

iOptron® Mount RS-232 Command Language 2014

Version 2.5

January 15th, 2019

Abbreviations used:

YYMMDD	YY: last two digits of the year, year are assumed to be 21 st Century MM: month, DD: day of the month
HHMMSS	HH: hour, MM: minute, SS: second
s	“+” or “-” sign, cannot be replaced by any other characters
MMM	minutes
SSSSSS	arc-seconds
TTTTTTTT(T)	0.01 arc-seconds
XXXXX(XXXXXXXXX)	milliseconds
n	digit(s)

All digits above including leading zeroes to match the format of each command.

Currently the document applies to the following products:

- CEM60-EC with firmware 20161101 and later
- CEM60 with firmware 20161101 and later
- CEM40-EC with firmware 20181018 and later
- CEM40 with firmware 20181018 and later
- iEQ45 Pro (EQ and AA mode) with firmware 20161101 and later
- iEQ30 Pro with firmware 20161101 and later
- CEM25-EC with firmware 20170518 and later
- CEM25(P) with firmware 20170106 and later
- SmartEQ Pro+ with firmware 20161028 and later
- AZ Mount Pro with firmware 20170410 and later
- Cube Pro with 8408 (EQ and AA mode) with firmware 20160610 and later
- Cube II (EQ and AA mode) with firmware 20160610 and later

CEM60 series stands for CEM60-EC and CEM60.

CEM40 series stands for CEM40-EC and CEM40.

CEM25 series stands for CEM25-EC, CEM25P and CEM25.

Unless specified, all commands applied to all products.

Underline is just to help you to separate adjacent data with different meanings.

Get Information and Settings

Command: “:GLS#”

Response: “sSSSSSSSSSSSnnnnn#”

This command gets longitude, latitude and all kinds of status. The response includes a sign and 18 digits.

The sign and first 6 digits indicate the current longitude. Valid data range is [-648,000, +648,000].

Note: East is positive, and the resolution is 1 arc-second.

The 7th to 12th digits equals the current latitude plus 90 degrees. Valid data range is [0, 648,000].

Note: North is positive, and the resolution is 1 arc-second.

The 13th digit indicate GPS status: 0 means GPS module malfunction or do not have a GPS module, 1 means GPS module works but have not received valid data, 2 means valid data has been received.

The 14th digit indicate system status: 0 means stopped at non-zero position, 1 means tracking with PEC disabled, 2 means slewing, 3 means auto-guiding, 4 means meridian flipping, 5 means tracking with PEC enabled (only for non-encoder edition), 6 means parked, 7 means stopped at zero position (home position).

The 15th digit indicate tracking rates: 0 means sidereal rate, 1 means lunar rate, 2 means solar rate, 3 means King rate, 4 means custom rate.

The 16th digit indicate moving speed by arrow buttons: 1 means 1x sidereal tracking rate, 2 means 2x, 3 means 8x, 4 means 16x, 5 means 64x, 6 means 128x, 7 means 256x, 8 means 512x, 9 means maximum speed (please refer to the first page for different mount models).

The 17th digit indicate the time source of the mount: 1 means from RS-232 port or Ethernet port, 2 means from hand controller, 3 means from GPS module.

The 18th digit indicate the current Hemisphere: 0 means Southern Hemisphere, 1 means Northern Hemisphere.

Command: “:GLT#”

Response: “sMMMYYMMDDHHMMSS#”

This command gets time related information. The response includes a sign and 16 digits.

The sign and first 3 digits indicate the minute offset from UTC (time zone). **Note: The Daylight-Saving Time will not be take account into this value.**

The 4th digit indicate the Daylight-Saving Time, 0 means Daylight Saving Time has not been observed, 1 means Daylight Saving Time has been observed.

The 5th to 10th digits indicate for current local date.

The 11th to 16th digits indicate for current local time in 24 hours format.

Command: “:GEC#”

Response: “sTTTTTTTTXXXXXXXXX#”

This command gets right ascension and declination. The response includes a sign and 16 digits.

The sign and first 8 digits indicate the current declination. Valid data range is [-32,400,000, +32,400,000]. Note: The resolution is 0.01 arc-second.

The last 8 digits indicate current right ascension. Valid data range is [0, 86,400,000]. Note: The resolution is 1 milli-second.

Command: “:GAC#”

Response: “sTTTTTTTTTTTTTTTTTT#”

This command gets altitude and azimuth. The response includes a sign and 17 digits.

The sign and first 8 digits indicate current altitude. Valid data range is [-32,400,000, +32,400,000].

Note: The resolution is 0.01 arc-second.

The last 9 digits indicate current azimuth. Valid data range is [0, 129,600,000]. Note: The resolution is 0.01 arc-second.

