

Controlling the NexStar 4/60/80/114 Series Telescopes Fully Remotely

Introduction:

Remote controlling the little NexStar telescopes has been discussed in the NexStar Yahoo Group since their introduction approx. 3 years ago. The latest GT hand-controllers do actually allow to control the telescope via the RS232 port of a PC or a PDA. After an alignment of the telescope using the menus of the GT hand-controller you can activate the RS232 port and subsequently control the telescope using Goto commands. However you cannot fine tune the telescope remotely – you need to use the direction buttons of the hand-controller.

Some testing and trials:

Thus I started to debug the protocol between the hand-controller and the base of the telescope. However I did not fully decode it and only when Michael Ganslmeier stepped in we finally managed to fully understand the protocol and the functions. Meanwhile Michael Swanson gave valuable hints on how to mimic the direction buttons by changing the tracking rate of the telescopes. These hints were given for the new GPS series telescopes and can be found at <http://www.nexstarsite.com/PCControl/NewGPSCCommands.htm>. We could finally adapt them also to the smaller NexStar telescopes.

The solution:

When bypassing the alignment of the GT hand-controller and fully remote control the telescope from a remote site we were facing the challenge of implementing the 2 star alignment or auto alignment on the PC. Being too lazy to work all this out Michael Ganslmeier and I finally managed to use the Celestron „GuideStar“ software and create a software plug-in to add the „direction button“ functionality. This means we use the „GuideStar“ software to align the telescope and also initiate Goto commands and have a small additional window with the directional buttons on the PC screen to fine tune the telescope (left-right-down-up). Thanks to Michael’s program “ArrowKeys4GS” it actually looks like it is all one piece of software. It runs under Windows 2000/XP, it is not working under Windows 98/ME.

Unfortunately the original GT hand-controller cannot be used to apply our approach. Yet we can offer 3 solutions how to get there:

- 1) If you have a HC hand-controller you are already there. Just use it and connect it to the PC by a RS232 cable.
- 2) You can slightly modify your GT hand-controller. The modification does not affect the functionality using the hand-controller „stand alone“. Please note that after the modification the „normal“ remote control of the telescope by the RS232 port does no longer work because the protocol to be used is changed.
- 3) You can build a small interface circuit and substitute the hand-controller completely. This circuit is connected to the base unit instead of the hand-controller and connects the base unit directly to the PC.

Subsequently you find explanations to the different hardware solutions including information to the RS232 cable as well as a description of how to install and operate the software.

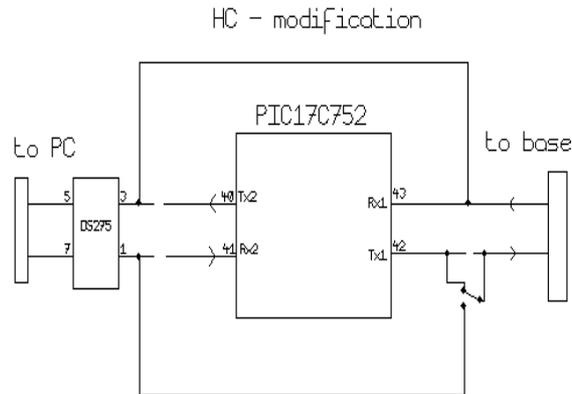
HC hand-controller:

For some time Celestron sold the little NexStars as a low budget version with a „HC“ hand-controller instead as the „GT“ hand-controller. As far as I know only very few of them were sold in Europe but quite some of them in the US. Even more were sold under the TASCOS brand name (models Starguide 60/80/114/4) and maybe you can get hold of a used one. As mentioned above, if you can get such a HC hand-controller you are set – no need for any modifications of the telescope. Below you find a picture with the HC hand-controller on the left and the GT hand-controller on the right side.



