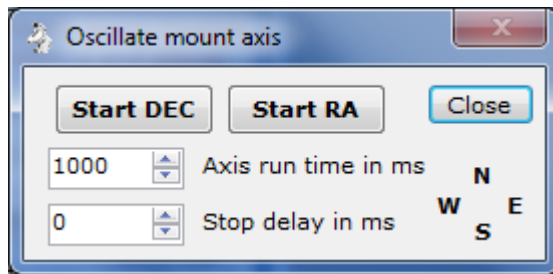
n – Number

Time seconds, 0 to 59.

Status – Text

Displays status messages.

17. Oscillate Mount Axis – Window



Runs the RA and DEC servo motors in forward then reverse direction with a delay between switching directions.

Note: Windows shows mounting moving West.

Note: This can be used to adjust the worm gear of the RA or DEC axis of the mount.

Start DEC – Button

Begin DEC motor running forward, delay, reverse until clicked again. Button changes to **Stop DEC** when running.

Start RA – Button

Begin RA motor running forward, delay, reverse until clicked again. Button changes to **Stop RA** when running.

nnnn – Number

Axis run time in milliseconds. Motor is run this amount of time before a delay or change direction is issued. Range is 100 to 100000.

nnnn – Number

Stop delay in milliseconds. Delay between switching motor direction. Range is 0 to 10000.

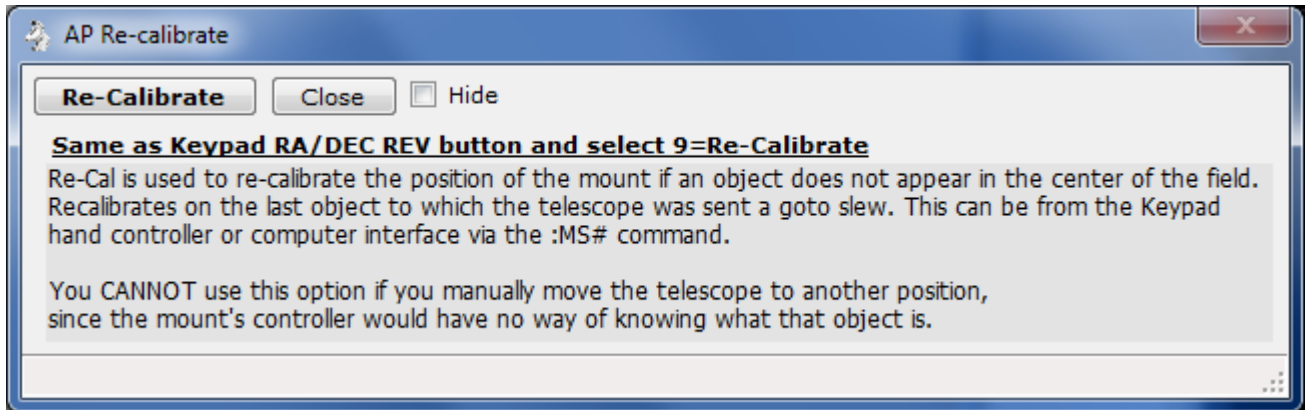
Close – Button

Stops running both motors and closes the window.

N S E W – Indicators

Will change to white with red background when mount is moving in indicated direction.

18. Re-calibrate – Window



Warning window displayed when the **Re-calibrate...** Menu button is clicked on the Main window.

This performs the same function as pressing the hand controller keys **RA DEC REV** then **9**.

On GOTCP4 hand controllers the key sequence is press and hold **RE CAL** then **NEXT >**.