Command: “:GPC#”

Response: “TTTTTTTTTTTTTTTTTT#”

This command gets parking position. The response includes 17 digits.

The first 8 digits indicate the altitude of parking position. Valid data range is [0, 32,400,000]. Note:

The resolution is 0.01 arc-second.

The last 9 digits indicate the azimuth of parking position. Valid data range is [0, 129,600,000]. Note:

The resolution is 0.01 arc-second.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ and AA mode, and iEQ30 Pro.

Command: “:GSR#”

Response: “7#”, “8#” or “9#”

This command gets the maximum slewing speed. 7 stands for 256x sidereal rate, 8 stands for 512x sidereal rate, 9 stands for the maximum speed (please refer to the first page for different mount models).

Note: This command only available to iEQ45 Pro EQ and AA mode, iEQ30 Pro and CEM25 series.

Command: “:GAL#”

Response: “snn#”

This command gets the altitude limit value. The response includes a sign and 2 digits. The altitude limit not only applies to tracking, but also applies to slewing. Moving by arrow buttons does not affect by this limit. Tracking will be stopped if you move or slew the mount to a position lower than the altitude limit.

Note: Valid data range is [-89, +89]. The resolution is 1 degree.

Command: “:AG#”

Response: “nnnn#”

This command gets the right ascension guiding rate and the declination guiding rate.

The first 2 “nn” stands for the right ascension guiding rate 0.nn * sidereal rate. The last 2 “nn” stands for the declination guiding rate 0.nn * sidereal rate.

Note: Valid range of guiding rate of right ascension is [0.01, 0.90] * sidereal rate, and valid range of guiding rate of declination is [0.10, 0.99] * sidereal rate. This command only available to equatorial mounts.

Command: “:GMT#”

Response: “nnn#”

This command will get the behavior about meridian treatment. The first digit 0 stands for stop at the position limit set below. The first digit 1 stands for flip at the position limit set below. The last 2 digits stands for the position limit of degrees past meridian.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ mode, iEQ30 Pro, CEM25 series.

Change Settings

Command: “:RT0#”, “:RT1#”, “:RT2#”, “:RT3#” or “:RT4#”

Response: “1”

These commands select the tracking rate. It selects sidereal (“:RT0#”), lunar (“:RT1#”), solar (“:RT2#”), King (“:RT3#”), or custom (“:RT4#”). This command has no effect on the slewing or moving by arrow buttons. **Note: The sidereal rate is assumed as a default by the next power up.**

Command: “:SRn#”

Response: “1”

This command sets the moving rate used for the N-S-E-W buttons. For n, specify an integer from 1 to 9. 1 stands for 1x sidereal tracking rate, 2 stands for 2x, 3 stands for 8x, 4 stands for 16x, 5 stands for 64x, 6 stands for 128x, 7 stands for 256x, 8 stands for 512x, 9 stands for maximum speed available. **Note: 64x is assumed as a default by the next power up.**

Data entered with the following commands in “Change Settings” section will be saved in all times, and will be automatically reapplied during power cycles:

Command: “:SGsMMM#”

Response: “1”

This command sets the minute offset from UTC (The Daylight-Saving Time will not be take account into this value). Valid data range is [-720, +780]. Note: the resolution is 1 minute.

Command: “:SDS0#” or “:SDS1#”

Response: “1”

These commands set the status of Daylight Saving Time. “:SDS1#” means Daylight Saving Time has been observed, “:SDS0#” means Daylight Saving Time has not been observed.

Command: “:SCYYMMDD#”

Response: “1”

This command sets the current local date.

Command: “:SLHHMMSS#”

Response: “1”

This command sets the current local time. The time can only be entered in the range of 00:00:00 to 23:59:59.

Command: “:SgsSSSSSS#”

Response: “1”

This command sets the current longitude. Valid data range is [-648,000, +648,000]. **Note: East is positive**, and the resolution is 1 arc-second.

Command: “:StsSSSSSS#”

Response: “1”

This command sets the current latitude. Valid data range is [-324,000, +324,000]. **Note: North is positive**, and the resolution is 1 arc-second.

Command: “:SHE0#” or “:SHE1#”

Response: “1”

These commands set the hemisphere. 0 means Southern Hemisphere, 1 means Northern Hemisphere.

Command: “:MSRn#”

Response: “1”

This command sets the maximum slewing speed. Note: n could only be 7, 8 or 9. 7 stands for 256x, 8 stands for 512x, 9 stands for maximum speed available.

Note: This command only available to iEQ45 Pro EQ and AA mode, iEQ30 Pro, CEM25 series.

Command: “:SALsnn#”

Response: “1”

This command sets the altitude limit. The altitude limit applies to both tracking and slewing. Movement caused by arrow buttons does not affected by this limit, however tracking will be stopped if you move the mount to a position past this limit.

