# Digital Setting Circles

**Introduction**

There are two issues with regard to using DSC's. Firstly there is the accuracy, secondly ease of use. Most potential users will require a higher degree of accuracy than can generally be obtained with manual circles. Unless they have used DSCs they might not be sure about how easy (or difficult) they are to use.

Anyone contemplating buying one of the 'calculator' style of DSC would be well advised to consider one with an RS232 option - this allows them to be used with many of the star charting programs. Check that they will interface to more than one program too! See also the review of Sky Commander on these pages.

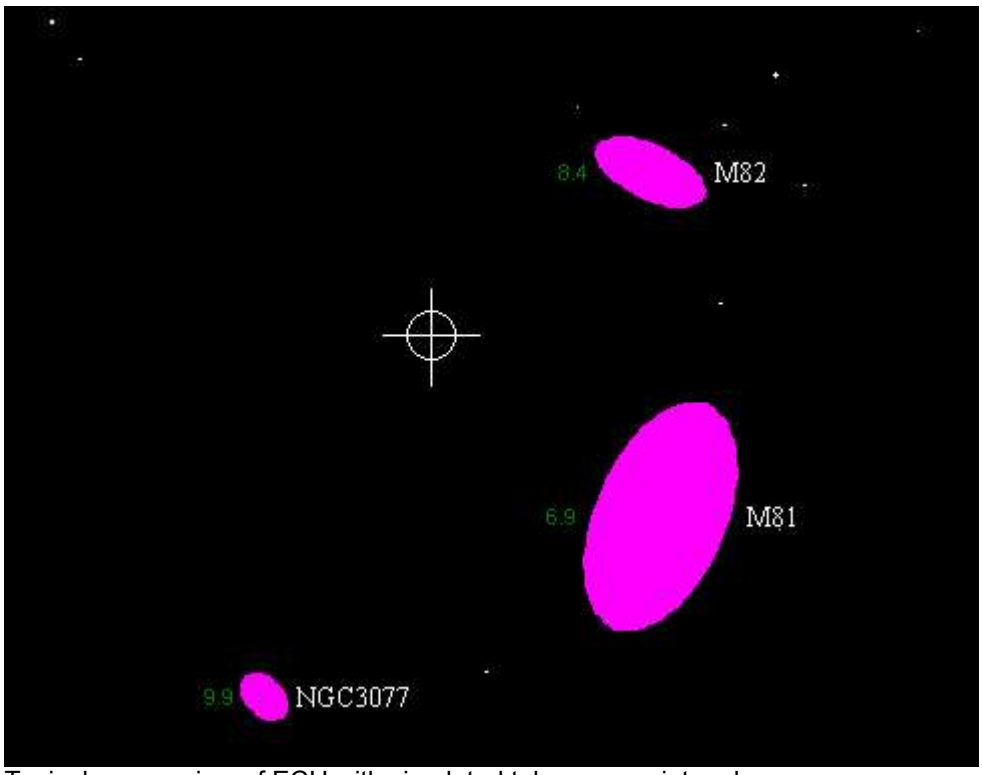
My experiences may not be typical, but hopefully they will enable potential users of DSC's to ask the right questions before parting with hard earned cash.

The original observatory telescope (a fork mounted Newtonian) didn't have an accessible ra drive shaft to easily fit circles to, a common problem with telescopes not produced for a wide market. For this reason we chose not to try fitting circles to that unit. The replacement telescope is a second hand Meade LX6/2120 (10 inch F6.3), it came with two different sets of second hand DSC's.

The LX6 mount has been replaced with a Losmandy G-11, this was ordered with the Losmandy encoder kit and is a significant improvement on the rather flimsy JMI encoder mounting arrangement (shown above right) that was used on the LX6.


The most useful addition has been JMI's SGT-MAX digital circles. These consist of a pair of encoders, an interface to RS232 and all the necessary brackets and cables to both fit the circles and connect them to a computer. This second hand SGT-MAX was manufactured between 1989 and 1993 -it may not be available in quite the same form today. The Losmandy encoders are geared 2:1 and provide 4096 steps per revolution of each axis. These equate to roughly 0.09 degrees per step. The interface box is powered by a PP3 (MN1604) sized alkaline battery which gives around 30 to 40 hours use. Software Bisque also supply a 'Bbox' interface that is similar (if not the same) to the JMI SGT-MAX. Nova Astronomics (the ECU people) have their Micro Guider which is purpose made to work with ECU. These units are programmed by their associated star charting program to match the encoder resolution. I have an early version of 'The Sky' but find ECU better value for money. ECU can program the SGT-MAX.