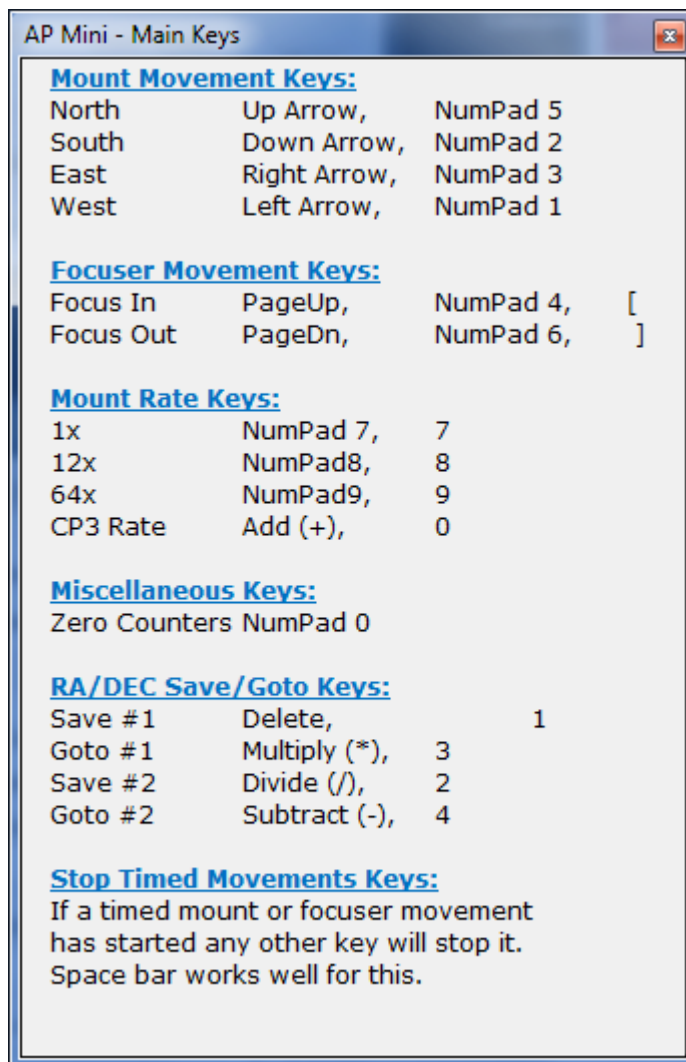
19. Keyboard Help – Windows

Main and Focuser windows keyboard usage keys.

Accessed via the Settings & Control – Help & About tab. See section 4.7.

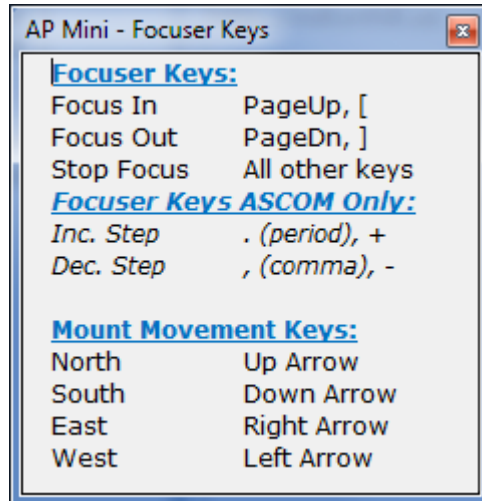
19.1. Main Window Keys

When the **KB** button is active, green indicator is on, keyboard control is active.



19.2. Focuser Windows Keys

When the **KB** button on a focuser window is active, green indicator is on, keyboard control is active.



20. Installing, Starting and Stopping the System

20.1. Installing the system

Program distribution includes the following two files.

- setup.exe
- SetupWizard.msi

Run either file to install the software. If .NET Framework 4 is not found you will be asked to download and install it. A desktop icon shortcut and program group is created.

20.2. Upgrading from previous version

If AP GTO Mini Control is already installed on the computer it will be automatically uninstalled during the installation. You do not need to remove the program before re-installing it or installing a new version.

20.3. Starting the system

Click on desktop icon with the name **AP Mini Control n.n-n** or **All Programs > Telescope Control > APGTO Mini Control vn.n-n**. Where n.n-n is the current program version number.

20.4. Stopping the system

Click on the **X** button on the main window's title bar.

Click on the main windows **Menu > Exit** button and click **Yes** on the popup message box. See section 3.

20.5. Uninstalling the system

Use **Control Panel > Programs and Features** to remove the program from the computer on Windows 7 & 8. For windows Xp use Control Panel > Add/Remove Programs.

The name of the program is **AP GTO Mini Control**.

21. Step by Step Instructions for using the system

This sections shows hardware connections needed and how to start the software.

21.1. Connections to Mount

At least 1 Serial COM port is needed by the program to communicate with the telescope mount for servo controllers GTOCP3 and older. This any device that supports RS-232 serial communication. See section 1.2 for a list of devices. The GTOCP4 servo controller can use RS-232, USB, Ethernet or Wifi as a connection.

AP Mini Control also supports the Lantronix XPort Ethernet to serial device with the appropriate circuits to provide 3.3 volts DC power and RS-232 TTL to RS-232 level converts. *The XPort Network Power Switch developed by Walter Rison has been used to communicate with the Astro-Physics mount.*

Use a 'modem' straight cable or device to connect on one of the two RS-232 serial connectors on the GTO Servo Controller module on the mount. The mount's connectors are DB9 female.

