Astronomy Club of Asheville

Using Digital Setting Circles with Your Telescope

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Digital Setting Circles

Just What Are They?

- Digital Setting Circles (DSCs) are an accessory piece of equipment for telescope mounts that help observers accurately locate objects in the night sky.
- DSCs utilize digital read-outs (viewed on a small CPU screen) to guide the observer on where to point ("push") the telescope on its mount > a "push-to" (not a "go-to") system.
- First introduced in the 1980s.
- DSCs use the celestial coordinate system.

How Astronomers Find Objects in the Sky

- Earth is mapped with a coordinate system of latitude and longitude.
- Asheville is approximately located at latitude 35° 36m North of the equator and 82° 30m West of the prime meridian.
- Similarly, the sky is mapped with a coordinate system of declination and right ascension.
- Declination is the equivalent of latitude, and right ascension is the equivalent of longitude.

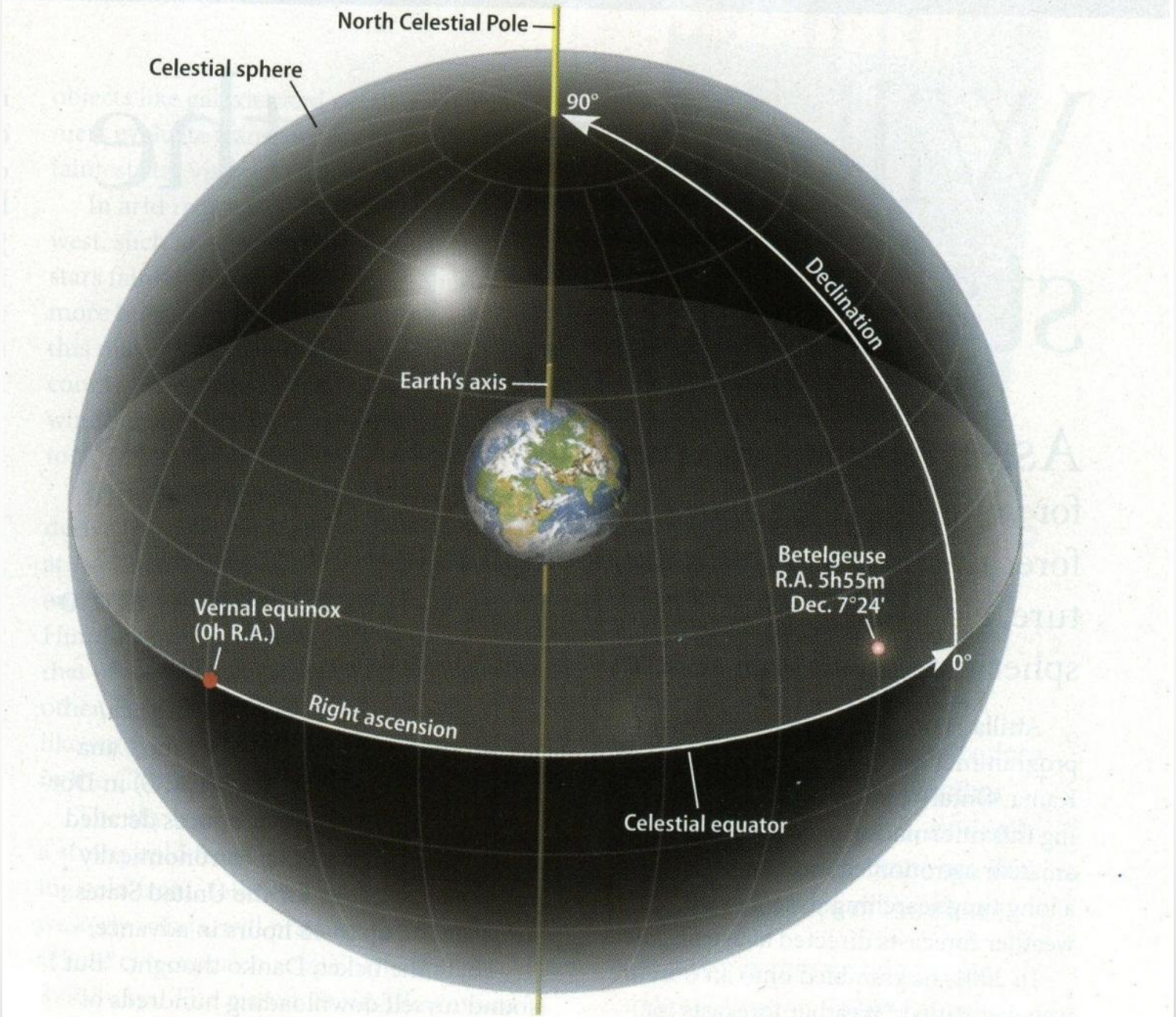
How Astronomers Find Objects in the Sky

- **Declination (DEC)** marks an object's position in relation to the celestial equator. The **celestial equator** is an extension into the sky of earth's equator.
- Objects on the celestial equator are designated 0 degrees. Objects lying north of the celestial equator range in designation from 0 to +90 degrees at the North Pole.
- Objects south of the celestial equator are designated from 0 to -90 degrees at the South Pole.
- Each degree is broken down into 60 minutes, and each minute into 60 seconds.

How Astronomers Find Objects in the Sky

- **Right ascension (RA)** marks an object's position across the sky "west to east" (right to left) along the celestial equator.
- Right ascension is recorded in a 24-hour system of hours, minutes and seconds.
- Right ascension begins measurement with 0 hours at the vernal equinox in the constellation Pisces. Remember that the **vernal equinox** is where the ecliptic and the Sun cross the celestial equator in March.
- Right ascension proceeds for 24 hours, from west to east along the celestial equator, before returning to the vernal equinox.