Note that currently (July 2000), only ECU and 'The Sky' will work with JMI and similar interface units.



Typical screen view of ECU with simulated telescope pointer shown

**The following comments refer to using SGT-MAX with ECU...**

First of all, how accurate are 4096 step circles? In theory it should be possible to align on one star and then find any object in the sky for hours on end. The reality is that telescopes aren't perfectly built either optically or mechanically. There is often mechanical play in the mount and movement of the main mirror. These movements contribute to potential errors with any type of setting circles. Another source of error can be polar alignment. However, with DSC's it's possible to use two star alignment - this allows the circles to be used regardless of polar alignment (or even with alt-azimuth mounts). The one star alignment is more convenient when used in an observatory as you don't have to rotate the dome to a second star.

Using **two star alignment** has problems when used with an equatorial mount used in a confined space, eg. close to a house, or looking through the slot of an observatory dome. The accuracy depends on the two stars being well spaced in *both* ra and dec, this can prove difficult to achieve in limited space. However, in practice you are able to select any stars visible; these can be either side of the wanted object. An example is finding M13 in Hercules: pick Arcturus and Vega as alignment stars (these are to either side of M13). This placed M13 near the centre in a 20mm eyepiece.

Using **one star alignment** does require accurate polar alignment, however it's benefit is the simplicity of use. Here is a step by step guide to setting ECU at the start of a session:

1. Pick any easy to find star by left clicking the mouse button over it. Don't pick one near the pole!

2. While the star details box is still open on screen, select miscellaneous, telescope, alignment stars, 1st alignment star and click the left mouse button. The star details are retained at power down, so you don't need to keep selecting a fresh star at each session.

3. Click on the telescope symbol. A menu drops down.

4. Choose to set the scope at 0 or 90 degrees (I'm assured by David Lane, the author of ECU, that doing this improves the pointing accuracy).

5. Select one star alignment.

The program now places a cross over a previously chosen alignment star. Point the telescope at that star and click on 'OK'. Moving the telescope moves a cross in a circle around the screen, when the cross moves over the screen's edge the background map moves to re-centre the cross on the screen.

The alignment star(s) can be any shown on screen.

If the object you wish to view isn't visible in the eyepiece, point the telescope to any nearby star you can identify on the screen. Centre in the eyepiece and click on the corresponding star on screen. A menu drops down, select 're-sync'. The circle and cross jump to that star. You are now re-aligned, it's that easy!

Given fairly accurate polar alignment this is what you might expect to achieve with one star alignment...

After aligning on Altair (in the south), moving the scope to Comet Linear S4/1999 near Ursa Major (in the north), placed it within the field of view of a 26mm eyepiece on a Meade 10" f6.3 SCT (mounted on a Losmandy G-11 mount). If the wanted object wasn't visible, it is easy to re-sync on a nearby star. With the aid of re-synchronizing any object in the sky can be placed near enough to the centre of a low power eyepiece.

Slowly moving off an object and returning without having 're-synchronized' elsewhere, does sometimes produce a slight error. In practice this isn't so bad as to cause concern. I can find any object in the sky (and place it onto my CCD camera) with these digital circles. It only takes a minute or two. Even if the object isn't on the CCD, or even centred on it, the program doesn't forget where you are pointing the scope and allows you to move a small distance and return to the same location. Note that due to the limited resolution of 4096 step encoders, at maximum zoom levels the cross hair pointer appears to step to the left and then jump back, this is quite normal and doesn't mean any loss of accuracy.

One area that sometimes causes me confusion, is to remember to start the session with the scope on the west side of the mount, pointing south. If I try and set the digital circles in operation with the scope 'the other way around' on the German equatorial mount (i.e. pointing north west), the declination movement is reversed on the star chart. The program can be 'reversed' but it's easier to start with the scope pointing south then the software will accommodate the 'reversed' scope without needing anything to be changed.

One point to consider is the large amount of data on some of the star chart programs. Megastar, for instance, contains more than 200 MB of data on a CD-ROM. While this is fine for use with a home pc, you might not be able to handle such an amount on a notebook or low cost second pc in an observatory. The shareware version of ECU takes little more than a megabyte of disk space. On the ECU CD-ROM, there is a 'limited size' floppy version that can be installed using between 7 and 9 MB of hard disk space.

Another consideration is the capability, and cost, of the observatory pc. I'm currently running a very cheap laptop computer that has a broken floppy disk drive (that's why it cost next to nothing) and no CD-ROM drive. It's running Windows 95 on a 100 MHz 586 with 16 MB of ram. I easily managed to transfer the main parts of ECU using a parallel cable connection to my home PC, some of the other software may require a more complex laptop or PC...