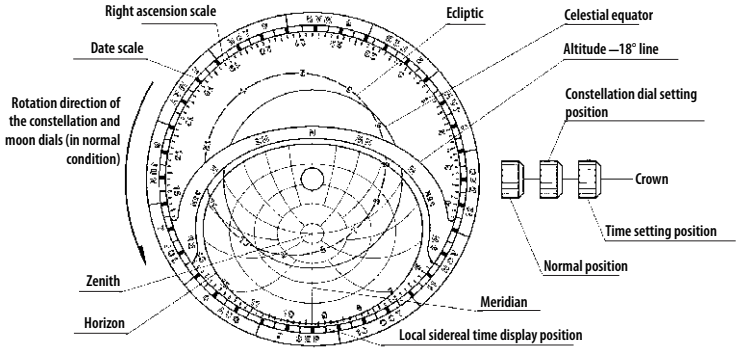
- To see details of specifications and operations, refer to the instruction manual: 4391/4394 instruction manual

Component identification

- Actual appearance may differ from the illustration.
- The crown has two positions when pulling it out.

Constellation dial (displaying the entire sky at 35°N)



- Distortion is minimal in the northern hemisphere and approximately 97.4% of the celestial sphere visible at 35°N is displayed. (The display range of the constellation dial: declination from -55.57° to +72.28°)

Setting the time

1. Pull the crown out to position 2 when the second hand points 0 second.

The second hand stops.

2. Rotate the crown to set the time.

- Move the hands 4 or 5 minutes forward and move them back to the right time to set the time more precisely.

3. Push the crown in to position 0 in accordance with a reliable time source.

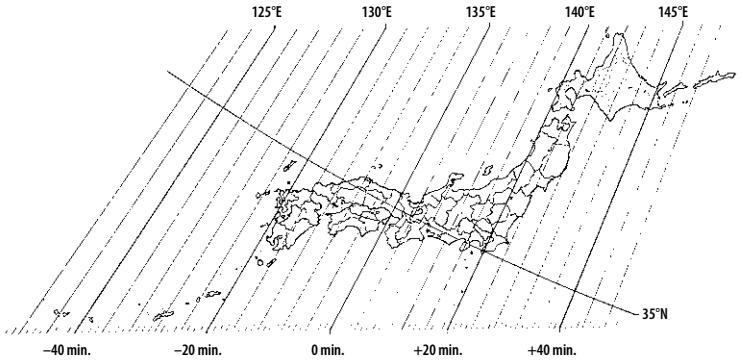
The second hand starts moving.

Setting the constellation dial and the moon dial

1. Find the time difference in local sidereal time from the difference between the longitude of Japan Standard Time and that of your observation place.

- +1° of longitude difference results in about +4-minute time difference.
- You can find the time difference in local sidereal time at your observation place through the difference between the longitude of Japan Standard Time (135°E) and your place using the figure below.
  For example, in places near Tokyo (the longitude of Japan Standard Time +5°), the time difference becomes 20 minutes (= 5 (degree) x 4 (minute)).

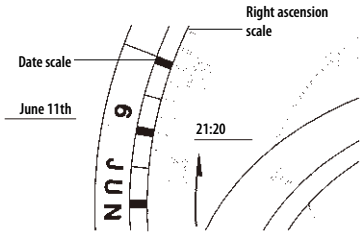
Difference from the longitude of Japan Standard Time and time difference



2. Pull the crown out to position 1.

3. Rotate the crown to set the constellation dial.

- Set the time of the day on the right ascension scale to the corresponding date on the date scale compensating the time difference found in step 1.
  Ex.: In a place of 140°E on June 11th 21:00 (compensated time: 21:20)



- Finally rotate the constellation dial clockwise to finish the setting.

4. Push the crown in to position 0.

- Each mark of the date scale on the dial is inscribed with setting each day's noon of universal time of the mean year (21:00 Japan Standard Time) as the center of the mark. The 1st, 11th and 21st of each month are indicated with a thick line, and the 6th, 16th and 26th are indicated with a thin line.
- In the period when the right ascension scale on the constellation dial is hidden, set the +2 hours of the current time on the right ascension scale to the target date of the previous month.