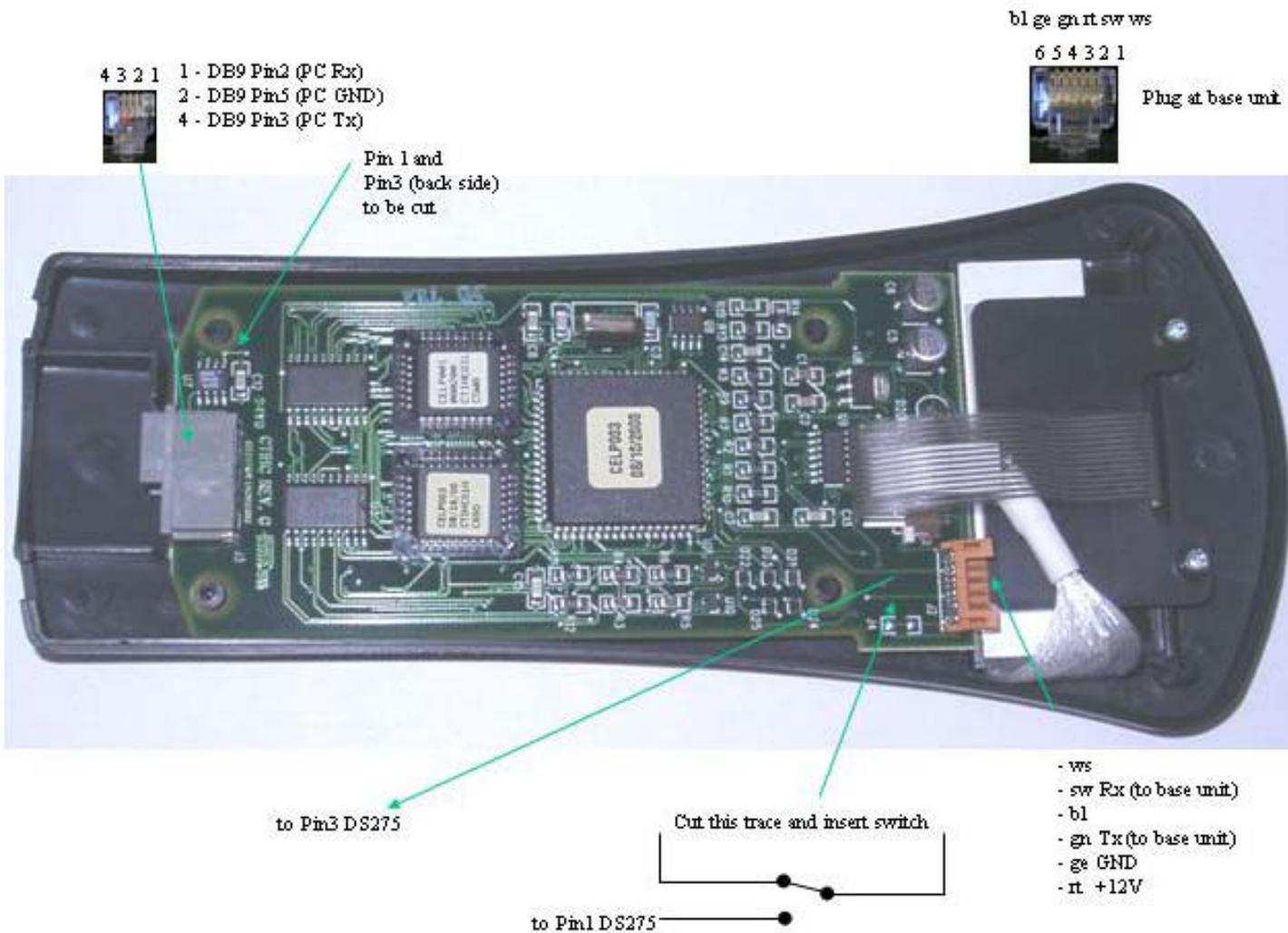
Modification of a GT hand-controller:

If you know how to use a soldering iron you should not have a problem to make the necessary changes inside your GT hand-controller. However be aware that you will definitely loose you warranty of the telescope! Essentially you only have to cut some traces on the PCB of the hand-controller and insert a switch with some wires (see the diagram below).