Note: Valid data range is [-89, +89]. The resolution is 1 degree.

Command: “:RGnnnn#”

Response: “1”

This command sets the right ascension guiding rate and the declination guiding rate.

The first 2 “nn” stands for the right ascension guiding rate 0.nn * sidereal rate. The last 2 “nn” stands for the declination guiding rate 0.nn * sidereal rate.

Note: Valid range of guiding rate of right ascension is [0.01, 0.90] * sidereal rate, and valid range of guiding rate of declination is [0.10, 0.99] * sidereal rate. This command only available to equatorial mounts.

Command: “:SMTnnn#”

Response: “1”

This command will set the behavior about meridian treatment. The first digit 0 stands for stop at the position limit set below. The first digit 1 stands for flip at the position limit set below. The last 2 digits stands for the position limit of degrees past meridian.

Mount Motion

Command: “:MS#”

Response: “1” if command accepted,
“0” The desired object is below the altitude limit or exceed the mechanical limits.

This command will let the mount slew to the most recently defined coordinates. A pair of defined right ascension and declination or a pair of altitude and azimuth must be issued before this command. If the object is below the altitude limit, this will be stated, and no slewing will occur. After slewing, the tracking will be enabled automatically regardless the former status of tracking if a pair of defined coordinates are right ascension and declination.

Command: “:Q#”

Response: “1”

This command will stop slewing only. Tracking and moving by arrow keys will not be affected.

Command: “:ST0#” or “:ST1#”

Response: “1”

These commands set tracking state. “:ST0#” indicates stop tracking, “:ST1#” indicates start tracking.

Command: “:MnXXXXX#”, “:MeXXXXX#”, “:MsXXXXX#” or “:MwXXXXX#”

Response: (none)

These commands command motion for XXXXX milliseconds in the direction specified at the currently selected guiding rate. The valid data range of XXXXX is [0, 99999].

Command: “:MP1#”

Response: “1” if command accepted,
“0” if park failed.

This command parks to the most recently defined parking position. In parked mode, the mount cannot slew, track, guide or perform any movement unless an unpark command is issued. If you parked the mount and powered it off, the mount will unpark automatically at the beginning of the next power up.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ and AA mode, and iEQ30 Pro.

Command: “:MP0#”

Response: “1”

This command un parks the mount. If the mount is already un parked, the command will have no effect.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ and AA mode, and iEQ30 Pro.

Command: “:MH#”

Response: “1”

This command will slew to the zero position/home position immediately.

Command: “:MSH#”

Response: “1”

This command will automatically search the mechanical zero position/home position immediately by detecting homing sensors. Current zero position/home position will be overwritten by this operation if the operation succeeds.

Note: This command only available to CEM60 series and CEM40 series mount. This operation is designed to be a safe operation in any cases.

Command: “:RRnnnnn#”

Response: “1”

This command sets the tracking rate of the RA axis to n.nnnn *sidereal rate. This value could be set at any time, but “Custom Tracking Rate” (“:RT4#”) must be selected before this command to take effect. Currently the value is limited to the range of [0.5000, 1.5000] * sidereal rate. Data entered with this command will be remembered through a power cycle and automatically re-applied on the next power up.

Note: This command only available to equatorial mounts.

Command: “:mn#”, “:me#”, “:ms#” or “:mw#”

Response: (none)

These commands have identical function as UP, RIGHT, DOWN or LEFT key pressed on the hand controller when hand controller in the main page. They will move the mount to the specified direction at specified speed. The mount will keep moving until a similar command like “:qR#”, “:qD#”, or “:q#” has been received.

Command: “:q#”

Response: “1”

This command will stop moving by arrow keys or “:mn#”, “:me#”, “:ms#”, “:mw#” command. Slewing caused by other commands and tracking will not be affected.

Command: “:qR#”

Response: “1”

This command will stop moving by left and right arrow buttons or “:me#”, “:mw#” command. Slewing caused by other commands and tracking movement will not be affected.

Command: “:qD#”

Response: “1”

This command will stop moving by up and down arrow buttons or “:mn#”, “:ms#” command. Slewing caused by other commands and tracking movement will not be affected.

Position

Command: “:CM#”

Response: “1”

This command calibrates mount (Synchronize). In equatorial mounts, the most recently defined right ascension and declination become the commanded right ascension and declination respectively. In Alt-Azi mounts, the most recently defined altitude and azimuth become the commanded altitude and azimuth. 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.

Command: “:SrXXXXXXXXX#”

Response: “1”

Defines the commanded right ascension, RA. Slew, calibrate and park commands operate on the most recently defined right ascension.

