EQ1300-GT EQUATORIAL MOUNT

Opticstar EQ1300-GT Equatorial Mount Instruction Manual

OPTICSTAR

CAUTION!

Never look at the Sun through your telescope, the telescope's finder or the mount's Polar scope as this will cause blindness. Observing the Sun directly, even for a very short period, without the appropriate protection can cause serious damage to your eyes.

IMPORTANT INFORMATION

The Instruction Manual
Please keep this instruction manual handy and always use this telescope mount as described in this manual. Read the safety instructions below carefully to avoid damage to the product and to avoid injury to yourself and others.

Attention
Never disassemble the mount, there are no serviceable parts inside. Disassembling the mount will invalidate your warrantee and may cause damage or injury. In the event of a defect please contact your dealer. Children should always use this product under the supervision of adults.

Intended Use
This mount has been designed primarily for astronomical use. It can be used with an optical instrument or similar device. Do not leave the mount under direct Sunlight as this can cause damage to the mount or instrument mounted to it. Note that optical instruments can focus Sun light into a point and cause a fire.

Observing the Sun
Never look at the Sun or close to the Sun through a telescope, the telescope's finder scope or the mount's Polar scope as this will cause permanent blindness. Always use the appropriate protection to observe the Sun through any telescope or through the naked eye.

Always use a full aperture Solar filter if you intend to observe the Sun with a telescope, avoid Solar filters that can be attached to the eyepiece end, they are unsafe and can result in damaging both your eyes and the telescope.

Chocking Hazards
Keep small parts, plastic bags and other packaging materials out of the reach of children.

Electric Hazards
Use the mount as described in the manual. Do not disassemble the mount as there is a risk of electric shock. The mount is powered by 8 x D cell batteries, always use the recommended batteries and make certain that the batteries have been inserted correctly.

Batteries
Damaged, old and discharged batteries can leak acid and cause burns if improperly handled. Always handle and dispose batteries with care. Never heat up or throw batteries into a fire as this can cause an explosion.

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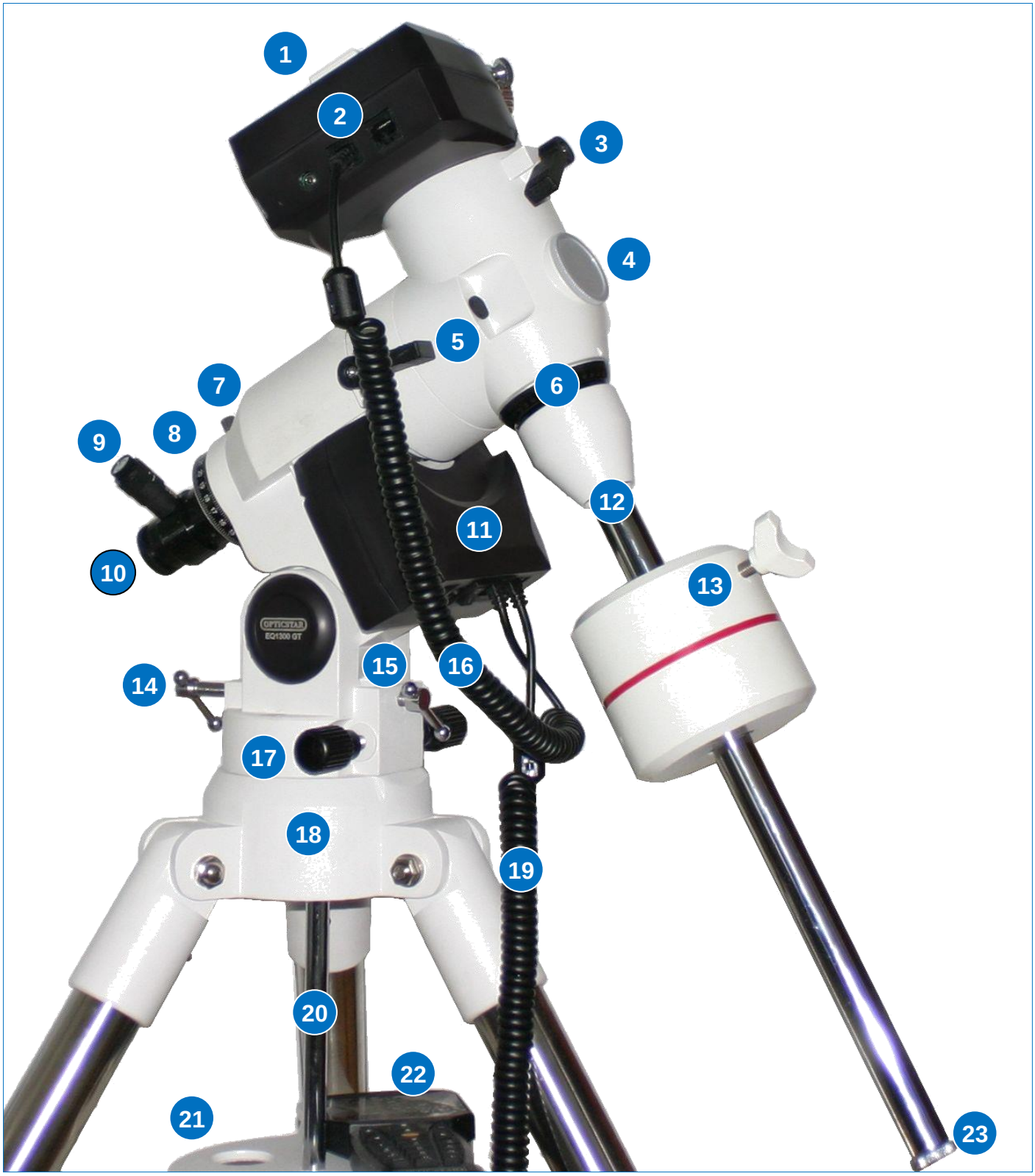
Opticstar EQ1300 GT Overview