After the modification you can switch between „stand alone mode“ of the telescope (i.e. you align and control it with the hand-controller) and „remote control mode“ (i.e. you can fully remote control the telescope with your PC). Below please find a picture with instructions for the modification. Please note the colours are:

1=white(ws), 2=black(sw), 3=red(rt), 4=green (gn), 5=yellow(ge), 6=blue(bl)



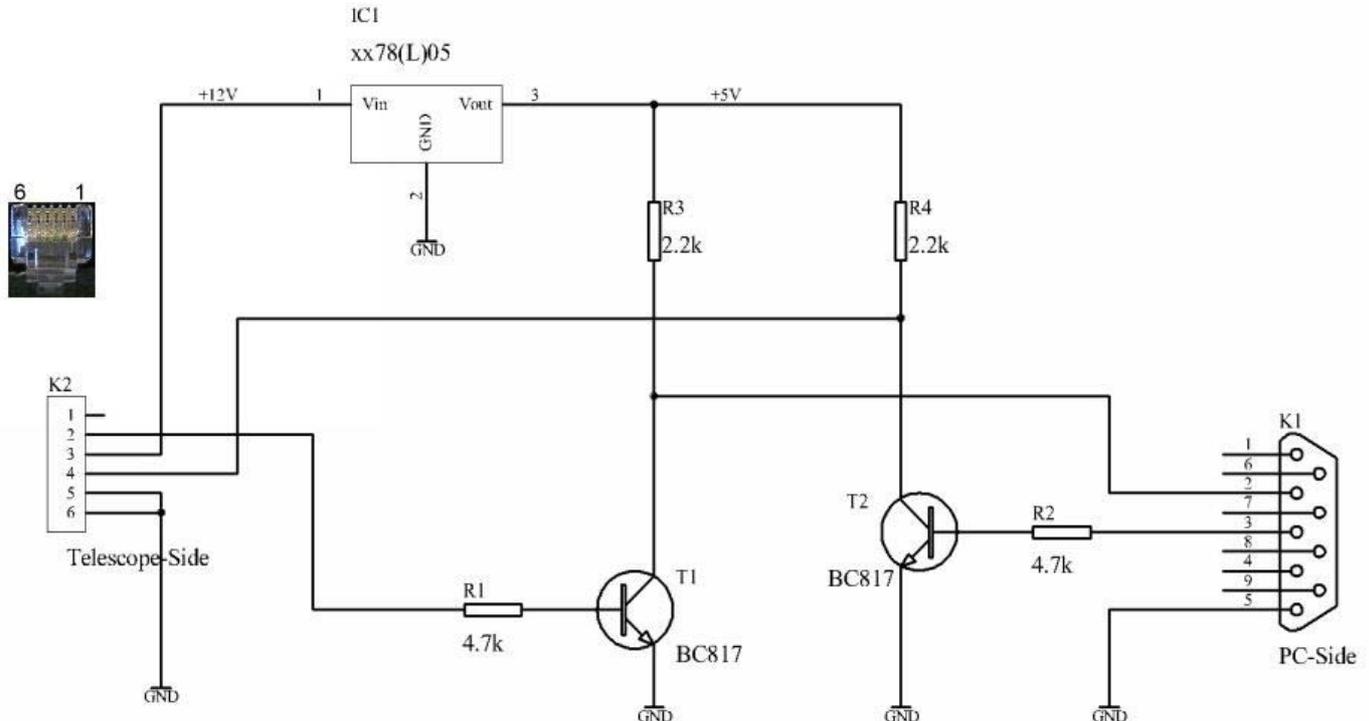
Finally please see 2 pictures of the hand-controller after the modification.



By using a multi pole/through switch you should be able to modify the hand-controller also in a way, that you can switch between “original mode” and “new remote control mode”. However we have not yet verified this in hardware.