Understanding celestial coordinates

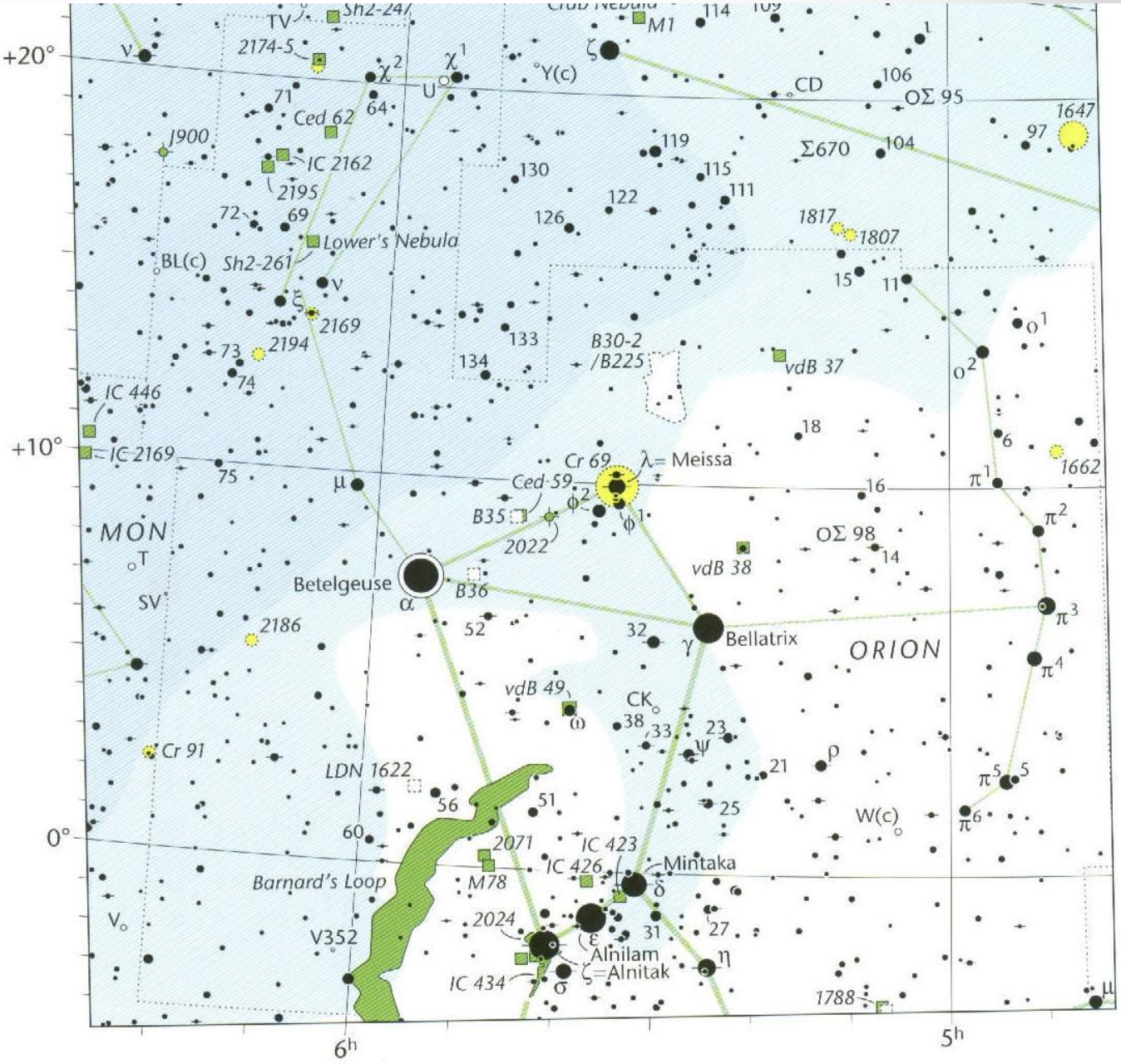


RA and DEC on a Star Chart

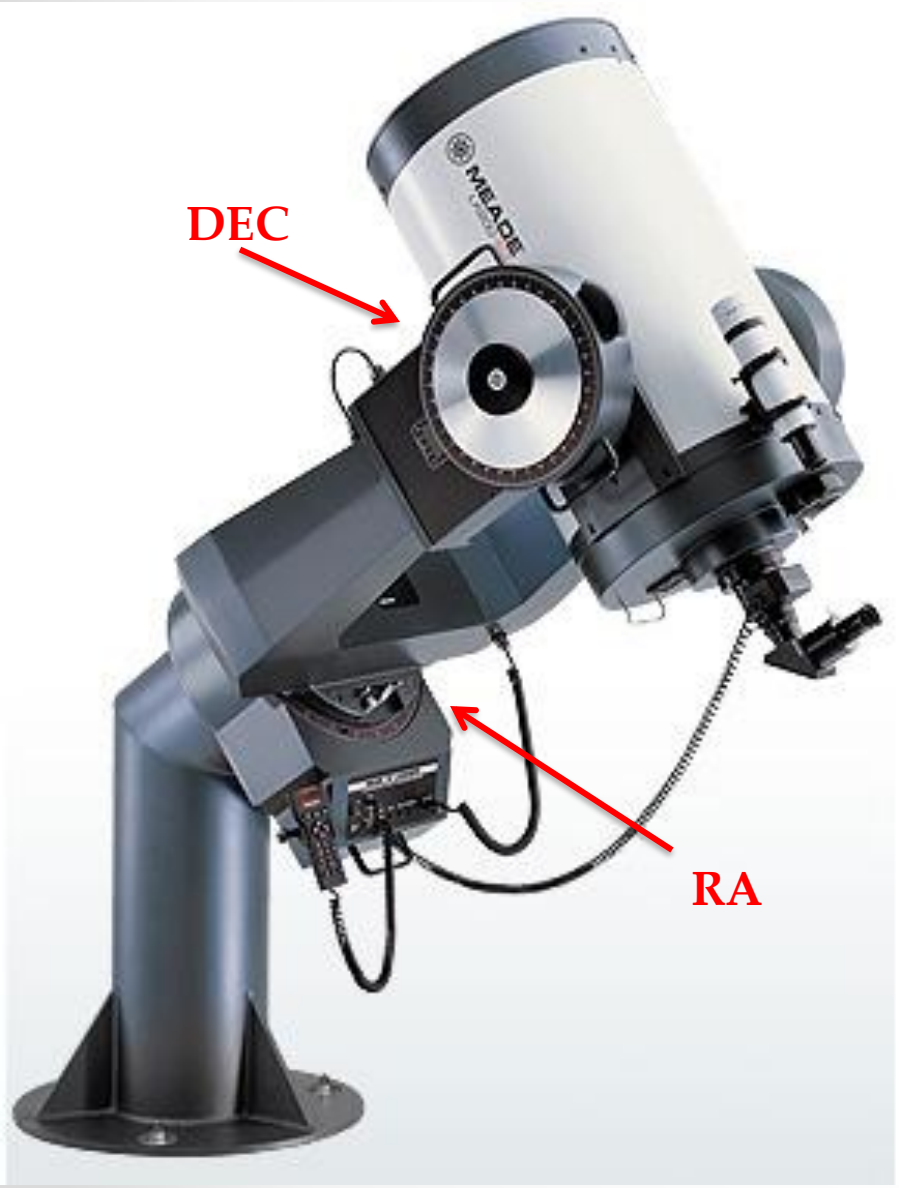
- Notice that the RA coordinates increase from west to east (right to left).
- Notice the DEC coordinates are positive above the celestial equator.
- All objects in the sky have a celestial address.
- Betelgeuse =