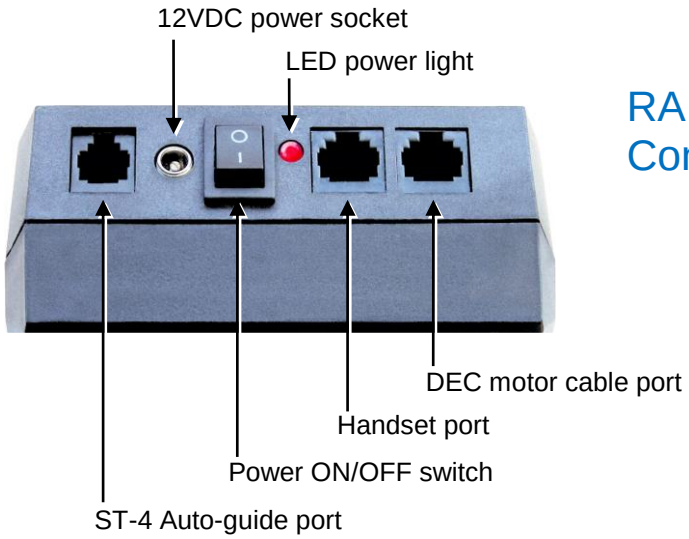


1. Telescope mounting saddle
2. DEC motor housing
3. DEC locking lever
4. Polar Scope cap
5. RA locking lever
6. DEC setting circle
7. RA setting circle locking knob
8. RA setting circle
9. Polar scope illuminator
10. Polar scope
11. R.A. motor housing
12. Counterweight shaft & locking nut
13. Counterweight with locking knob
14. Rear latitude adjustment T-bolt
15. Front latitude adjustment T-bolt
16. DEC motor cable
17. Azimuth adjustment knobs
18. Tripod platform
19. Handset cable
20. Tripod tension bolt
21. Tripod leg spreader
22. GOTO handset
23. Counterweight safety screw-cap

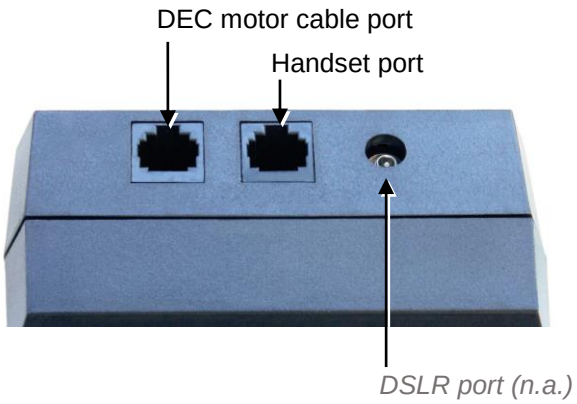
Opticstar EQ1300 GT Handset & Motors

Handset

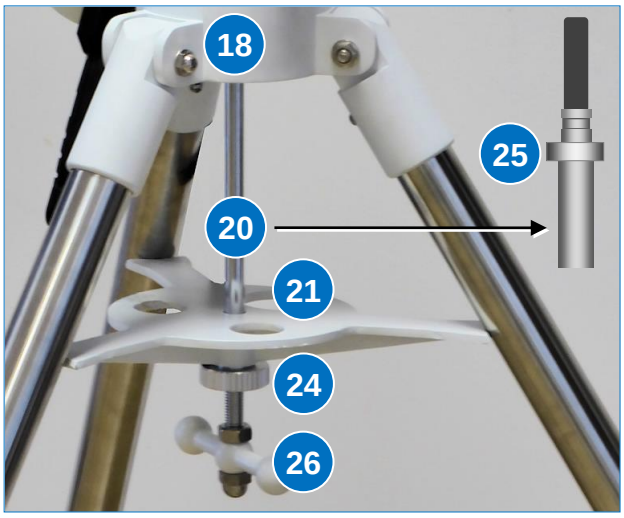
RA Motor Control Panel



DEC Motor Control Panel



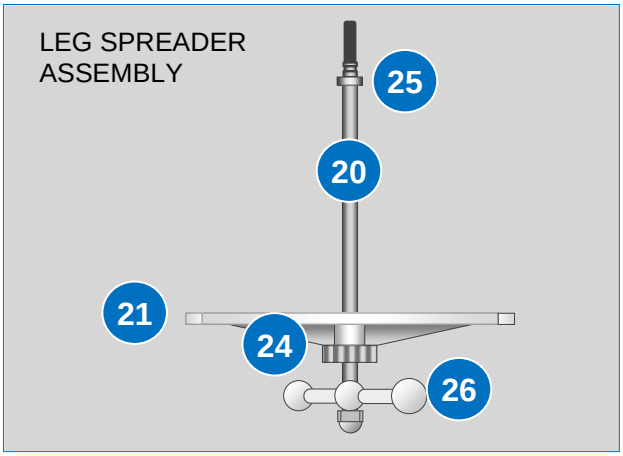
Mount & Telescope Assembly



You will need a fair amount of space to unpack the parts and assemble the mount and telescope. Please note that some parts are heavy. Carefully remove all the parts and tools from their packaging and lay them out on a flat surface.

When removing the tripod from the box hold it level to the ground or the tripod leg extensions will slide out as they are not locked in place. Do not throw packaging materials before having assembled the mount. Look carefully through the packaging materials as it is easy to miss smaller parts.

Pick up the tripod and fully spread the legs making certain that the tripod platform (18) is level by adjusting the tripod's legs, then secure the legs by tightening the leg locking knobs until firm. Before continuing assembling the tripod, you will need to first assemble the leg spreader assembly as follows:

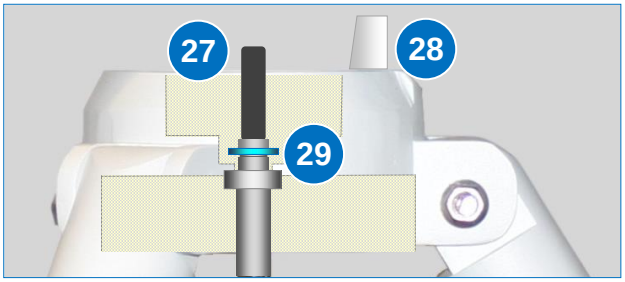


Thread the tension nut (24) into the silver threaded shaft (20) as far as it will go, do not tighten the tension nut at this point and ensure that the stop-washer is in position (25).

Pass the shaft (20) through the leg spreader (21).

Pass the leg spreader assembly through the base of the tripod platform (18). Snap the e-clip (29) all the way onto the shaft, the shaft should extend above the tripod's platform at this point when pushed from below. Note that slanting the shaft makes the insertion of the e-clip easier.