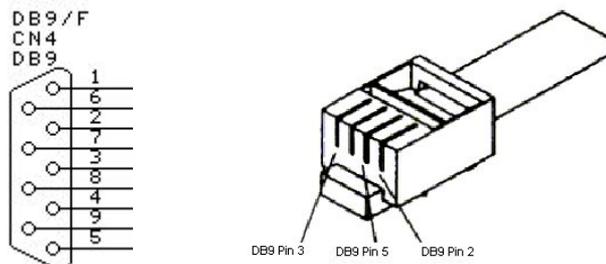
Simple Interface Circuit:

The third solution is a small electronic circuit you need to build. Below you find the schematic of a simple interface. No external power supply is needed, the circuit is powered by the base unit of the telescope. Because this interface does not provide true RS232 levels it may not work with some PCs. However from our experience it should work with most of them. We recommend putting the PCB in a small plastic casing to insulate and protect it.



Cable between telescope and PC:

The RS232 cable for connecting the telescope to the PC is the same for the NexStars 4/5/8/60/80/114. You can buy it at Celestron and their dealers. If you are fond of home-brewing you may build your own cable. The signals at the plug going into the NexStar hand-controller are shown below..



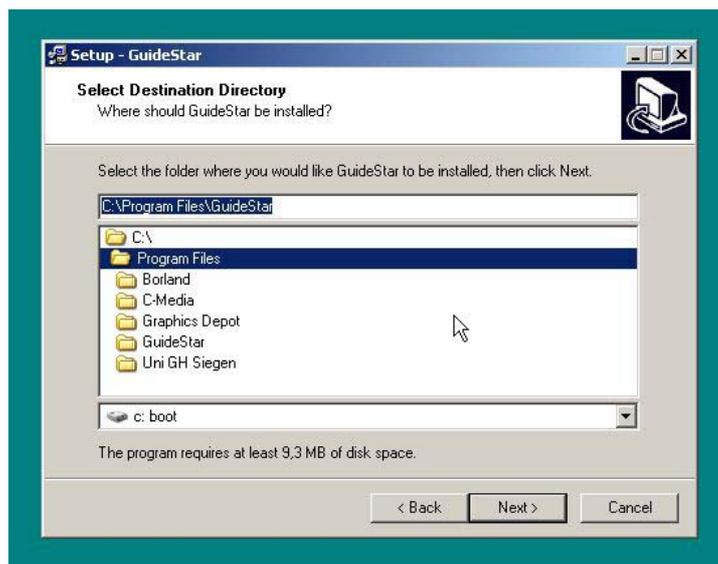
A very comprehensive description can be downloaded from Mike Swanson's NexStar resource site at <http://www.nexstarsite.com/PCControl/RS232Cable.htm>. He also offers a list of hints if you experience problems with the communication between the telescope and the PC at <http://www.nexstarsite.com/PCControl/PCControlProblems.htm>.