Main features

- The constellation display shows 452 fixed stars of visual magnitude 4.0 or brighter (maximum magnitude values for variable stars) in increments of 0.1 and in four colors by spectral type. In addition, 119 major nebulae, star clusters and galaxies, the delimitations of constellations, the ecliptic, and the celestial equator are shown based on their positions as of the year 2000.0.
- The constellation dial not only displays the current positions of constellations but also functions as a planisphere in which the constellation dial is independently rotated.
- The solar position display shows, in the form of spaces along a broken line, the position of the sun along the ecliptic (the sun's apparent path on the celestial sphere during the year) on the 1st, 11th, and 21st of each month (for 12 noon Universal Time over the mean year). You can see the times for sunrise and sunset by looking at the horizon line on the dial.
- The azimuth and altitude display feature shows the azimuths and altitudes of the major fixed stars, nebulae, star clusters and galaxies on the celestial sphere. The altitude line, with intervals of 20° on the dial, compensates for refractions.
- The local sidereal time display is convenient for finding the positions of constellations. Reading the right ascension scale that lays below the meridian on the dial allows you to find the local sidereal time.
- The astronomical twilight indicator lets you identify the hours of increasing darkness, a function especially useful for astronomical observations. Using the sun's position on the ecliptic and the -18° altitude line on the dial (with reference to 35°N), you can find the beginning and end of astronomical twilight.
- The polar star hour display lets you align an astronomical telescope to the polar axis. The right ascension values of the polar star for every 10 years between the year 2000.0 and 2050.0 is displayed with marks on the constellation dial. The angle that is measured counterclockwise from the meridian direction of the transparent dial to the position equivalent to the current right ascension value of the polar star is the polar star hour angle.
- The celestial sphere near the turning center of the constellation dial is not displayed because it is hidden under the hands.

Indication of the constellation dial

- In principle, the fixed stars are displayed by color in the categories below, based on the spectral types.

Spectrum type of fixed stars	Displaying color	No. of stars
O type and B type	Bluish silver	128
A type and F type	Silver	134
G type and K type	Yellowish silver	161
M type	Reddish silver	29

- The fixed star magnitude is displayed near the right ascension scale of 2 - 3h on the constellation dial.
- Nearby stars (including multiple stars) that are difficult to separate on the constellation dial are displayed with a combined magnitude. The color and position are displayed according to the spectral type and position of the main star (the star that appears brightest).
- Variable stars are displayed on the constellation dial at their maximum magnitude. Note that variable stars are not separately identified on the constellation dial.
- The main nebulae, star clusters and galaxies are displayed in light green.
- The star clusters of Pleiades and Hyades are shown together in the fixed star group.