  RA: **5h 55m**

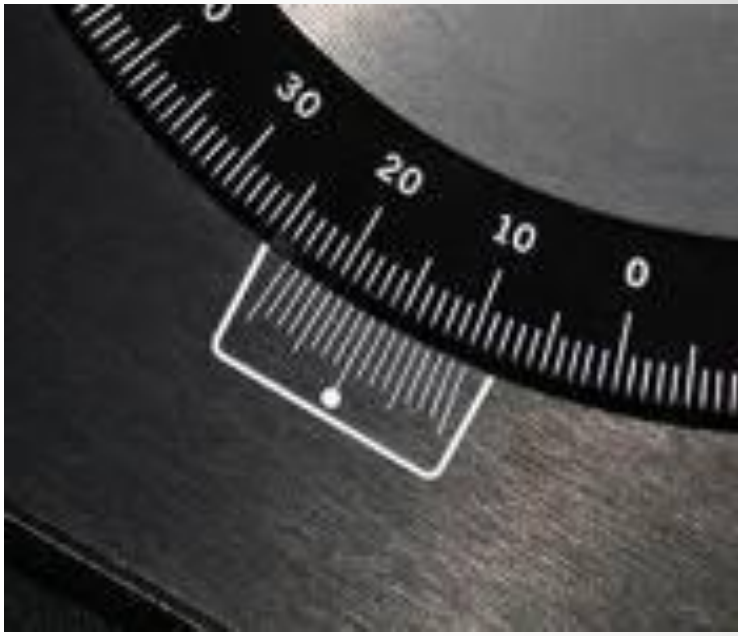
  DEC: **+7° 24m**



Analog Setting Circles



DEC
Circle >



RA
Circle >



Why Use Digital Setting Circles

- Even the most experienced observer can benefit from DSCs.
- It speeds up your time (over “star hopping”) in locating objects, especially faint objects.
- Light pollution can make many celestial objects difficult to locate.
- If you are doing outreach, you will minimize wait time for your guests.
- DSCs are much more accurate than mechanical, analog, circular setting circles that come on many telescopes.
- DSCs are easy to use.

Differences Between DSCs and Go-To Telescopes

- Go-To telescopes, once initialized, may not be used in “manual mode” without requiring re-initialization to enter “go-to” mode.
- DSCs allow you to switch between uses with or without the DSCs, and no re-initialization is required.
- For someone who knows the night sky, this can be a very nice feature.
- Both systems have a large database in their CPUs of the many objects in the night sky, including the planets.

Components of the DSC System

1 . CPU with celestial database. Most of them use a 9V battery. Lithium batteries perform much better in cold weather, and last longer.