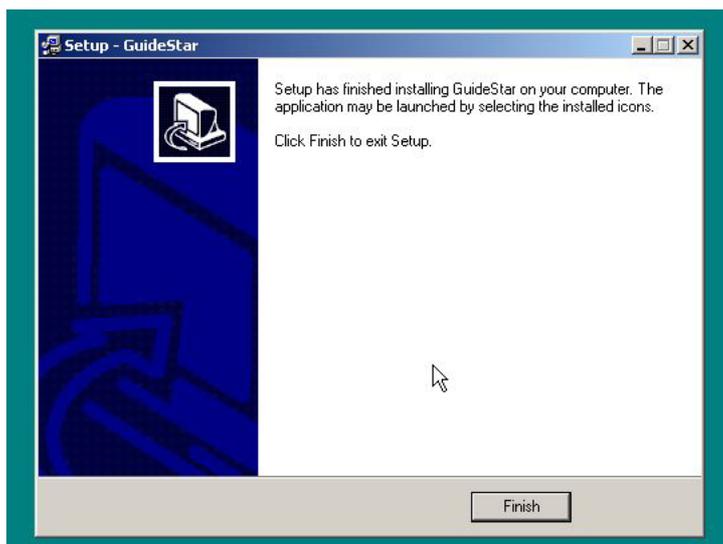
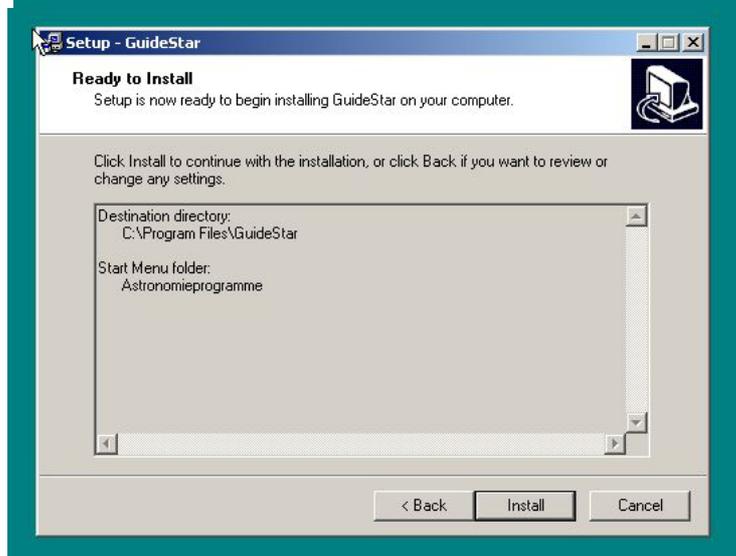
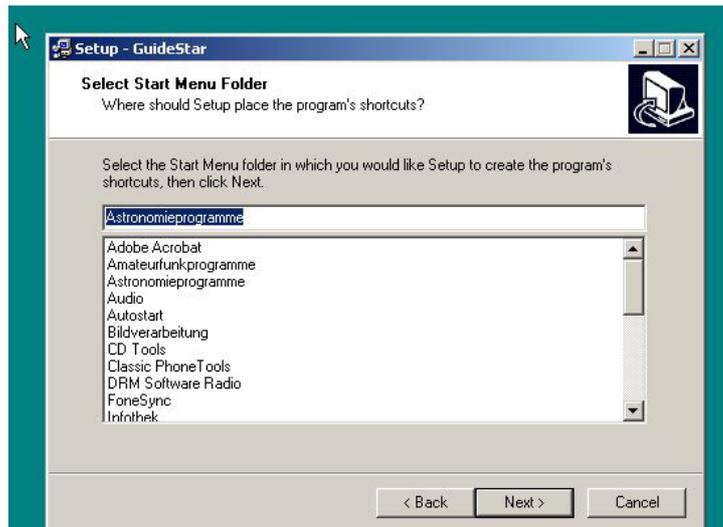
How to install the software:

The „GuideStar“ software was shipped for a while with the NexStar telescope but Celestron meanwhile ceased to distribute it. I got permission from Celestron to freely distribute the software and you can download it from my homepage <http://www.dd1us.de>. Please note, that you can download the software free of charge but Celestron Inc. continues to hold all rights of the software.



The full software package is called "GuideStar_Setup.zip" and is 5.1MByte large. After downloading this .zip-file please unpack the installation program "GuideStar_Setup.exe" into an empty folder (e.g. c:\copybox). Next you start this installation program to install the programs "GuideStar" and "ArrowKeys4GS" and the necessary auxiliary files. The default directory "c:\program files\GuideStar" must not be changed. If you have "GuideStar" already installed you need to download only the small file "ArrowKeys4GS_only.zip" from my homepage and unzip it to "c:\program files\GuideStar".





