ASTRO-PHYSICS COMMAND PROTOCOL FOR GTO MOUNTS
Shipped prior to 11-13-00

Protocol Last Modified: 5/17/99
Mounts shipped later than 11-13-00 have additional commands.
Refer to Astro-Physics Command Protocol for GTO Mounts - Version D or KD - a PDF file.

These commands are based on the Meade LX200 protocol:

Command: :Sr HH:MM.S# or :Sr HH:MM:SS#
Response: "1"

Defines the commanded Right Ascension (RA). Must be issued in order for the calibrate mount command to be accepted. Command may be issued in long or short format regardless of whether long format has been selected. Move and calibrate commands operate on the most recently defined RA.

Command: :Sd sDD*MM# or :Sd sDD*MM:SS#
Response: "1"

Defines the commanded Declination (DEC). Must be issued in order for the calibrate mount command to be accepted Command may be issued in long or short format regardless of whether long format has been selected. Move and calibrate commands operate on the most recently defined DEC.
Note: We use "" as an asterisk. The Meade manual states that this symbol represents ASCII 223 in their command language.*
TheSky software appears to recognize it either way.

Command: :SG sHH#
Response: "1"

Sets the offset from Greenwich mean time. Must be issued in order for the calibrate mount command to be accepted.

Command: :Sg DDD*MM# or :Sg DDD*MM:SS#
Response: "1"

Sets the current longitude. Must be issued in order for the calibrate mount command to be accepted. Command may be issued in long or short format regardless of whether long format has been selected.

Command: :St sDD*MM#
Response: "1"

Sets the current latitude. Must be issued in order for the calibrate mount command to be accepted. Command may be issued in long or short format regardless of whether long format has been selected.

Command: :SL HH:MM:SS#
Response: "1"

Sets the current local time. Must be issued in order for the calibrate mount command to be accepted. Command may be issued in long or short format regardless of whether long format has been selected.

Command: :SC MM/DD/YY#
Response: 16 spaces followed by "#", followed by 16 spaces, followed by "#"

Sets the current date. Note that year fields equal to or larger than 97 are assumed to be 20th century, year fields less than 97 are assumed to be 21st century. Must be issued in order for the calibrate mount command to be accepted.

Command: :GG#
Response: sHH

Gets the offset from Greenwich mean time.

Command: :Gg#
Response: DDD*MM# or DDD*MM:SS# if long format

Gets the current longitude.

Command: :Gt#
Response: sDD*MM# or sDD*MM:SS# if long format

Gets the current latitude.

Command: :GL#
Response: HH:MM.S# or HH:MM:SS# if long format

Gets the current local time.

Command: :GS#
Response: HH:MM.S# or HH:MM:SS# if long format

Gets the current sidereal time.

Command: :GR#
Response: HH:MM.S# or HH:MM:SS# if long format

Gets the current Right Ascention.

Command: :GD#
Response: sDD*MM# or sDD*MM:SS# if long format

Gets the current Declination.

Command: :CM#
Response: "Objects Coordinated#"

Calibrate mount. Current Right Ascension and Declination become the commanded Right Ascension and Declination respectively. This command must precede the first :MS# because it enables slewing motion. This command will be ignored if any one or more of the following has not been set since powerup: offset from Greenwich, latitude, longitude, local time, date, commanded RA, or commanded DEC.

Command: :Mn# :Ms# :Me# :Mw#
Response: (none)

Command motion in the direction specified (n=north, s=south, e=east, w=west) the currently selected guide or centering rate. Motion will continue until a quit command is issued.

Command: :MS#
Response: "0" if command accepted,
(none) if command not accepted,
"1 Object is below horizon. #" (total length of this string is 33 characters) if the horizon check is turned on and the desired object is below 0 degrees altitude.

Slew to the most recently defined RA and DEC coordinates. A calibrate mount command must have been previously issued else this command is ignored. Slewing is performed at the currently selected slew rate. If the horizon check is turned on, and the object is below the horizon, a string containing the appropriate message will be returned, and no slewing will occur.

Command: :Qn# :Qs# :Qe# :Qw#
Response: (none)

Stop motion in the specified axis. Note that :Qn# is identical to :Qs#, and :Qe# is identical to :Qw#. Motion is terminated only if it was not started by a slew (:MS#) command.

Command: :Q#
Response: (none)

Motion in both axes is stopped, regardless of how the motion was invoked.

Command: :P#
Response: "HIGH PRECISION# " or " LOW PRECISION# "

Inquire format. If long format has been set on the communication port currently receiving the :P# command, then "HIGH PRECISION#" is returned. If long format has not been selected, then "LOW PRECISION#" is returned. This command has a slightly different function than described in the Meade protocol.

Command: :U#
Response: (none)

Select long format, valid only for the communication port through which this command is issued, ports are controlled independently. Unlike the Meade definition, though, once long format has been selected it cannot be deselected without powering down the unit. Only the first occurrence of :U# acts upon the port in question. Long format only defines the format of the return strings, Input data (using the set command) will be recognized in any format whether or not long format has been selected.

Command: :B+# :B-#
Response: none

Incrementally increases (B+) or decreases (B-) reticle brightness. Command to be sent over RS-232 each time a button is pressed to increase or decrease brightness. When the brightness is at the maximum, subsequent :B+# commands are ignored. When the brightness is at the minimum, subsequent :B-# commands are ignored. On powerup, the brightness is at the minimum (off).
The Meade commands :B0# :B1# :B2# :B3# are not implemented.

