iOptron iEQ45 RS-232 COMMAND LANGUAGE

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Abbreviations used:

DD or DDD	degrees or day of the month depending on the context
HH	hours
MM	minutes or month depending on the context
MM.M	minutes and tenths of minutes
s	+ or– sign, assumed to be + if omitted
SS	seconds
SS.S	seconds and tenths of seconds
YYYY	year
YY	last two digits of the year

General Telescope Information:

Command: :SG sHH# or :SG sHH:MM.M# or :SG sHH:MM:SS#
Response: "1"
Sets the offset from Greenwich mean time. Command may be issued in any format regardless of whether long format has been selected. Although any length format is acceptable, only the hours field is typically of interest. Data entered with this command will be "remembered" through a power cycle and automatically re-applied on the next powerup. The offset can be entered in unsigned 24-hour format (0-23 hours) or in signed format (-12 to +12) hours.

Command: :Sg DDD*MM# or :Sg DDD*MM:SS#
Response: "1"
Sets the current longitude. Command may be issued in long or short format regardless of whether long format has been selected. Data entered with this command will be "remembered" through a power cycle and automatically re-applied on the next power up.

Command: :St sDD*MM# or :St sDD*MM:SS#
Response: "1"
Sets the current latitude. Command may be issued in long or short format regardless of whether long format has been selected. Data entered with this command will be "remembered" through a power cycle and automatically re-applied on the next power up.

Command: :SL HH:MM:SS#
Response: "1"
Sets the current local time. Command may be issued in long or short format regardless of whether long format has been selected.

Command: :SC MM/DD/YY#

Response: 32 spaces followed by “#”, followed by 32 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.

Command: :GG#
Response: HH:MM.M# or HH:MM:SS.S# if long format
Gets the offset from Greenwich mean time. Although typically only hours field is of interest, the return value will be in standard 24 hour format.

Command: :Gg#
Response: +DD*MM# or +DDD*MM# ,+DD*MM:SS# 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.M# or HH:MM:SS.S# if long format
Gets the current local time in 24 hr. format. Overflows from 23:59:59 to 00:00:00. Updates calendar day on overflow.

Command: :GS#
Response: HH:MM.M# or HH:MM:SS.S# if long format
Gets the current sidereal time in 24 hr. format.

Command: :GR#
Response: HH:MM.M# or HH:MM:SS.S# if long format
Gets the current Right Ascension.

Command: :GD#
Response: sDD*MM# or sDD*MM:SS# if long format
Gets the current Declination.

Command: :GA#
Response: sDD*MM# or sDD*MM:SS# if long format
Gets the current Altitude.

Command: :GZ#
Response: sDD*MM# or sDD*MM:SS# if long format
Gets the current Azimuth.

Command: :GC#
Response: MM:DD:YY#

Gets the current calendar day. Leading zero appears only in the year field.

Telescope Motion

Command: :MS#
Response: "0" if command accepted,
(none) If command not accepted,
"1Object is below horizon #" if the horizon check is turned on, and the desired object is below 0 degrees altitude. (8 trailing spaces before "#", 32 total characters plus "#")
Slew to the most recently defined RA and DEC coordinates in RA-DEC mode, or most recently defined ALT and AZ coordinates in ALT-AZ mode. Slewing is performed at the currently selected slew rate. If the horizon check is turned on, and the object is below the horizon, this will be stated, and no slewing will occur.

Command: :Mn# :Ms# :Me# :Mw#
Response: (none)
Command motion in the direction specified (n=north, s=south, e=east, w=west) at the currently selected guide or centering rate. Motion will continue until a quit command is issued.

Command: :Mnxxx# :Msxxx# :Mexxx# :Mwxxx#
Response: (none)
Command motion for xxx milliseconds in the direction specified at the currently selected guide rate. If xxx has a value of zero, motion is continuous and requires a quit command to terminate. Otherwise a quit command will not terminate.

Command: :NS#
Response: (none)
This command swaps the functions of the north and south buttons. Subsequent commands :Mn# and :Ms# are affected.

Command: :EW#
Response: (none)
This command swaps the functions of the east and west buttons. Subsequent commands :Me# and :Mw# are affected.

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: :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.

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. These rates are predefined selections for the command :RCxxx# as shown below.

Command: :Rcxxx#
Response: (none)
Sets the centering rate for the N-S-E-W buttons to xxx. Xxx is an integer from 1 to 255.

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#).

Command: :Rsxxxx#
Response: (none)
Sets the slew rate used by the telescope move functions. This command has no effect on the use of the N-S-E-W buttons. For xxxx, specify an integer from 1 to 1200. Although larger integers will be accepted, your upper limit should not exceed 1200. This command is an expansion of the :RS commands, allowing the programmer to specify additional slew rates.

Command: :RT0# :RT1# :RT2# :RT9#
Response: (none)
This command selects the tracking rate. It selects lunar (:RT0#), solar (:RT1#), sidereal (:RT2#), or zero (:RT9#). 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. Zero tracking rate is useful in ALT-AZ mode. These rates are predefined selections for the command :RR sxxx.xxx# as shown below.

Command: :RR sxxx.xxxx# :RD sxxx.xxxx#
Response: “1”
This command selects the tracking rate in the RA axis (“RR”) or DEC axis (“RD”) to xxx.xxxx. The rate added to the standard sidereal rate and can be positive or negative.

Command: :Bd DD*MM:SS#

Response: "1"
This command sets the amount of DEC backlash compensation employed each time a servo motor axis reverses direction. Resolution of the compensation is in arc seconds. Typically, the degrees and minutes fields are zero to specify the amount 0of compensation only in seconds. Values of compensation 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 compensation is 00*00:00.