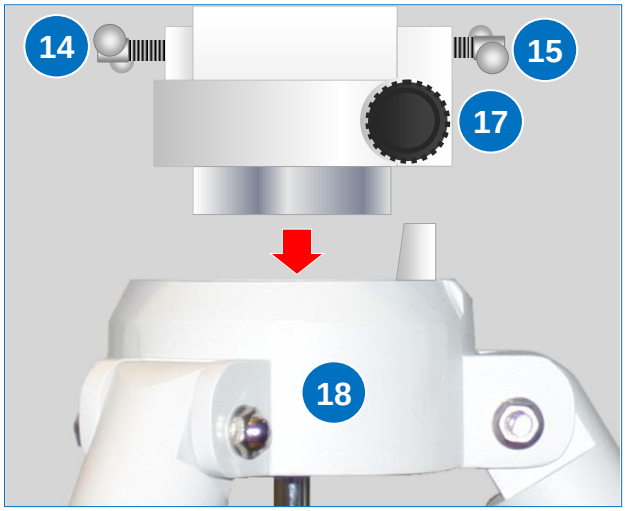
Loosen both Azimuth adjustment knobs (17) on the mount-head equally so that they are apart by just over 1cm.



Place the mount-head over the tripod platform and onto the shaft so that protruding peg (28) on top of the tripod's platform is positioned between the two Azimuth adjustments knobs (17).

If necessary, loosen the Azimuth adjustment knobs (17) further for the peg to fit between them.

Tighten the T-handle (26) so the shaft screws-into the base of mount-head until it feels firm, this secures the mount-head in place. Make certain that the mount-head is secure before going to the next step.



Line up the leg spreader braces so that each faces and supports their corresponding tripod leg.

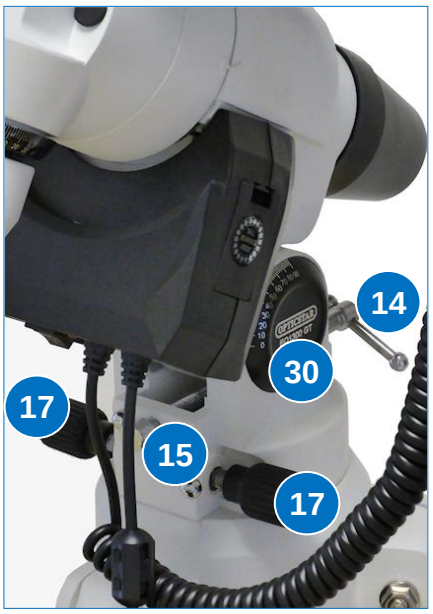
Tighten the tension nut (24) until the leg spreader presses firmly against the tripod legs. Now lightly-tighten the two Azimuth bolts (17).

Place the counterweight shaft locking nut over the threaded end of the counterweight shaft (12) and screw it firmly in place.

Thread the counterweight shaft and counterweight locking nut assembly (12) into the threaded hole under the declination setting circle (6) and tighten firmly.

TIP To partially collapse the tripod for storage first remove the telescope and counterweights, loosen the tension knob (24) enough so that you can freely rotate the leg spreader to partially collapse the legs. There is no need to remove the tripod shaft unless you intend to completely collapse the tripod.

Setting the Mount's Latitude



Latitude is the angular distance in degrees North or South from the Equator for a location on the Earth's surface. You will first need to establish your location's latitude and longitude. GPS devices including mobile phones will supply this information that you will also later need to set up the handset. You can also obtain the latitude and longitude for your location from a map or via an Internet search-engine. A list of large cities and their longitudes and latitudes have been listed on page10 for your convenience.

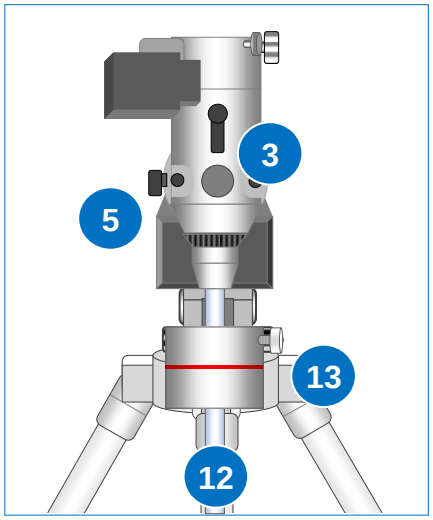
You will only need to physically set the mount's latitude once for your current location. It is important that you set the latitude without any load on the mount at this point i.e. no counterweights and no telescope. It makes the process easier, safer and without the need to balance the telescope prior to physically setting the latitude.

To physically set the latitude for your mount you will need to use the two latitude adjustment T-bolts (**14, 15**). By always loosening one T-bolt and tightening the one opposite you will be able to revolve the upper part of the mount-head until the latitude pointer points to the correct latitude on the mount's latitude scale (**30**). Once the latitude pointer points to the desired latitude slowly tighten both T-bolts until they make contact. Do not overtighten.

ATTENTION The two latitude adjustment T-bolts work in a *push & pull* fashion, in other words as you tighten one you must always loosen the other. If you tighten one T-bolt without loosening the one opposite, you will bend the bolts resulting to damage not covered by warranty.

You are now ready to mount the counterweight and optical tube to the EQ1300 GT mount.

Mounting the Counterweights



Before proceeding make certain that the counterweight shaft (**12**) is pointing to the ground and that the DEC and R.A. locking levers are tight (**3, 5**).

Completely unscrew and remove the counterweight safety screw-cap (**23**) at the end of the counterweight shaft (**12**).

Carefully lift a counterweight and loosen the counterweight locking knob (**13**) enough to ensure that the hole in the counterweight is free of the floating locking pin.

Carefully slip the counterweight to approximately halfway up the counterweight shaft and tighten the counterweight locking knob firmly. Replace the counterweight safety screw-cap (**23**).

You can position and secure the counterweight further up the counter-shaft if you intend to mount a smaller telescope like an 80-100mm aperture refractor, lower down if you intend to mount a heavy telescope.

ATTENTION The counterweight safety screw-cap (**23**) prevents counterweights from sliding entirely off the counterweight shaft and must remain in place during normal use.