2. Encoders.

3. Cables and attachment hardware.





Words of Caution about DSCs

- Make sure that your mount will take the encoders by contacting the mount manufacturer, the encoder manufacturer or both.
- Make sure the encoders will be compatible with your CPU.
- It's generally a good idea to purchase the encoders, CPU and attachment hardware from the same manufacturer.
- Not all telescope mounts will adapt to using encoders and hence can't use a DSC system.

The DSC CPU

- DSC CPUs vary in their CPU capacity and functions.
- Some have a celestial database (library) as small as a couple hundred objects, others up to 30,000.
- Databases usually include the planets, and catalogs of all 110 Messier objects, some or all the NGC and IC objects, many binary stars, and other indexed objects.
- In cold weather these CPUs can have performance problems.
- Consider using lithium batteries and/or an eyepiece dew-heater, wrapped around the CPU.
- Beware of battery power running low!
- Always bring a spare battery.
- Many DSC CPUs have a RS232 cable interface to connect to your computer for updates and programs.

The RS232 and USB Adapter





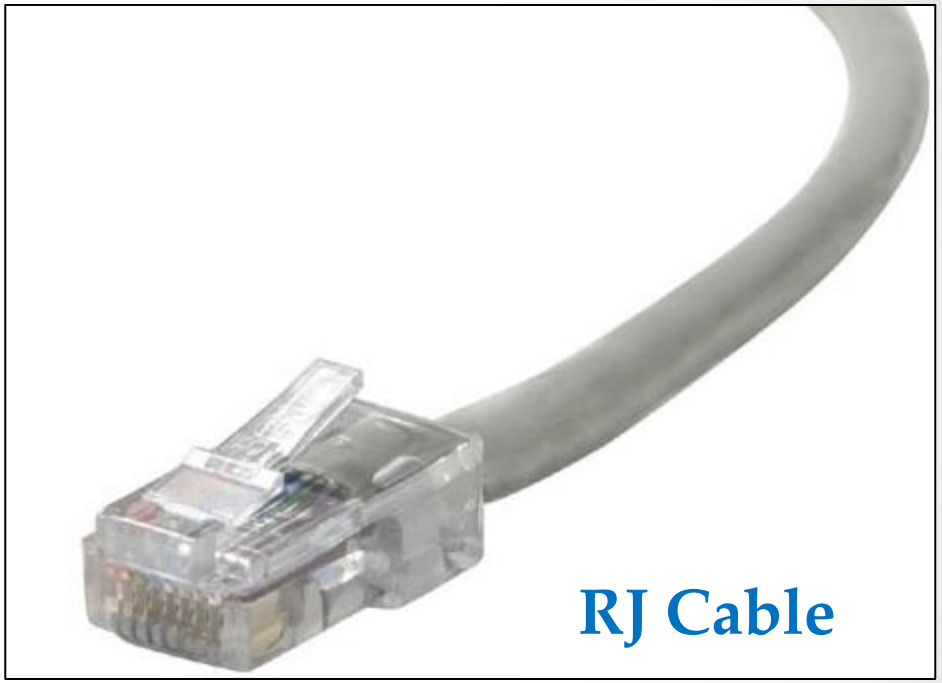
These cables are used for updates of the DSC CPU via a computer with an internet connection.

The DSC Encoders – Motion Counters

- A telescope mount has 2 axes, for example, altitude and azimuth for an alt-az mount.
- DSC systems use 2 encoders: one for each axis.
- Encoders, along with their mechanical gears, act as "step counters" that record the tics, steps or pulses of the mount's motion along with the mount direction.
- The higher the encoder pulses per revolution the more accurate the encoders will be.
- An encoder with 4,000 pulses per revolution of the telescope axis, will yield accuracy of about 5 arc minutes --- 21,600 (the arc minutes in a circle) divided by 4,000.
- An encoder with 2,000 pulses would result in half that pointing accuracy.

The DSC Cabling and Attachment

- Encoders are usually connected to the CPU with RJ socket cables, resembling modular telephone outlet cabling and plugs.