Command: :Br DD*MM:SS# or :Br HH:MM:SS# or :Br HH:MM:SS.S#
Response: "1"
This command sets the amount of RA backlash compensation employed each time a servo motor axis reverses direction. Resolution of the compensation is in arc seconds, seconds, or tenths of seconds, depending upon the format used. Typically, the degrees (or hours) and minutes fields are zero to specify the amount of compensation only in seconds. Values of compensation 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 RA backlash compensation is 00:00:15 (same as 00*03:50).

Command: :KA#
Response: (none)
This command invokes the parked mode. The tracking stops and the motors are de-energized when slewing has completed. The mount will remain parked, even if power is cycled, until a move, quit, calibrate, or park-off command is issued. However, a power surge or glitch may cause the mount to start tracking once again.

Command: :PO#
Response: (none)
Park-off. This command un-parks the mount and also restores calibration. To restore proper calibration, the mount must receive date and time (:SC dd/mm/yy# and :SL hh:mm:ss#) prior to receiving the Park-off command. If park-off is received when the mount is not actually parked (i.e. during an active session when is power on), calibration error will be introduced. A :CM# command can be used, however, to establish accurate calibration.

Command: :pS#
Response: “East#” or “West#”
This command returns the side of the pier on which the telescope is currently positioned. It is useful for remote observatories where it is not possible for the viewer to see the mount. Initially, the mount must be manually positioned on the proper pier side for the calibration object and calibrated using the :CM# command. The correct pier side will be returned after subsequent move, recalibrate, park and unpark commands are completed.

Command: :p# :pR# :pP#
Response: (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 been 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.

Command: :FM#
Response: (none)
This command is intended for software developers. It turns off the meridian flip and makes a German Equatorial mount behave like a fork mount. It is not to be used by individuals without slewing safeguards. It is mainly intended as a tool for writers of mount control software to implement slewing past the meridian during imaging, and then only with the proper limits and controls to prevent the telescope from slewing into the pier or other abnormal motions. It overrides the manufacturing default. The manufacturing default (meridian flip) is restored after a power cycle.

Command: :EM#
Response: (none)
This command is the manufacturing default, which invokes the meridian. If :FM# had been used to eliminate the meridian flip, this command restores the mount back to a normal equatorial mount.

Position

Command: :CM#
Response: “Coordinates matched. #”
(there are 5 spaces between “Coordinates” and “matched”, and 8 trailing spaces before the “#”, the total response length is 32 character plus the “#”.
Calibrate mount (Sync). Current Right Ascension and Declination become the commanded Right Ascension and Declination respectively if in RA-DEC mode. If in ALT-AZ mode, then the commanded Altitude and Azimuth become the current. This command assumes that the mount has been manually positioned on the proper pier side for the calibration object. This command is ignored if slewing is in progress. This command should be used for initial calibration. It should not be used after the mount has been tracking unless it is known that it has not tracked across the meridian. Please refer to the most recent version of the Keypad Manual for a complete discussion of how Sync and Re-Cal should be used.

Command: :CMR#
Response: “Coordinates matched. #”
(there are 5 spaces between “Coordinates” and “matched”, and 8 trailing spaces before the “#”, the total response length is 32 character plus the “#”.

Re-calibrate (Re-Cal) mount. This command performs a function very similar to the :CM# command with one exception. It does not assume that the user has manually positioned the mount on the proper pier side for the object in view. It assumes that the pier side has not changed since the most recent :CM# or :MS# commands. It allows re-calibration on known coordinates even if the mount has tracked across the meridian. This command should not be used to perform the initial calibration. This command is ignored if slewing is in progress. Please refer to the most recent version of the Keypad Manual for a complete discussion of how Sync and Re-Cal should be used.

Command: :Sr HH:MM:SS# or :Sr HH:MM:SS.S#
Response: "1"
Defines the commanded Right Ascension, RA. Command may be issued in long or short format regardless of whether long format has been selected. RA specified as DD*MM:SS will also be interpreted properly if greater precision is required, but this is not typically how RA is expressed. This command automatically selects RA-DEC mode. Move and calibrate commands operate on the most recently defined RA if in RA-DEC mode.

Command: :Sd sDD*MM# or :Sd sDD*MM:SS#
Response: "1"
Defines the commanded Declination, DEC. Command may be issued in long or short format regardless of whether long format has been selected. This command automatically selects RA-DEC mode. Move and calibrate commands operate on the most recently defined DEC if in RA-DEC mode.

Command: :Sa sDD*MM# or :Sa sDD*MM:SS#
Response: "1"
Defines the commanded Altitude, ALT. 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 ALT. This command automatically selects ALT-AZ mode, however tracking rate is unaffected.

Command: :Sz DDD*MM# or :Sz DDD*MM:SS#
Response: "1"
Defines the commanded Azimuth, AZ. 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 AZ. This command automatically selects ALT-AZ mode, however tracking rate is unaffected.

Miscellaneous

:FirmWareDate#
Response: ":YYYYMMDD#"
Gets the building date of firmware of main board.

Command: #
Response: (none)
Sending a # clears the input buffer. Advisable to do this before sending the very first command on power up.

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 power up, the brightness is at the minimum (off).

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 power up default of FS is assumed.

Command: :V#
Response: (current servo controller software version number)
This command returns the current servo controller software version (followed by "#").

Command: :ho# :hq#
Response: (none)
This command turns on (:ho#) and off (:hq#) the horizon check. The horizon check, when turned on, is performed when a "go-to" (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.

Miscellaneous information

The command set is written in ASCII character format and can be used to write your own programs. The commands are case sensitive.

RS-232 Port Settings:

Baud Rate:	9600
Parity:	none
Data bits:	8
Flow Control:	none (does not support Xon/Xoff or hardware flow control)
Start Bits:	1
Stop Bits:	1