After the installation you can delete the file "GuideStar_setup.exe" in your temporary folder (e.g. c:\copybox\). Please do never move the files but leave them in the directory "c:\program files\GuideStar" even when installing the software "GuideStar 2.1" on a PC running a German version of Windows (probably every non-US revision). Furthermore you must not set the Windows PC's country settings to German (again non-US). When changing to English (USA) it seems to work fine. If the country settings are set to German the RA/DEC values from the window "change information" are wrong converted to the used RA/DEC values in the window "information". Another small "bug" we noticed testing

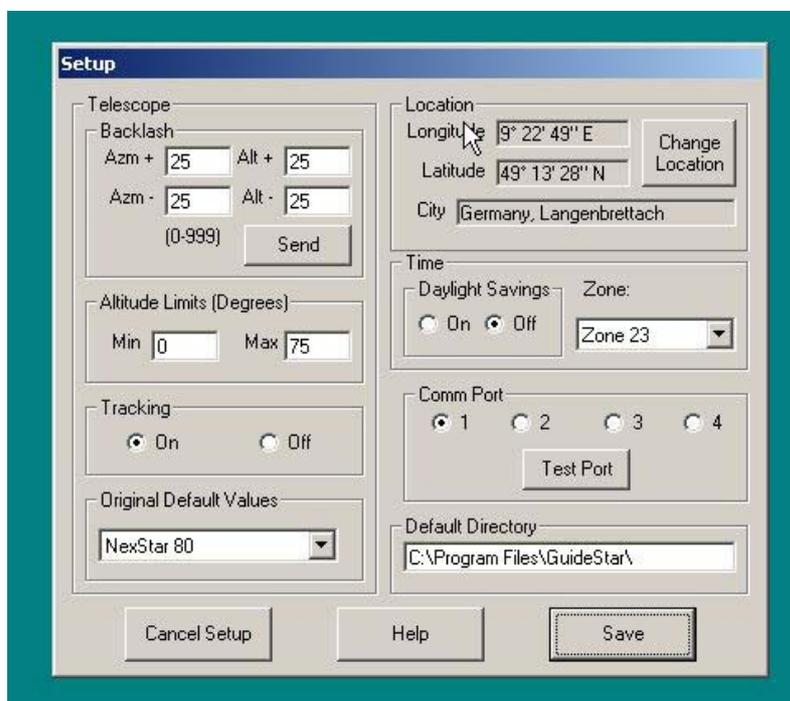
“GuideStar” was the fact, that it is not completely removed out of memory when exiting the program. You can see this in the Windows task manager. However we have not noticed any problems associated with this behaviour.

How to use the software:

Now you can either start “GuideStar” and “ArrowKeys4GS” manually or just start the Batch file “GuideStar remote.bat” which you can find in the same directory and automates the launch of both programs together.

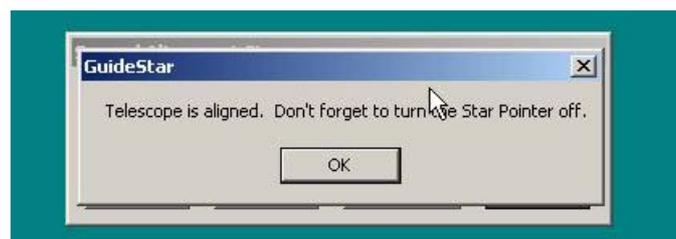
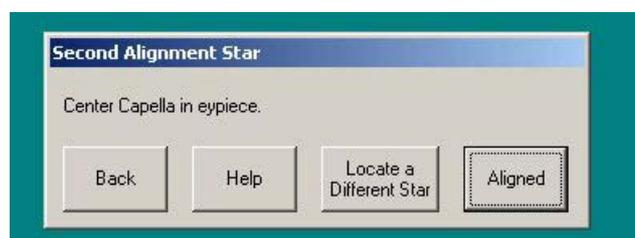
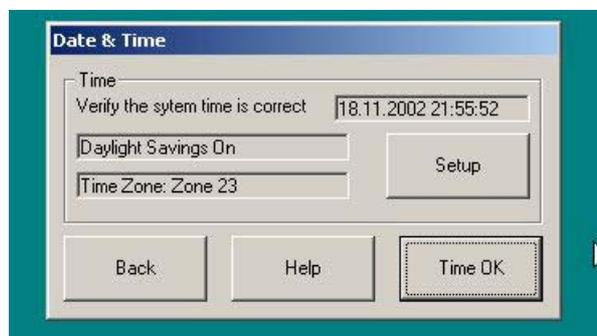
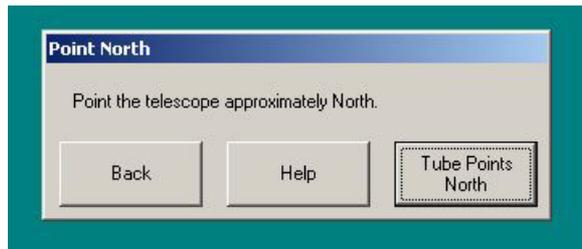