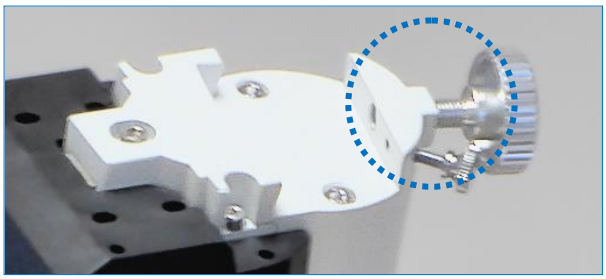
Connecting the Handset

Use one of the two supplied black coiled cords to connect the handset to the handset port on the RA or DEC motor control panel. Use the second coiled cord to connect the two DEC Motor Cable ports found on the RA and DEC motor control panels respectively (page 4).

ATTENTION Only use original cables supplied with the mount, incorrectly wired cables can cause serious damage to the mount.

Mounting the Telescope

Ensure that the DEC and R.A. locking levers are tight (**3, 5**). loosen both the large hand-wheel bolt and smaller safety thumb screw on the mount's saddle (**1**) so that they do not protrude into the saddle.



Lift the optical tube and let it rest centrally on the saddle, tighten the hand-wheel bolt. Make certain the hand-wheel and safety thumb-screw have been firmly tightened and that the scope has been secured before releasing.

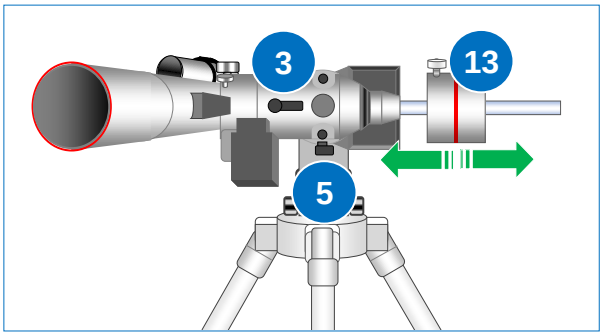
TIP When dismounting the optical tube first loosen the safety thumb screw followed by the larger hand-wheel while firmly holding the optical tube. When mounting an optical tube reverse the process, first tighten the larger hand-wheel followed by the safety thumb-screw.

Balancing the Telescope

It is necessary to correctly balance the mount and optical tube on the R.A. and DEC axes before proceeding. A well balanced mount will be accurate, will extend the life of the motors, is safer and easier to use. Always hold the optical tube firmly during all the steps of the balancing process as the tube could easily swing under its own weight.

Balancing the Optical tube round the R.A. Axis

Firmly hold the optical tube and slowly loosen the RA locking lever (**5**). Rotate the optical tube so that the counterweight shaft is parallel/horizontal to the ground. While holding the optical tube unlock the counterweight locking knob (**13**) and carefully slide the counterweight either way until the optical tube does not drift up or down.

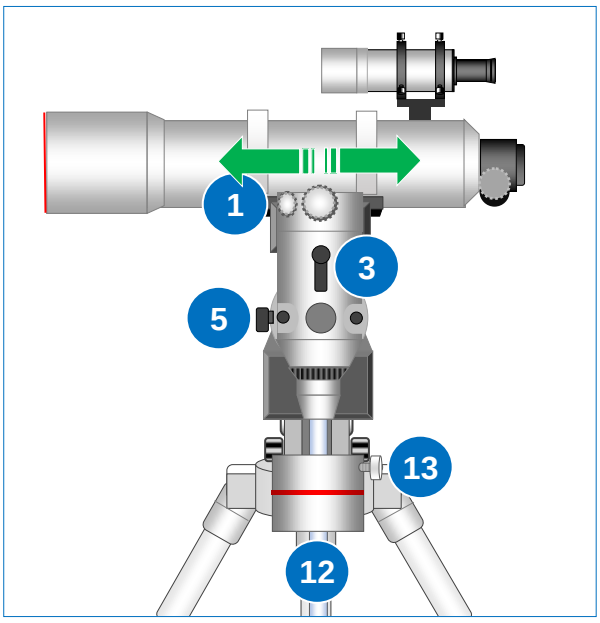


Once the optical tube is balanced tighten the counterweight locking bolt, then tighten the RA locking lever in this order. Rotate the scope round the R.A. axis so that the counterweight shaft is pointing down and tighten the R.A. locking lever.

Balancing the Optical tube round the DEC Axis

Make certain that the counterweight shaft is pointing downwards and that the R.A. locking lever is locked before proceeding.

While holding the optical tube so that it does not accidentally swing freely loosen the DEC locking lever (**3**). The optical tube will now be able to rotate freely around the DEC axis. If the optical tube is mounted on rings loosen the ring locking knobs that hold the optical tube in place just enough to be able to slide the optical tube back and forth inside its own tube rings.



Slide the optical tube inside its rings to a position where the tube is balanced. Once the optical tube is balanced tighten the ring locking knobs and the DEC locking lever (**3**) on the mount.

