

**PROGRAM LX: COMPUTERIZED VARIABLE STAR OBSERVING**

**John M. (Jack) Nordby**  
 P.O. Box 465  
 Moorhead, MN 56561

*Presented at the 84th AAVSO Spring Meeting, May 13, 1995*

**Abstract**

A DOS/Windows 3.1 computer program performs many routine tasks to plan, facilitate, and automate visual variable star observing.

**1. Introduction**

This observer used the star-hopping technique with various telescopes for years and was quite content. However, in 1992, I purchased a Meade Instruments ten-inch LX200 telescope so that stars could be tracked in altazimuth mode, allowing high powers to be used, and observations to be made while comfortably seated, with the telescope resting on a 25-inch high mount.

I originally intended to continue this method of star-hopping by manually moving the telescope to most stars and to use the keypad to key in star numbers or coordinates only for difficult ones. Unfortunately, I found that the LX200 would lose alignment whenever it was unclamped, so it was necessary to use the keypad for slewing. This was slow, awkward and frustrating. It was actually faster to unclamp the LX200 and use it manually. Other telescopes were even faster.

In order to bring the LX200 up to speed, I designed a computer program to run the telescope via its serial port. I wanted to have the telescope slew to a star just by typing its name, for example, "SS Cyg." It seemed even better if it could also just go down an ASCII text file of variables and slew the telescope to each in turn without even typing names but just by hitting the <enter> key as needed. This would allow an observer to follow an easily changed yet consistent plan night after night merely by keeping the charts in the same order. This was done and has been used since July 1993.

Later it seemed useful for the same program to skip recently observed long period variables, calculate Julian dates, and allow entry of estimates into the same computer while observing, saving the observations to disk in AAVSO format so they are ready to be used later to prepare a monthly report.

Still later, it seemed useful for the same program to list all the stars in the text file along with their altitudes and azimuths for any time, date or location. This would allow an observer to determine easily the best times to observe them and to arrange all charts in the best order so as to save time and minimize movement. Such a list could also show sun and moon altitudes and azimuths as well as moon phases so as to avoid moon and twilight.

All of these ideas and many more have been developed in PROGRAM LX. Success is exemplified by results on the night of September 12–13, 1995. On that night, PROGRAM LX allowed this observer to make 162 estimates despite a waning gibbous moon, using charts for nearly all observations. This is more than three times what I had ever achieved using any other method. Annual totals have more than doubled, even though approximately 30% of observations made during the past two years have been inner sanctum observations, some in the sixteenth magnitude range.

During October to December 1995, the program was massively debugged and updated to conform to the new 1995 AAVSO data format while maintaining the familiar

ease of data entry.

## 2. PROGRAM LX basics

Program LX is IBM-compatible and comes on a 3.5-inch 1.44 megabyte floppy disk accompanied by related files. (These files should be copied into an empty directory on one's hard drive or solid-state drive, depending on the computer being used.) For the time being, the AAVSO program KSOLOREP also must be present in the directory when preparing monthly reports. To examine PROGRAM LX, one can type "LX" from the DOS prompt of that directory, or from Windows 3.1, execute Alt Run, and then enter the directory and "LX" when prompted. DOS is best.

Best results are achieved when using PROGRAM LX with an LX200 telescope, yet the horizontal coordinate values have been used to easily point both a Celestron C-8 and a homemade refractor, used while unclamped in altazimuth mode, making a nice substitute for star-hopping. The program successfully slews an LX200 using a Toshiba T1900C laptop, a T1000SE laptop, and a Prolinear MiniNote palmtop computer having the maximum memory configuration. It will run slowly on an HP200 LX pocket computer having 2 MB memory, but so far the HP hasn't been interfaced with the LX200 for slewing.

## 3. A typical night's run

First the telescope and computer are set up and connected via the RS232 serial port before being switched on. The computer is housed in an insulated box with plexiglass top and front. A hinged door provides fast access to the keyboard.

