

CELESTRON HC HAND-CONTROLLER LOGS

This log shows the commands between the PC running the Guidestar software and the HC hand-controller. Please note that the log was always only unidirectional, i.e. only the signals from the PC or to the PC were logged at a given time by using the program NexCmd. I did use a simple switch to alternate the directions and so check the response of the HC hand-controller.

PC checks link to HC:

The next command is sent by the PC to check whether the HC is present:

[06,80,66,E0]

If the HC does receive the request and is ready it responds by:

[00,00,00,E0,00,00,06,80]

This respond may vary depending on the status of the encoders in the base unit of the telescope (i.e. whether the telescope did move after power on or not).

Setting Backlash:

When setting the backlash values in the setup menu of the Guidestar software or when exiting the setup menu the following command is sent from the PC to the HC:

[98,80,00,00,00,9E,80,00,00,00,F8,E0,00,00,00,FE,E0,00,00,00]

This string is actually sent if all backlash values are set to 0.

In the next example the values for AZM+ and AZM- backlash were both 15, the values for ALT+ and ALT- were both 10.

[98,80,00,00,FE,80,9E,80,00,00,FE,80,F8,E0,00,00,98,80,FE,E0,00,00,98,80]

Another example shows the command sequence for AZM+=0, AZM-=15, ALT+=5, ALT-=25:

[98,80,00,00,00][9E,80,00,00,FE,80][F8,E0,00,00,66,80][FE,E0,00,00,86,E0]

It consists of 24 hex commands. Each of the 4 blocks represents the backlash settings for the telescope set in the Guidestar software. The sequence is:

AZM+, AZM-, ALT+, ALT- (different to the GT controller backlash values in both directions can be set, e.g. AZ right and left !)

The length of the 4 blocks is not constant ! The first 2 commands are constant but then the actually length for the value to be transferred depends on the value.

Backlash numbers as proposed by Guidestar to the telescope:

Set Backslash for AZM+: [98,80]+hex numbers for the value itself

Set Backslash for AZM-: [9E,80]+hex numbers for the value itself

Set Backslash for ALT+: [F8,E0]+hex numbers for the value itself

Set Backslash for ALT-: [FE,E0]+hex numbers for the value itself

By the way, when changing the type of the telescope the command stream does not Change. I achieved the same results for NexStar 60,80,114 and Starguide 114. This means the code values for the different gears (e.g. 1059334) is apparently not sent to the HC hand-controller but only used in the Guidestar software.

Table Backlash value versus hex output

Backlash	Hexcode
0	00 00 00
1	00 00 06 80
2	00 00 18 80
3	00 00 1E 80
4	00 00 60 80
5	00 00 66 80
6	00 00 78 80
7	00 00 7E 80
8	00 00 80 80
9	00 00 86 80
10	00 00 98 80
11	00 00 9E 80
12	00 00 E0 80

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13      00 00 E6 80
14      00 00 F8 80
15      00 00 FE 80

16      00 00 00 E0
17      00 00 06 E0
18      00 00 18 E0
19      00 00 1E E0
20      00 00 60 E0
21      00 00 66 E0
22      00 00 78 E0
23      00 00 7E E0
24      00 00 80 E0
25      00 00 86 E0
26      00 00 98 E0
27      00 00 9E E0
28      00 00 E0 E0
29      00 00 E6 E0
30      00 00 F8 E0
31      00 00 FE E0

32      00 00 00 F8 ??? maybe a bug !? same value as for 46 !
33      00 00 06 86
34      00 00 18 86
35      00 00 1E 86
...

46      00 00 F8 86
47      00 00 FE 86

48      00 00 00 F8
49      00 00 06 F8
50      00 00 18 F8
...
63      00 00 FE F8

64      00 00 00 FE
65      00 00 06 98 ???

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The last 2 bytes are non consistent ... they seem to be inconsistent for some values. I tried 2 different configurations: running Starguide at COM1 and NexSim to check the outputs on COM3 both simultaneously and Starguide on one PC and NexCmd to monitor on another PC.

So we can see that the 5th and the 6th byte repeat with an offset of 16 (hex). Looking at the binary values of this 2 bytes the following table can be set up:

Backlash	hex	dec	oct	bin
0	00	0	0	00000000
1	06	6	6	00000110
2	18	24	30	00011000
3	1E	30	36	00011110
4	60	96	140	01100000
5	66	102	146	01100110
6	78	120	170	01111000
7	7E	126	176	01111110
8	80	128	200	10000000
9	86	134	206	10000110
10	98	152	230	10011000
11	9E	158	236	10011110
12	E0	224	340	11100000
13	E6	230	346	11100110
14	F8	248	370	11111000
15	FE	254	376	11111110

So we can see, the last bit is always 0, counting up from zero there are 2 bits used instead of just 1 bit. A somewhat logic structure is visible but not completely consistent.

Alignment:

Next during the alignment process the Guidestar software asks the user to level the tube. When done the user will hit a button and the PC sends:

[7E,E0]

Then the software asks the user to point the OTA to north. When done the user will hit a button and the PC sends:

[1E,80]

Now the Guidestar software will send the command "slew to the first alignment star" to the HC:

[18,80,1E,80,E0,E6,E0,E0,78,E0,18,80,78,F8,86,98]

During slewing the PC polls the HC with

[E6,80]

and as long the slewing is not finished the HC answers with

[00]

Once the slewing is finished the HC will answer to the polling command with

[FE]

The same procedure will follow for the 2nd alignment star.

Reading the position of the telescope:

After the alignment is finished the PC will poll the HC hand-controller continuously by sending

[E6,80,66,E0]

The HC hand-controller will answer with the position of the telescope i.e. the encoder values, e.g.

[78,80,80,18,66,FE,06,60,66,98,E0]

or e.g.

[E0,80,18,F8,FE,18,80,9E,86,98,FE]

or e.g.

[00,06,80,86,F8][00,7E,80,78,80]

[00,06,80,86,F8][00,98,66,18]

here I only changed ALT not AZM

[00,06,80,86,F8][06,80,98,18,1E,FE]

slewing ALT further up

[00,06,80,86,F8][18,80,FE,60,1E,E6]

slewing ALT even further up

[78,60,78,66,66][18,80,FE,60,1E,E6]

now only AZM changed counter clockwise

So apparently the length of the response differs again depending on the information to be transmitted. However it is unclear to me how the PC will recognize when the AZM value ends and the ALT value starts ???

Tracking on/off:

If you disable tracking in the Guidestar software the following command is sent from the PC:

[78,80,00,00,00,98,E0,00,00,00]

The HC will not answer/confirm this command.

Once the alignment procedure is successfully done, tracking can be enabled and the PC will send the following command to the HC:

[78,80,00,00,00,FE,98,E0,00,00,60,80]

Goto command:

If a new object is selected and the Goto command button pressed the PC sends the following command to the HC hand-controller:

[18,80,7E,80,06,38,E0,E0,78,E0,18,80,7E,1E,60]

The telescope starts slewing and as during the alignment procedure will respond to the poll command

[E6,80]

with

[00]

as long as slewing is not completed. The HC hand-controller will change the speed during approach on its own. No special command is sent by the PC during that time.

After slewing is completed the HC answers the polling command with

[FE]

The PC starts sending the command

[E6,80,66,E0]

and the HC hand-controller answers the position, e.g.

[7E,80,06,18,7E,F8,18,80,7E,06,66]

This is what I found so far. Comments and questions are always appreciated ...

Kind regards

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