CELESTRON HC HAND-CONTROLLER INFORMATION

Today I received from CI a complimentary HC hand-controller for my 114GT telescope. It works fine with the Guidestar 2.1 software on my Windows PC and my NexStar114GT. Please note this is the simple hand-controller without the LCD display.

Here is some information on the internals of the HC hand-controller:
It is powered from the base unit in the telescope and receives from there +12V. In the HC controller a voltage regulator stabilizes the +12V to +5V. There are 2 further ICs inside: a PIC16C63A micro-controller from Microchip and a DS275 RS232 transceiver chip from Dallas Semiconductors.

Information about the PIC16C63A:
PIC16C63A is an EPROM-based 8 bit micro-controller. It contains 4096x14 words of program memory, 192 bytes of user RAM and 5 MIPS performance @ 20MHz. It includes Brown-Out-Reset (BOR), Power-On-Reset (POR), three timer/counters, two Capture/Compare/PWM modules and two serial ports. The synchronous Serial Port can be configured as either a 3-wire Serial Peripheral Interface (SPI™) or the 2-wire Inter-Integrated Circuit (I2C™) bus. This device also features a Universal Synchronous Asynchronous Receiver Transmitter (USART) which is also known as a Serial Communications Interface (SCI).

The PIC16C63A has 22 I/O pins with 25mA source/sink per I/O. These pins are used to control the 5 LEDs of the HC controller (additional NPN transistors are used as switches) and as inputs from the 6 buttons of the HC hand-controller. It is in a 28-pin SOIC package.

Information about the DS275: It is a RS232 transceiver IC which converts the TTL/CMOS signals (digital 0V low, 5V high) to RS232-E compatible signals and vice versa.

The intent of the DS275 is not so much to meet all the requirements of the RS-232 specification as to offer a low-power solution that will work with most RS-232 ports with a connector length of less than 10 feet! As a prime example, the DS275 will not meet the RS-232 requirement that the signal levels be at least ±5 volts minimum when terminated by a 3 kOhms load and VDRV = +5 volts.

Typically a voltage of 4 volts will be present at TXOUT when spacing. However, since most RS-232 receivers will correctly interpret any voltage over 2 volts as a space, there will be no problem transmitting data. To generate the negative output levels it steals the negative voltage from the RXin line. I think it will work with most RS232 compatible devices but there may be problems with some older ports and/or longer cables.

The RS232 output signal (to the PC) is provided by the base unit of the telescope, converted by the DS275 and routed to the RS232 jack.

There seems to be no connection to this transmit data line from the base unit to the micro-controller of the HC hand-controller. This means the micro-controller in the hand-controller does not get any information about the status of the base unit like the position/direction of the telescope.

The RS232 input signal (from the PC) is routed to the DS275 converter and from there to pin 18 of the PIC16C63A in the hand-controller. There seems to be no direct connection to the base controller.

My guess of the purpose of the PIC in the hand-controller is as such:
It senses the buttons of the hand controller for any inputs. These inputs are decoded (up, down, backlash adjustments etc) and used to control the base unit. Simultaneously it is also monitoring the RS232 input signals from the PC and converts them to commands for the base unit.

There is a single control output line from pin 17 of the PIC micro-controller running to the connector of the base unit. Here the commands to the base unit are sent (without any direct feedback from the base unit).

HAND CONTROLLER PIN-OUTS

The signals on the 6-pin connector between the base unit and the hand-controller are shown in the next table. The PIN numbers refer to the connector inside the HC hand-controller ! The colours

PINOUT (connector inside the HC hand-controller)	PINOUT (connector at the end of cable which goes into base unit)	WIRE	FUNCTION
1	1	White	Ground
2	2	Black	TXD (serial data sent from base unit to hand-controller)
3	6	Blue	Ground
4	4	Green	RXD (serial data sent from hand-controller to base unit)
5	5	Yellow	Ground
6	3	Red	+12V power supply from base unit to hand-controller)

Please note that the serial data are TTL/CMOS levels and not RS232 levels!

No warranty is implied that this data is complete or correct. Please take care when experimenting with the hardware.

Any questions and comments are appreciated.

Kind regards

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