Langenbrettach/Germany, March 4th 2001
Michael Ganslmeier & Matthias Bopp

Connection between hand-controller and base of the GT telescopes (hardware and software)

Hello,

subsequently we will explain somewhat more how the different microcontrollers are interconnected. For simplicity we will use the following naming convention:
uC#1   PIC16C63A in base unit for AZM control
uC#2   PIC16C63A in base unit for ALT control
uC#3   PIC16C63A in HC hand-controller
uC#4   PIC17C752 in GT hand-controller

The Base Unit:
Pins 17 and 18 of uC#1 and uC#2 are connected in parallel. This is the interface to the hand-controllers.

The HC hand-controller:
The RS232 output signal (to the PC) is provided by the base unit of the telescope (uC#1 and uC#2 pins 17), converted by the DS275 in the HC hand-controller and routed to the RS232 jack of the HC. There seems to be no connection of this transmit data line from uC#1 and uC#2 to the input pin of uC#3. This means the microcontroller in the hand-controller does not get any information about the status of the base unit like the position/direction of the telescope. We may have missed a signal in the hand-controller but that's our guess.
The RS232 input signal (from the PC) is routed to the DS275 converter in the HC hand-controller and from there to pin 18 of uC#3. There seems to be no direct connection to uC#1 and uC#2. We did not yet check but we guess the output pin 17 of the uC#3 is connected to the input pins 18 of uC#1 and uC#2 (connected parallel).

The GT hand-controller:
When using the GT hand-controller the RS232 signals are routed again through a DS275 level converting. However all signals are routed from the DS275 to uC#4 and not directly to the base unit. The signals from the base unit (uC#1 and uC#2) are routed to uC#4.

Connecting HC and GT hand-controllers in parallel:
We tested successfully connecting both hand-controllers in parallel. Actually it is physically almost the same as done in the base unit where uC#1 and uC#2 are connected in parallel. Both hand-controllers do work properly however the Guidestar software running on a PC connected to the RS232 port of the HC hand-controller does not respond perfectly (e.g. the acknowledge signals during auto alignment are not recognized by the PC). This was first tested by Mike Swanson. However please note that there may be some risk connecting them in parallel – we cannot give any warranty that this is a safe operation and damage is excluded.

Command set for the communication between Nexstar GT hand-controller and base:
Baud rate: 4800,8,n,1
Inverted signals with TTL-Level
Commands are sent without CRLF
(PRINT #COMx, CHR$(Code1);CHR$(Code2); ....)

| Set backlash: | Azimuth: | 0A 00 00 xx |
| | Altitude: | 1E 00 00 xx |

Set scaling:	(Set maximal count for 360 degrees)	
	Azimuth:	0C xx xx xx
	Altitude:	20 xx xx xx

Arrow keys/Tracking: (xx is speed i.e. FC BF 00 (fast) or 00 00 FF (slow))

	Go Right:	06 xx xx xx 1A 00 00 00
	Go Left:	07 xx xx xx 1A 00 00 00
	Go Up:	06 00 00 00 1A xx xx xx
	Go Down:	06 00 00 00 1B xx xx xx

| Get current position: | Get Azimuth value: 01 |
| | Get Altitude value: 15 |

| Goto position: | Azimuth / Altitude: | 02 xx xx xx 16 yy yy yy --> xx is Azimuth yy is Altitude |

| Get status: | 0D | Status answer: 00 when busy / FF when ready |

Set Tracking vector or arrow keys: 06 xx xx xx 1A yy yy yy --> xx is azimuth speed yy is altitude speed
                                       For example: 06 00 00 69 1A 00 00 4F

End tracking or release arrow keys: 06 00 00 00 1A 00 00 00

| Reset counter (Set Counter to 1): | 03 for Azimuth |
| | 17 for Altitude |

| Stop motors immediately: | 05 for Azimuth |
| | 19 for Altitude |

All known commands sorted by Code:
  Commands for Azimuth:
    01 Read Counter value
    02 Goto xx xx xx
    03 Reset Counter
    04 ??
    05 Stop Goto
    06 Move right xx xx xx (speed)
    07 Move left xx xx xx (speed)
    08 ??
    09 ??
    0A Set backlash xx xx xx
    0B Speed for backlash xx xx xx
    0C Full scale xx xx xx for 360°
  Commands for both Axis:
    0D Read Status
    0E Length of ramp for Goto xx xx xx
    0F ??
    10 ??
    12 ??
    13 ??
    14 ??
  Commands for Altitude:
    15 Read Counter value
    16 Goto xx xx xx
    17 Reset Counter
    18 ??
    19 Stop Goto
    1A Move up xx xx xx (speed)
    1B Move down xx xx xx (speed)
    1C ??
    1D ??
    1E Set backlash xx xx xx
    1F Speed for backlash xx xx xx
    20 Full scale xx xx xx for 360°

No warranty that these data are complete / correct. Please take care when experimenting with the hardware.

Kind regards

Michael & Matthias

Email: DD1US@AMSAT.ORG   Homepage: http://www.dd1us.de