Command: “:SdsTTTTTTTTT#”

Response: “1”

Defines the commanded declination, Dec. Slew, calibrate and park commands operate on the most recently defined declination.

Command: “:SasTTTTTTTTT#”

Response: ”1”

This command defines the commanded altitude. Move or calibrate commands operate on the most recently defined altitude.

Note: This command could work with all mounts when using with slewing commands. However, when using with synchronization command, this command only works with altitude-azimuth mounts.

Command: “:SzTTTTTTTTT#”

Response: ”1”

This command defines the command azimuth. Move or calibrate commands operate on the most recently defined azimuth.

Note: This command could work with all mounts when using with slewing commands. However, when using with synchronization command, this command only works with altitude-azimuth mounts.

Command: “:SZP#”

Response: “1”

This command will set current position as zero position.

Command: “:SPATTTTTTTTT#”

Response: “1”

This command will set azimuth of the parking position.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ and AA mode and iEQ30 Pro.

Command: “:SPHTTTTTTTTT#”

Response: “1”

This command will set altitude of the parking position.

Note: This command only available to CEM60 series, CEM40 series, iEQ45 Pro EQ and AA mode and iEQ30 Pro.

Miscellaneous

Command: “:FW1#”

Response: “YYMMDDYYMMDD#”

This command gets the date of the mainboard’s and the hand controller’s firmware. The first “YYMMDD” indicates the date of the mainboard’s firmware, the second “YYMMDD” indicates the date of the hand controller’s firmware.

Command: “:FW2#”

Response: “YYMMDDYYMMDD#”

This command will get the date of the RA motor board’s and the Dec motor board’s firmware. The first “YYMMDD” indicates the date of the RA motor board’s firmware, the second “YYMMDD” indicates the date of the Dec motor board’s firmware.

Command: “:MountInfo#”

Response: “0010”, “0011”, “0025”, “0026”, “0030”, “0040”, “0041”, “0045”, “0046”, “0060”, “0061”, “5010”, “5035”

This command gets the mount model. “0010” means Cube II or Cube Pro EQ mode, “0011” means SmartEQ Pro+, “0025” means CEM25(P), “0026” means CEM25-EC, “0030” means iEQ30 Pro, “0040” means CEM40, “0041” means CEM40-EC, “0045” means iEQ45 Pro EQ mode, “0046” means iEQ45 Pro AA mode, “0060” means CEM60, “0061” means CEM60-EC, “5010” means Cube II or Cube Pro AA mode, “5035” means AZ Mount Pro.

Additional information

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

Currently, the maximum speed of CEM60-EC and CEM60 is 840x sidereal rate, the maximum speed of CEM40 series, iEQ45 Pro EQ and AA mode, iEQ30 Pro, CEM25 series is 1440x sidereal rate.

Initialization sequence

To properly initialize the mount with your software, you must issue the following commands when you establish your link:

:MountInfo#

RS-232 Port settings

Baud Rate: 115200 (For CEM40 series)
9600 (For all products other than CEM40 series)
Parity: none
Data bits: 8
Flow Control: none (does not support Xon/Xoff or hardware flow control)
Start Bits: 1
Stop Bits: 1

Version History

1.0 July 4th, 2014

Initial release.

2.0 August 8th, 2014

This document now applies to CEM60, iEQ45 Pro and later products.

Corrected the wrong response description of “:q#”, “:qR#” and “:qD#”.

“:GAS#” now can determine if the mount is at zero position.

Guiding rate has been expanded from [0.10, 0.80] * sidereal rate to [0.10, 0.90] * sidereal rate.

Changed response of “:GEC#”, “:GAC#”, “:Gg#”, “:Gt#” and “:AG#”.

Changed the following set commands: time zone, local date, local time, longitude, latitude, custom tracking rate, target right ascension, target declination, target altitude, target azimuth.

Added set hemisphere command “:SHE0#” and “:SHE1#”.

Added auto search zero position command “:MSH#”.

Added set zero position command “:SZP#”.

“:AH#” has been removed.

2.5 January 15th, 2019

Updated the list of support devices.

Updated initialization sequence.

Update RS-232 Port settings.

“:GLS#” now supersede “:GAS”, “:Gg#”, “:Gt#”,

The response of “:AG#” has been changed.

Changed the following set commands: guiding rate “:RG”, custom RA tracking rate “:RR”.

Added get parking position command “:GPC#”.

Added get and set maximum slewing speed command “:GSR#” and “:MSR”.

Added get and set altitude limit value command “:GAL#” and “:SAL”.

Added get and set meridian treatment command “:GMT#” and “:SMT”.

“:V#” has been removed.

“:GAS”, “:Gg#”, “:Gt#” and “:RDsmn.nnnn#” has been removed.