Of course you have to configure the „GuideStar“ software when you use it first time. Simply go through the setup menu and enter your location, time zone incl. daylight savings status, comm port number of the PC and your telescope model.

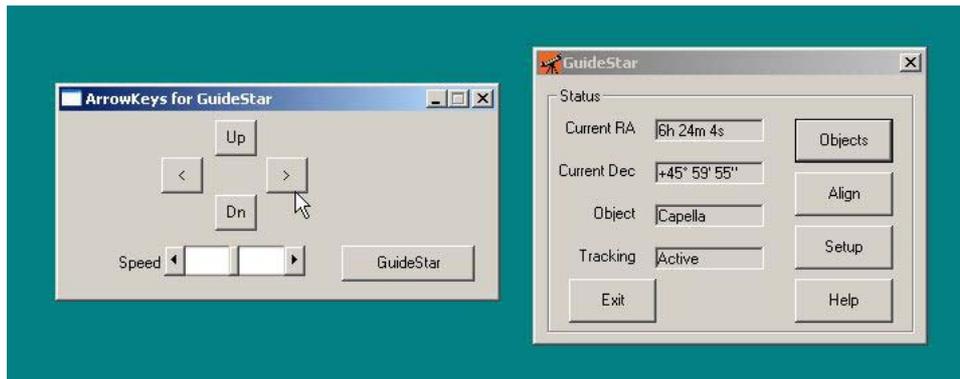


Once you saved these parameters they will be used as default for future alignments of the telescope. With the software using the time of the PC the alignments become thus very simple and fast. Next you need to align the telescope. The „GuideStar“ software offers the same auto-alignment procedure as the GT hand-controller but with an improved menu.

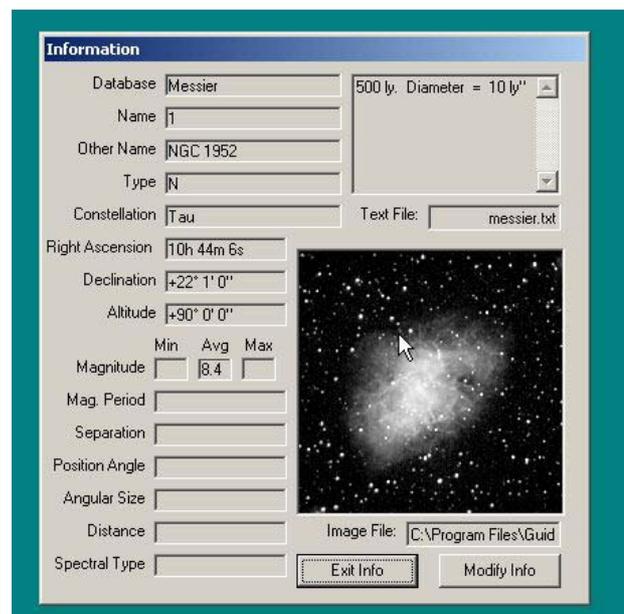
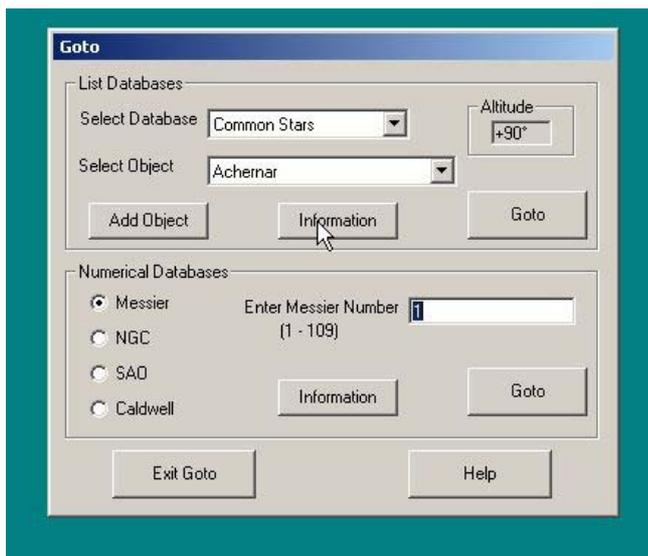