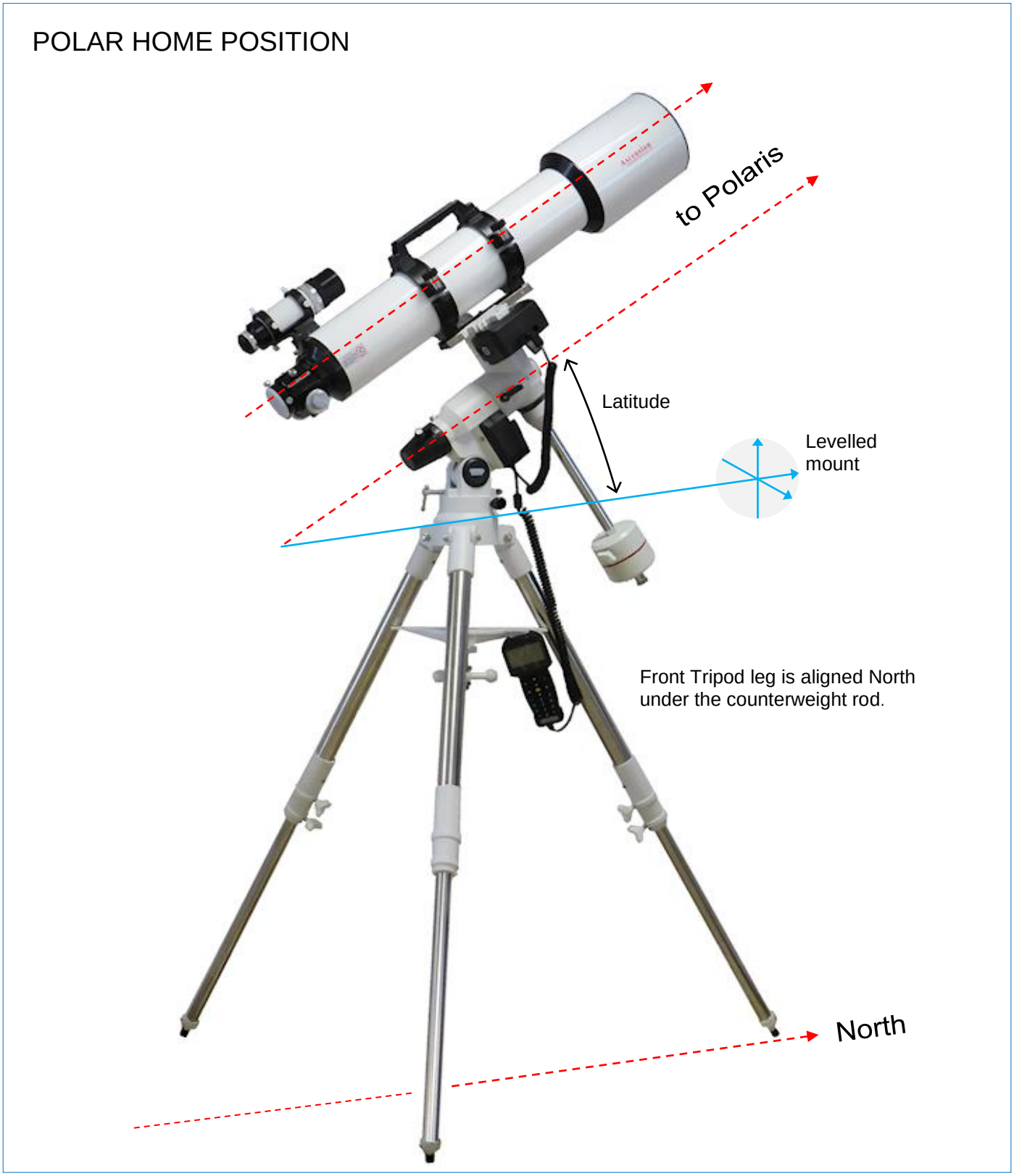
Alternatively hold the optical tube and slightly loosen both the hand-wheel bolt and thumb screw on the mount's saddle (**1**). You will need to move the whole of the optical tube assembly back and forth to a position where the optical tube is balanced. Every time you check for balance, at least the hand-wheel bolt must tightened to prevent the optical tube slipping off the saddle.

Once balanced rotate the tube to point the same direction as the Polar scope. Tighten the hand-wheel bolt and thumb screw (**1**).

TIP The mount is supplied with a 4.5Kg counterweight but you may need an additional counterweight for heavy equipment. Never overload the mount beyond its maximum 13Kg payload (excludes counterweights).

Preparing your Mount and Telescope for Observation

The following figure shows a fully assembled telescope consisting of an Opticstar EQ1300 GT mount and 127mm Opticstar-Ascension 127mm apochromatic triplet refractor.

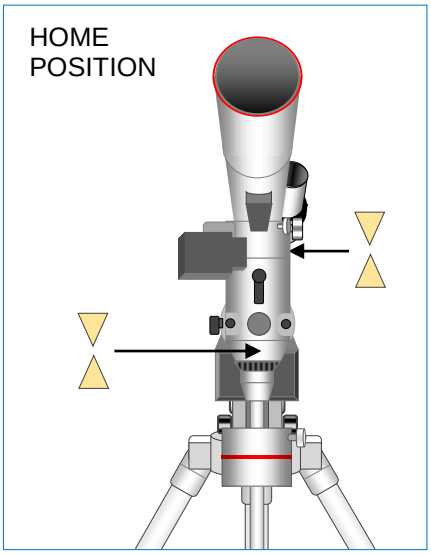


The telescope is in Home Position and ready to Star Align via the mount's handset. The following section outlines the procedure of how to get your mount and telescope into Home Position. This is necessary so that you can Star-align the complete telescope and subsequently issue GOTO commands.

Setting the Telescope to Polar Home Position

Please follow the list of steps below to set your mount and telescope in Home Position. Ensure that:

1. the tripod is level.
2. the mount's latitude is correctly set for your observing location.
3. the counter-weight shaft points downwards.
4. the mount/telescope has been balanced.
5. both the mount and the telescope point towards Polaris if you are in the Northern Hemisphere. Check that the two DEC and R.A. arrows are opposite each other to confirm.
6. that the R.A. and DEC Locking levers have been tightened.
7. all fixings have been secured.
8. there is power to the mount.



Once you have assembled positioned and set the balanced telescope in Home Position you will be ready to proceed with Star Alignment. Setting to Home Position is necessary for the telescope to operate correctly.

Powering the EQ1300 GT Mount

The mount can be powered by a good quality regulated/switch-mode 12VDC power supply (pin positive) delivering a minimum 3A of power. Alternatively insert eight D cell batteries (not supplied) in the battery pouch that came with the mount. Observe the polarity when inserting the batteries, inserting batteries in the wrong way will cause complications and the mount will not operate.

GOTO Telescope Star Alignment & Control

Once the telescope has been assembled, balanced and set to Home Position as described earlier in this document you will be ready to Star-align. Insert a diagonal to the telescope's drawtube if it is not a Newtonian reflector. Now insert a medium power eyepiece (20mm-25mm) to the eyepiece drawtube and remove all dust covers. Secure all accessories in place by tightening all holding locking-screws found on the focuser's drawtube and other parts.

The following text describes the procedure of setting up the handset and Star-aligning your telescope. The diagram on page 12 outlines the same but in a concise graphical form.

Handset Setup

With the power switch in the OFF position insert eight D cell batteries into the battery holder or connect the telescope to a regulated mains PSU (12VDC ~3A, pin positive).

Plug one end of the coiled RJ-45 cable in either Handset port on the mount (page 4) and the other one into the RJ-45 port of the handset. Switch ON the telescope. The handset will light up accompanied by a short beep.