21.2. NCO Dome Controller Connection

The NCO Dome Controller connects to a computer network via a RJ45 Ethernet connection.

The computer this program is running on must be able to access the network the NCO Dome Controller is connected to. See section 10.8.

21.3. AGF Dome Controller Connection

The AGF Dome Controller uses it's USB serial or Ethernet XPort device to accept connections. A toggle switch selects which one will be used. See section 10.10.

21.4. Starting the Program

Double click on the desktop icon **AP Mini Control** or click **AP GTO Mini Control** under the **Telescope Control** start group to start the program.

If the setting **Add/Remove from Windows Startup** is checked the program will start when Windows starts. See section **Error! Reference source not found..**

See section 22 for a quick start and usage guide.

21.5. Errors, Malfunctions, and Emergencies

Program errors can be shown in the following places:

- Status line of a window.
- Command log window.
- Dome Command log window.
- Popup message box.
- Visual Studio real time debug message box.

Some errors such as serial COM port or TCP read timeouts to commands sent will generate an entry in a one of the log windows and operations will continue.

22. Quick-Reference for NCO Observatory

Use this sequence to do basic control of the telescope mount and dome tracking with the NCO dome controller when Auto Dome Track at Startup is disabled or fails.

Note: This assumes all hardware connections to the mount and dome controller have been made.

1. **Power On** the NCO dome controller and telescope mount.
2. **Power On** the PC located on the left just inside the door.
3. Start the program by double clicking desktop icon **AP Mini Control**.
4. Normal operating mode is for **Auto Dome Track at Startup** to be enabled and the dome will begin tracking the telescope mount and no further action is required. *If an error occurs during these operations you must either shutdown AP Mini Control and restart it or follow the steps listed below to begin dome tracking.*
5. Make sure the **COM** port showing is the one connected to the AP mount.
6. Click on the **Connect** button.
7. The status line will show **Servo controller version x GTOCPn** and the **Connect** button will change to **Disconnect**. *If this does not happen do not continue.*
8. Click on **Menu > Dome Control...** to open the Dome Rotation Control window.
9. The following is done using the **Dome Rotation Control** window.
10. Select the **NCO Controller** tab.
11. Check the **NCO Control** menu to make sure all **Use ...** buttons are unchecked.
12. Make sure the **Dome Position Calculation** preset is set to **SMAS,2.44,450,0,0,0**.
13. If the IP address next to the Connect button is **Unknown** click the **Locate** button.
14. Click the **Connect** button.
15. A successful connection will show a changing **face** icon and the **Status** button will be enabled. *If this does not appear you are unable to communicate with the NCO dome controller.*
16. Click the **Enable** check box under Tracking to begin dome to mount tracking. Warning the dome may move if its position is unknown.
17. If the dome has not been moved by using remote control box in the observatory click the **Move CCW** or **Move CW** buttons until the dome picture updates. Note: The NCO dome controller does not know it's position until it read an RFID tag. This is why this step may need to be done.
18. Click the **Calc. Dome** button to calculate where the dome needs to be with the telescope in its current position.
19. Check the **Enable** box under Tracking to being automatic dome tracking tied to the mount's position.

Shutdown Procedure:

1. When you are ready to shutdown everything just press the **X** on the title bar of the **AP GTO Mini Control** window. This will disable tracking, close the connections to the NCO dome controller and telescope mount, then save the current settings and exit.
2. Power Off the PC.
3. Use the AP hand controller at the telescope mount to park the mount. From the main menu select:
 - 2=Setup
 - 4=Park / Mount Opt.
 - 3=Mount Park
 - Wait for mount to stop moving.
4. **Power Off** the telescope mount and NCO dome controller.

23. Appendix A – Reference Documents

The following documents are used in writing software program and this document:

Astro-Physics GTO Keypad Version v4.12 Appendix A and Appendix B

SMAS web site documents web page <http://doc.smas.us/domecontrol/index.html>

24. Appendix B – Glossary of Terms

Explain the meaning of all terms used in this document.

Term	Meaning
AP	Astro-Physics name of telescope mount manufacture.
MHO	Milton Hill Observatory, William Rison's home observatory and name used to develop software.
NCO	Nanjemory Creek Observatory, SMAS observatory.
SMAS	Southern Maryland Astronomical Society.
GTOCP2	Motor controller used in Astro-Physics telescope mounts, model 2.
GTOCP3	Motor controller used in Astro-Physics telescope mounts, model 3.
GTOCP4	Motor controller used in Astro-Physics telescope mounts, model 4.
GTO	Goto servo controller, one of the GTOCP controllers.