After alignment you can use „GuideStar“ alone or the auxiliary program along with it. Below please find a screen shot of the „GuideStar“ program (right) and the small auxiliary program “ArrowKeys4GS” with the direction buttons (left).



You can actually either use your mouse to click on the direction buttons or use the direction buttons on your keypad. Make sure numlock is deactivated. You can press two direction buttons simultaneously (e.g. right and up). With the slider "speed" in the "ArrowKeys4GS" window you can control the speed of the telescope. Once initiated a command from the program "ArrowKeys4GS" the program "GuideStar" is in a kind of hibernation mode (without losing the alignment). However the tracking mode as defined in "GuideStar" is still active thus you can Goto an object, track it and center it with the direction buttons of the PC. If you want to send new commands from "GuideStar" (e.g. send a new Goto command or change the tracking mode) please first click on the button "GuideStar" in the window "ArrowKeys4GS" and then use the program „GuideStar“. The program „GuideStar“ offers quite some nice features – you should really give it a try. The next screenshots give you examples of the Goto menu as well as an information window for some of the objects.



You can jump between both programs as often as you want. Please note that the two programs do communicate properly using Windows 2000 and XP, they are not working together using Windows 98 and ME. It looks like the used hibernation mode in „GuideStar“ cannot be used in some Windows versions, sorry! If you test it with other Windows versions we kindly ask you to share your experience with us and the other NexStar users.

What's missing?

Now that you can control your telescope remotely you also want to watch the sky remotely. You can attach a web- or video-camera to your eyepiece/instead of your eyepiece. The live pictures can be transferred to a TV/video screen to watch it or to a frame grabber card in your PC for further processing. There are many nice programs available to process such signals like integrating, noise reduction, enhancements.

What comes next?

Well, of course we want to get rid of all the wires between the telescope and the PC. You can find an article on my webpage (<http://www.dd1us.de>) showing a 2.4 GHz radio link to transmit the video signal from the telescope to you. An RF link for the RS232 control signals is under investigation and will be published once we succeed ;-)

Acknowledgement and Disclaimer:

We cannot take any guarantee that the instructions and the software is error free. All modifications as well as the operation of the software are at your own risk.

We want to thank Celestron for allowing us to offer the „GuideStar“ software download free of charge. Please note, that Celestron Inc. maintains all rights at the „GuideStar“ software. We think that this is a great gift from Celestron Inc. to the NexStar community.

The auxiliary program is provided as „beerware“. You do not have to pay any money to us but should once pay a cold drink to one of the key contributors of the NexStar Yahoo Group (too many to name). If you are interested in the source code of the program “ArrowKeys4GS” you may send a request to the authors.

For further information please first have a look at <http://www.dd1us.de>. The most recent versions and additional information are available there. We publish this information hoping it will help other users having even more fun with their NexStar telescopes. If you can give us additional information or have any questions please feel free to send an Email to Michael Ganslmeier (Michael.Ganslmeier@t-online.de) and/or Matthias Bopp (dd1us@amsat.org).

Kind regards

Michael & Matthias