Please note that that the **+** and **–** keys on the handset keypad can be used to navigate the menus. Pressing the **–** key for example a few times will get you back to the main menu from where you can issue GOTO commands once the telescope has been Star-aligned.

TIP Inputting an illegal value like the year may cause the handset to fail Initialisation. In such cases switch OFF and then switch ON power before starting again.

Time & Date

You will be prompted to enter the date and time (yyyy:mm:dd & hh:mm:ss). Do so by navigating the entry fields using the Arrow keys and typing in the values using the numeric pad on the handset. Once finished, press the oval Confirm key to proceed.

Daylight Saving

Use the Up/Down Arrow keys to select Daylight Saving time by selecting the status (ON/OFF). Press the Confirm key to proceed.

At the time of writing in the UK the following applies:

2015: Sunday, 29 March, 01:00 Sunday to 25 October, 02:00 → Daylight Saving ON
2016: Sunday, 27 March, 01:00 Sunday to 30 October, 02:00 → Daylight Saving ON
2017: Sunday, 26 March, 01:00 Sunday to 29 October, 02:00 → Daylight Saving ON
2018: Sunday, 25 March, 01:00 Sunday to 28 October, 02:00 → Daylight Saving ON

Otherwise Daylight Saving needs to be set to OFF.

Location

When prompted to enter your location you can either select a city (Country & City) close to you or directly enter your GPS coordinates in terms of longitude and latitude (Custom Site). Press the Confirm key to proceed.

Selecting: Country & City

To select a city close to you select the Country & City option. Select the country with the Up/Down Arrow keys and then the city with the Left/Right Arrow keys. Once you have made your choice press the oval Confirm key to proceed.

Selecting: Custom Site

To set you own Custom Site instead, enter your site's details as follows:

Name:	custom name for your location	London	Name: London
Lon:	your location's longitude in: degrees:minutes:seconds	W 0º 05' = E 359º 55'	Lon: E359:55
Lat:	your location's latitude in: degrees:minutes:seconds	N 51º32'	Lat: N51:32:00
Zone:	your time zone in: hours:minutes:seconds	UK: 00:00:00	Zone: E00:00:00

For example, if the telescope was in a location listed below on the 22nd of December 2015, the time was 8:10pm, the telescope (mount and optical tube) was pointing North (Home Position) the inputs list would look as follows:

Name:	Birmingham	Cardiff	Edinburgh	Leeds	Liverpool	London	Manchester	Newcastle	Ipswich
Lon:	358º 07'	356º 49'	356º 43'	358º 27'	357º 00'	359º 55'	357º 45'	358º 23'	1º 09'
Lat:	52º 29'	51º 29'	55º 57'	53º 48'	53º 24'	51º 32'	53º 30'	54º 58'	52º 04'
Zone:	00:00:00	00:00:00 0	00:00:00 0	00:00:00 0	00:00:00 0	00:00:00 0	00:00:00 0	00:00:00 0	00:00:00 0

Date: 2015:12:22 (yyyy/mm/dd) Time:20:10:00 Daylight Saving: OFF

Please note that if your location is West of Greenwich (Greenwich longitude: 000º 00') the value would be negative i.e. -0º.5' or 0º5' West. Since the handset expects a positive value between 0-360 this can be calculated by subtracting the value you want from 360, i.e. 360º0' - 0º5'=359º55' as in the previous 'London' example.

Longitudes & Latitudes List

City	Longitude	latitude	City	Longitude	Latitude
Aberdeen	57º 09' N	4º 07' W	Londonderry	55º 00' N	0º 07' W
Bangor	54º 39' N	5º 40' W	London	51° 29' N	0° 0' W
Bath	51º 23' N	2º 22' W	Manchester	53º 28' N	2º 14' W
Belfast	54° 36' N	5° 55' W	Newcastle upon Tyne	54º 58' N	1º 37' W
Birmingham	52° 29' N	1° 56' W	Newry	54º 11' N	6º 21' W
Bristol	51º 27' N	2º 35' W	Norwich	52º 37' N	1º 17' E
Cambridge	52º 12' N	0º 07' E	Nottingham	52º 57' N	1º 08' W
Cardiff	51° 28' N	3° 10' W	Omagh	54º 36' N	7º 15' W
Coventry	52º 24' N	1º 31' W	Oxford	51º 46' N	1º 15' W
Dundee	56º 27' N	2º 59' W	Peterborough	52º 35' N	0º 15' W
Edinburgh	55° 55' N	3° 11' W	Plymouth	50º 22' N	4º 10' W
Glasgow	55° 52' N	4° 17' W	Reading	51º 27' N	0º 58' W
Inverness	57º 28' N	4º 14' W	Sheffield	53º 23' N	1º 28' W
Ipswich	52º 04' N	1º 10' E	Southampton	50º 54' N	1º 24' W
Leeds	53º 48' N	1º 33' W	Swansea	51º 37' N	3º 57' W
Liverpool	53º 24' N	2º 59' W	York	53º 58' N	1º 06' W

Telescope Star Alignment

The telescope needs to be Star-aligned before GOTO commands can be issued. There are three ways the telescope can be Star-aligned; One-star, Two-Star and Three-star alignment. We recommend the Three-star alignment as it will deliver the highest accuracy and only takes a couple of minutes to complete once you are familiar with the procedure.

With the telescope set at the Home Position (page 8) press the oval Confirm key on the handset and select “Telescope Align” from the menu to start the Star-alignment procedure. There is a choice between one-star, two-star and three-star alignment. Choose One, Two or Three Star Alignment and press the oval Confirm key to proceed.

Always use the Arrow keys on the handset to slew and point the telescope. Manually moving the telescope to a target or disturbing the tripod will require going through the alignment procedure again.

The diagram on the following page shows all the steps involved in setting up the handset and aligning your telescope on a single star (One Star-alignment). It assumes the telescope is switched ON to start and that it is set at the Home Position (page 8) which is a requirement. The text below outlines the Star-alignment process and other relevant operations. It may be useful to read the text below with reference to the diagram on the following page before attempting to star align your telescope for the first time.

One-Star Alignment

To Star-align the telescope on a star follow the procedure below.