RJ Cable

- Cables and the CPU must be attached to the telescope mount securely.



Velcro

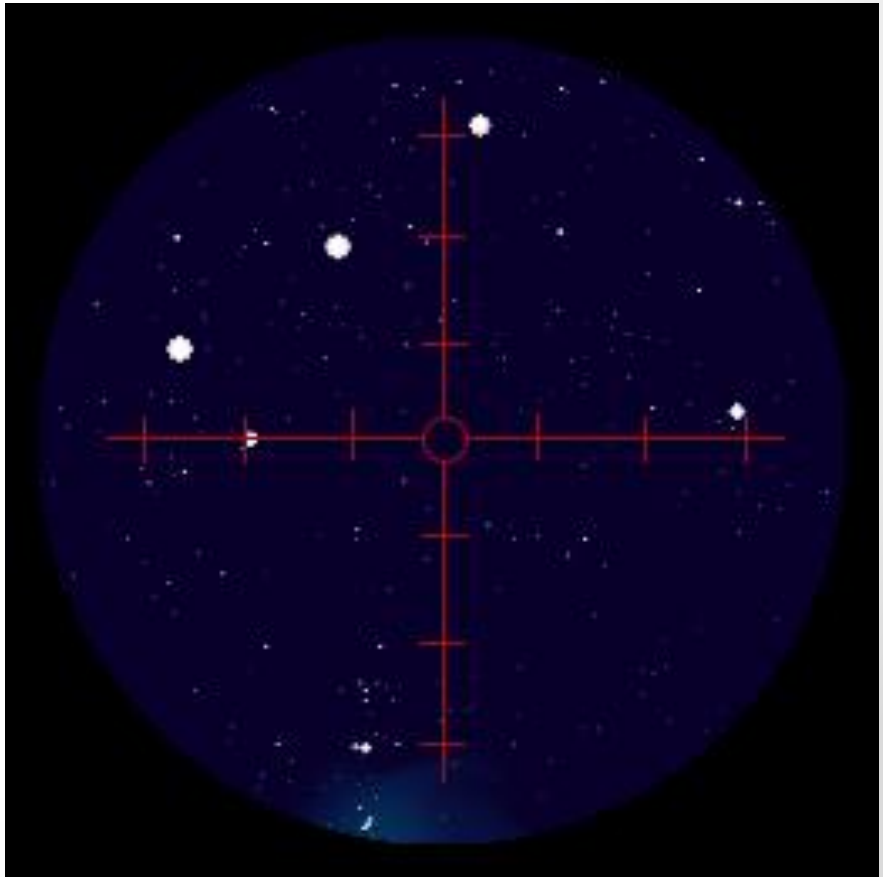
Initializing the DSC System

- Your tripod/mount should be reasonably level.
- Besides increasing the accuracy of the DSC computer, it increases the balance and stability of the telescope.
- The initialization varies somewhat from one DSC manufacturer to another, but the process is very similar to that used with many "go-to" telescopes.
- For locating the planets, you must enter a date into the CPU.
- You usually have to select 2 bright alignment stars in the night sky – do not select ones that are at the zenith or along the horizon. These 2 stars must be in the CPU alignment star database.
- For best accuracy try to pick 2 stars that are at least 60 degrees apart in the sky.

Initializing the DSC System

- Use of an eyepiece yielding magnification of 75x or more increases the accuracy of the alignment process.
- Use of an illuminated reticle eyepiece increases the accuracy even more.





Other Common Features of a DSC System

- "Identify" function
- "Realignment" function
- "RA/DEC" function
- "Favorites" function

Manufacturers and Prices
(Updated Nov 2026)

- Astro Devices carries the Nexus line which run from $230 to $460.
- Astro Sytems also sells the Nexus pro with prices running from $440 to $800.
- TeleVue's Sky Tour package is no longer available, but some encoder kits are still sold by major scope dealers.
- Obsession Telescopes sells a DSC system for their high end Dobsonian reflectors. Complete DSC packages for these "Dobs" run $975 installed.

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