Command: :F+# :F-# :FF# :FS# :FQ#
Response: none

Advances (F+) or retracts (F-) focus adjust motor on the eyepiece. F+ or F- commands commence adjustment and :FQ# stops it. This works the same way the N-S-E-W keypad works (it may even be an operating mode of the same keys). If :FS# has been issued previously, then the focus adjustment will be slow. If the :FF# command has been issued, then the adjustment will be fast. If neither FF nor FS is specified, the powerup default of FS is assumed.

Command: :RG# :RG0# :RG1# :RG2#
Response: none

Selects guide rate for the N-S-E-W buttons. Optionally selects 0.25x (:RG0#), 0.5x (:RG1#), or 1.0x (:RG2#). If no index is provided (:RG#), the previously selected guide rate will be used, else the power up default of 0.5x will be assumed by the motor drive. The indexes are extensions of the Meade protocol.

Command: :RC#; :RC0# :RC1#; :RC2# :RC3#
Response: none

Selects centering rate for the N-S-E-W buttons. Optionally selects a rate of 12x (:RC0#), 64x (:RC1#), 600x (:RC2#), or 1200x (:RC3#). If no index is provided (:RC#), then the previously selected speed will be used, else the power up default of 64x will be assumed by the motor drive. The indexes are extensions of the Meade protocol.

Command: :RS# :RS0# :RS1# :RS2#
Response: none

Selects the slew speed used by the telescope move functions. This command has no effect on the use of the N-S-E-W buttons (therefore, :RS# has no effect). The default slew speed is 1200x. Slewing can be done at 1200x (:RS2#), 900x (:RS1#), or 600x (:RS0#). The indexes are extensions of the Meade protocol.

Non-Meade commands:

Command: :RT0# :RT1# :RT2#
Response: none

This command selects the tracking rate. It selects lunar (:RT0#), solar (:RT1#), or sidereal (:RT2#). The sidereal rate is assumed as a default by the motor drive if nothing is specified. This command has no effect on the use of the N-S-E-W buttons. This command is not in the Meade manual.

Command: :NS#
Response: none

This command swaps the functions of the north and south buttons. Subsequent commands :Mn# and :Ms# are affected. This command is not in the Meade manual.

Command: :EW#
Response: none

This command swaps the functions of the east and west buttons. Subsequent commands :Me# and :Mw# are affected. This command is not in the Meade manual.

Command: :p# :pR# :pP#
Response: (currently none)

This command either invokes PEM record mode (:pR#), invokes PEM playback mode (:pP#), or turns playback off (:p#). The record function will remain active for one full revolution of the worm gear and cannot be terminated. If :p# or :pP# is received during record, it will be ignored. The time required for a record cycle depends upon which mount is used and how much correction is applied. Commands to slew will be ignored during record. Commands to select centering speed will become active only after the record cycle has completed.

When playback is selected, it remains active until turned off. Playback is also temporarily turned off when a command to slew is issued or any of the N-S-E-W buttons are pressed. It is automatically reinvoked when the commanded position has been reached and none of the N-S-E-W buttons are pressed. This command is not in the Meade manual.

Command: :Bd DD*MM:SS# :Br DD*MM:SS#
Response: "1"

This command sets the amount of backlash compensation employed each time a servo motor axis reverses direction. Bd sets the backlash of the DEC axis, Br sets the backlash of the RA axis. Resolution of the backlash is in arc seconds. Typically, the degrees and minutes fields are zero to specify the amount of backlash only in seconds. Values of backlash above 00*54:36 may be truncated, depending upon which mount is used (this is a ridiculously large value, typical values should be well under 00*01:00). The default DEC backlash is 00*00:00, the default RA backlash is 00:00:15 (same as 00*03:50). Backlash in either axis will be properly interpreted whether expressed as DD*MM:SS or HH:MM:SS. This command is not in the Meade manual.

Command: :ho# :hq#
Response: (currently none)

This command turns on (:ho#) and off (:hq#) the horizon check. The horizon check, when turned on, is performed when a "goto" (or :MS#) is issued. If the coordinates define a location below zero degrees altitude, then the string "1Object is below horizon. #" is returned instead of "0". No compensation of coordinates for atmospheric refraction is made. On powerup, the horizon check is off since it is currently performed in the keypad controller, Digital Sky, and TheSky.

Command: :de# :dn#
Response: (currently none)

This command invokes the data feedthrough function between COM 1 and the keypad controller. The purpose is to allow software and database updates to the keypad controller, through the servo drive, without special connectors. For code downloads, :de# is used to provide transparent communications between COM 1 and the keypad unit with even parity. For database downloads, :dn# is used to provide transparent communications with no parity. Once either command is issued, normal operation (or parity change) can only be resumed by powering down the servo drive. COM 2 cannot be used in the transparent mode. Once the pound sign of the command has been received by the servo drive, all subsequent bytes received from COM 1 or the keypad are reflected to the other. Data received on COM 2 is ignored, and no data is transmitted from COM 2.

Applications:

Park Mode:

Park mode is invoked by setting the guide rate to 1x (:RG2#), and commanding the RA axis east (:Me#). This effectively stops the RA motor since tracking is done at 1x west. If the motor drive powers down in this condition, it recognizes this on the next powerup and stays in park. To terminate park mode and continue normal tracking, a quit command must be issued (:Q# or :Qe# or :Qw#). Park should not be invoked if a PEC record cycle is in progress.

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