1. The handset will prompt you to select an Alignment star and suggest a bright star for you.

   If the star was not visible because it was hidden behind a tree you could select another star by pressing the Up and/or Down Arrow keys to go through a predetermined list of bright stars, before pressing the oval Confirm key to choose the Alignment star of your choice.

2. Once an Alignment star has been selected the telescope will automatically slew to the chosen star and prompt you to centre it in the field of view using the Arrow keys, once you have centred the target star press the oval Confirm key to finish.

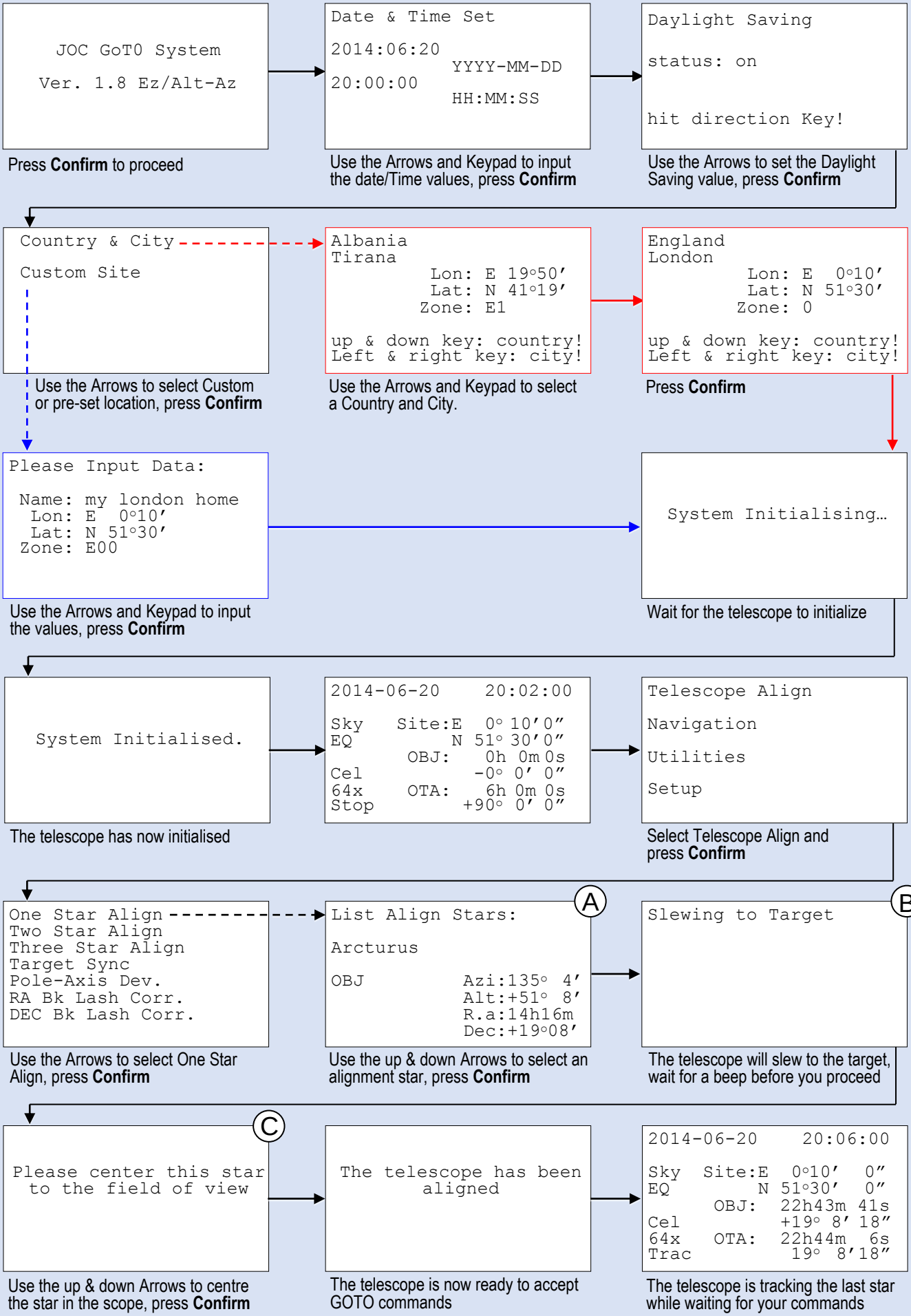
```
List Align Stars:

Arcturus

OBJ          Azi:135° 4′
             Alt:+51° 8′
             R.a:14h16m
             Dec:+19°08′
```

Two-Star & Three-Star Alignment

These are very similar to One-star alignment with the only difference that you will need to repeat steps 1 and 2 above twice or three times respectively. It is advisable to select the suggested stars for star aligning the mount but in case this is not possible select the stars so that they in the same Meridian (East or West), around 30 degrees apart and form a triangle.

Two star-alignment is acceptable for casual observation, three-star alignment is necessary for more serious work or when imaging. One star-alignment on the other hand is more relevant to permanent installations i.e. in an observatory where the mount is on a permanent pillar and has already been accurately aligned at least once.

In certain situations, the mount may not offer all three alignment stars. It is still possible to add a third or fourth star once you have completed the alignment process. This can be done at any point following Star Alignment via the Target Sync command (page 13) and is recommended when imaging or following a mount Meridian flip.



In two and three Star alignment you will need to repeat steps A, B and C twice or three times respectively.

Using your Telescope for the First Time to Locate an Object

Once the telescope has been Star-aligned you will be able issue GOTO commands using the telescope's handset. Take care not to move the telescope by hand or accidentally move the whole mount and telescope. If you do you will need to re-establish Home Position and Star-align the telescope again.

A properly aligned telescope will compensate for the earth's rotation and enable you to issue GOTO commands. A GOTO command will slew the telescope to the selected object in the night sky and track it over long periods.

Press the oval Confirm key and select Navigation. In the menu list you can select any object catalogue but for now select Solar System and press the oval Confirm key. Select a bright object in the night sky like the Moon, Jupiter, Venus or Saturn if they are visible. These objects are visible at different dates and times depending on your location.

Assuming Jupiter was visible select Jupiter from the list with the aid of the Up/Down Arrow keys and press the oval Confirm key to proceed. The telescope will now automatically slew to Jupiter and slow down as it reaches the planet, the telescope will confirm with a beep once it has reached its destination and subsequently automatically track the planet.