The telescope is switched on, and the LX200 alignment procedure is completed, using the LX200 keypad.

The computer is then switched on, and PROGRAM LX is started. The observer sets the computer clock per instructions, which also sets the LX200 clock. He chooses the active disk drive and chooses "Y" to record observations to disk. Then as the program performs tasks such as file backups, the observer readies his charts. A red filter covers the computer screen.

When the program is ready, the observer may type "FF" to show altitudes and azimuths for stars, to decide which to observe. Otherwise, the observer now begins by entering the name of the first star or group corresponding to the first star chart, then hits <enter> twice. The program searches, then the telescope slews to the star if coordinates exist and if the object is within the specified altitude and azimuth parameters. Thereafter, a search isn't required because each star in "var.fil" comes up in sequence and hitting <enter> twice slews the telescope to each in turn. LPV's are skipped if they were observed within the last seven days, but this can be overridden. To jump to another part of the sequence, one can enter the appropriate name as described above.

Each time after slewing to the star, while the estimate is being made, the program screen shows in large letters the designation, star name, and, as one option, the ever-changing altitude and azimuth readout, used for pointing some telescopes.

As soon as the observer makes an estimate, he hits the <enter> key to time precisely the observation, bringing up the data entry screen. The observer then enters the magnitude estimate, comparison stars, chart data, and other optional data. The designation, name, and Julian decimal date will be recorded automatically without user input.

Hitting the <enter> key enters the first line of data and brings up an extension to the data entry screen with up to 63 spaces for optional extended remarks (minus whatever space has been already used by keycode standard remarks). Hitting <enter> again will bring up the next star in the program, and the cycle repeats. Hitting <enter> twice more

causes the next slew. By the time the observer reaches the next chart, the telescope is usually at the next star.

This cycle is used over and over to obtain high observing totals. In actual use it goes much faster and more smoothly than this description might suggest. The method has been continually improved using dozens of field trials.

The observer can choose to have the program automatically generate keycodes and extended remarks for twilight and moon conditions according to calculated existing conditions. While in this mode, some shortcut words such as "haze" or "smoke" can be used instead of keycodes. The program then automatically puts the proper keycodes and extended remarks into AAVSO data format.

Entering chart scale immediately after the magnitude estimate can substitute for placing it at the right of the screen, where it can be updated with the rest of the chart data.

At the end of the night, one enters "Q" to quit the program, after which it performs a few tasks, including file backups.

A separate sort and report program for PROGRAMLX is planned. Meanwhile, at the end of the month, LXREPORT is run. It rapidly splits the month's observations into small files and calls KSOLOREP to sort these and prepare AAVSO report files on disk in order to assure conformity with AAVSO data requirements. Diskettes are submitted, and hard copy is usually submitted as backup.

Users of older LX200's can use bright alignment stars to resynchronize coordinates to insure that variable stars will be centered in the eyepiece. One can also use continuous automatic realignment using each variable star itself.

#### **4. Some additional PROGRAMLX capabilities**

- a. Keeps a running total of sanctums and of all observations.
- b. Can quickly call up recent observations of a star before or after slewing to it, to help identify a variable. This function also calls up AAVSO predictions for some stars.
- c. Can put charts on screen for some stars, suggesting the possibility of eliminating paper charts in the future.
- d. Sounds audible alarms for moon rise or set, and for twilight.
- e. Color computers can be set to red on black for night vision.
- f. Allows direct entry of new variable stars and coordinates into database while observing, and slews to them.
- g. Will show a large Julian Date clock to four decimal places.
- h. Altitudes and azimuths are recorded for each observation.
- i. Informal observing notes can be made at any time.
- j. Can slew to deep sky objects for supernova search by using common nicknames, such as "Whirlpool" or "Sombrero," when the ROM chip or text file includes objects under their usual NGC or Messier designations.

Suggestions, feedback, and criticism are welcome as the program continues to evolve. To obtain a copy of the program, or for more information, please contact the author at the address above.