Nebulae, star clusters and galaxies on the constellation dial

M31(And) NGC752(And) M72(Aqr) NGC7009(Aqr) M2(Aqr) NGC7293(Aqr) NGC6397(Ara) M38(Aur) M36(Aur) M37(Aur) M30(Cap) NGC281(Cas) M103(Cas) M52(Cas) NGC5128(Cen) NGC5139(Cen) M77(Cet) M41(CMa) M44(Cnc) M67(Cnc) NGC1851(Col) M99(Com) M100(Com) M85(Com) M88(Com) NGC4565(Com) M64(Com) M53(Com) NGC6541(CrA) NGC4258(CVn) NGC4631(CVn) M94(CVn) M63(CVn) M51(CVn) M3(CVn) I.1318(Cyg) M29(Cyg) NGC6992-5(Cyg) NGC7000(Cyg) M39(Cyg) M35(Gem) NGC2392(Gem) M13(Her) M92(Her) M48(Hya) NGC3242(Hya) M68(Hya) M83(Hya) NGC2903(Leo) M96(Leo) NGC3379(Leo) M66(Leo) M79(Lep) M57(Lyr) M56(Lyr) NGC2237-9(Mon) M50(Mon) NGC6067(Nor) NGC6171(Oph) M12(Oph) M10(Oph) M62(Oph) M19(Oph) M9(Oph) M14(Oph) M42(Ori) M78(Ori) M15(Peg) M76(Per) NGC869(Per) NGC884(Per) M34(Per) NGC1499(Per) M74(Psc) M47(Pup) M46(Pup) M93(Pup) NGC55(Scl) NGC253(Scl) M80(Sco) M4(Sco) M6(Sco) M7(Sco) M26(Sct) M11(Sct) M5(Ser) M16(Ser) M71(Sge) M23(Sgr) M20(Sgr) M8(Sgr) M21(Sgr) M24(Sgr) M17(Sgr) M28(Sgr) M69(Sgr) M25(Sgr) M22(Sgr) M70(Sgr) M54(Sgr) NGC6723(Sgr) M55(Sgr) M75(Sgr) M1(Tau) M33(Tri) M81(UMa) M82(UMa) NGC3556(UMa) M97(UMa) M101(UMa) NGC3132(Vel) M61(Vir) M84(Vir) M49(Vir) M87(Vir) M58(Vir) M104(Vir) M60(Vir) M27(Vul)

- The nebulae, star clusters and galaxies are arranged in the alphabetic order of the constellation to which they belong, and those within constellations are ordered according to the right ascension sequence (moving to the right around the constellation dial).

Abbreviations of constellations and their full name

Abbreviation	Full name
And	Andromeda
Ant	Antlia
Aps	Apus
Aql	Aquila
Aqr	Aquarius
Ara	Ara
Ari	Aries
Aur	Aurgia
Boo	Bootes
Cae	Caelum
Cam	Camelopardalis
Cap	Capricornus
Car	Carina
Cas	Cassiopeia
Cen	Centaurus
Cep	Cepheus
Cet	Cetus
Cha	Chamaeleon
Cir	Circinus
CMa	Canis Major
CMi	Canis Minor
Cnc	Cancer
Col	Columba
Com	Coma Berenices
CrA	Corona Australis
CrB	Corona Borealis
Crt	Crater
Cru	Crux
Crv	Corvus
CVn	Canes Venatici
Cyg	Cygnus
Del	Delphinus
Dor	Dorado
Dra	Draco
Equ	Equuleus
Eri	Eridanus
For	Fornax
Gem	Gemini
Gru	Grus
Her	Hercules
Hor	Horologium
Hya	Hydra
Hyi	Hydrus
Ind	Indus
Lac	Lacerta

Abbreviation	Full name
Leo	Leo
Lep	Lepus
Lib	Libra
LMi	Leo Minor
Lup	Lupus
Lyn	Lynx
Lyr	Lyra
Men	Mensa
Mic	Microscopium
Mon	Monoceros
Mus	Musca
Nor	Norma
Oct	Octans
Oph	Ophiuchus
Ori	Orion
Pav	Pavo
Peg	Pegasus
Per	Perseus
Phe	Phoenix
Pic	Pictor
PsA	Piscis Austrinus
Psc	Pisces
Pup	Puppis
Pyx	Pyxis
Ret	Reticulum
Scl	Sculptor
Sco	Scorpius
Sct	Scutum
Ser	Serpens
	Serpens Caput
	Serpens Cauda
Sex	Sextans
Sge	Sagitta
Sgr	Sagittarius
Tau	Taurus
Tel	Telescopium
TrA	Triangulum Australe
Tri	Triangulum
Tuc	Tucana
UMa	Ursa Major
UMi	Ursa Minor
Vel	Vela
Vir	Virgo
Vol	Volans
Vul	Vulpecula

- Abbreviations are not shown for the Aps, Cha, Cir, Cru, Hyi, Men, Mus, Oct, Pav, TrA, Tuc and Vol constellations because they are in a range that are completely or almost completely in a celestial sphere range that cannot be seen from 35°N.