Use the Arrow keys on the handset to bring the planet into the centre of the field of view, then use the telescope's focuser controls to bring the planet into focus. Use a high power eyepiece (i.e. 5mm-10mm) or higher to observe the planet and refocus the telescope if necessary.

Note that if an object like a planet or star is well out of focus it may not be visible even if it is inside the field of view. This is very evident with deep sky objects and especially when using telescopes of smaller apertures.

Choosing your First Targets

During the early stages it is advisable to concentrate on bright objects within our Solar system including the Moon and planets. In deep-sky terms the Orion Nebula (M42), the Ring Nebula (M57) the Andromeda Galaxy (M31) and the Hercules star cluster (M13) also qualify.

From a reasonably dark site you should also be able to easily observe many of the brighter deep-sky objects including nebulae like the Orion Nebula (M42) the Ring Nebula (M57) the Lagoon Nebula (M8) the Omega Nebula (M17) and the Dumbbell nebula (M27). Other possible targets include galaxies like the Andromeda (M31) the Triangulum (M33) the Cigar (M82) and Bode's Galaxy (M81). Star clusters of interest include the Hercules (M13) the Pleiades (M45) and the Butterfly (M6). Double stars include Sirius, Capella, Polaris and Albireo among many others.

Target Sync

Whether you have Star-aligned the telescope on one, two or three stars you can further improve the GOTO accuracy of the telescope by adding another star at any point after alignment and during a session.

1. Use a high power eyepiece (i.e. 5mm-10mm).
2. Issue a GOTO command to a familiar star. Do not use planets, the Moon or deep-sky objects.
3. Once the telescope slews to the selected star and stops use the handset Arrow keys to precisely centre the object in the field of view. Using a cross-hair eyepiece will improve accuracy.
4. Now select >Telescope Align >Target Sync and press the oval Confirm key. The telescope will add the star to its list of Alignment stars and use this information to increase GOTO accuracy for the rest of the session.

if you have only performed a One-star alignment adding a Sync star is highly recommended and may prove necessary.

Backlash Correction

Backlash is inherent in the gears and may introduce a small pointing error, in the vast majority of cases the error is too small to make a difference. However, you may still improve the GOTO precision of the telescope by training the "backlash correction of the axis". This is done separately for each axis and is not always necessary.

In the handset's main menu press the oval Confirm key, select Telescope Align and then RA BKlash Corr. or DEC BKlash Corr. depending on which of the two motors you would like to train. Follow the on-screen instructions to complete the training for each motor. We recommend that you leave backlash correction training for later as it only adds unnecessary complexity at this point.

Time, Date and Daylight Saving

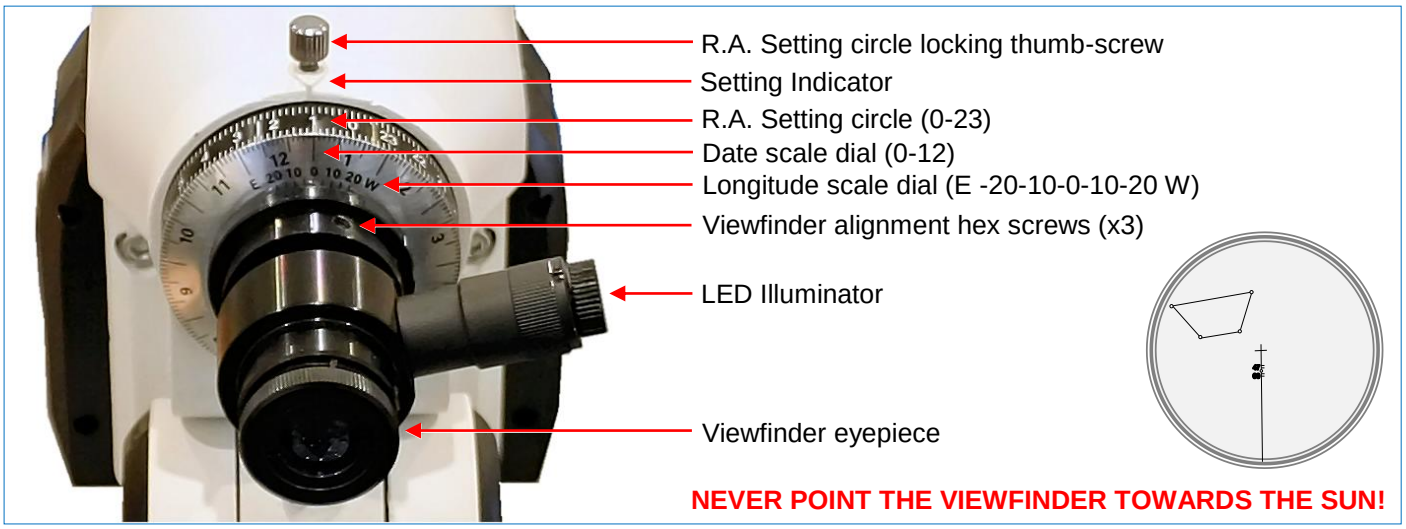
Please note that the telescope will not remember the Time, Date and Daylight Saving values. These need to be entered every time you switch on the telescope.

Accurate Polar Alignment

Accurate mount Polar alignment is necessary for imaging and can be achieved via the built-in Polar viewfinder.

Viewfinder Alignment Round the R.A. Axis

The Polar viewfinder can be adjusted in daytime. Remove the silver cap at the front of the mount-head, also remove the black cap at the back of the mount-head to gain access to the viewfinder eyepiece.



1. Starting at the Polar Home position, loosen the R.A. locking lever, turn the mount-head round the DEC axis by 90° and tighten the DEC locking lever. This is required to be able to obtain an unobstructed view through the viewfinder.
2. Point the mount/viewfinder at a white wall and turn he viewfinder's eyepiece until you can see a focused image of the viewfinder's etched scale.
3. Point the viewfinder at a distant terrestrial object like a lamp post, church steeple or similar so that it lines up with the centre cross of the reticule.
4. Loosen the R.A. locking lever and carefully hand rotate the mount-head round the R.A. axis to ascertain whether the object under the crosshair moves out of centre.
5. If the object moves off centre, correct the error half way by adjusting the three Viewfinder alignment hex screws. Now correct the remaining error by repositioning the mount-head by turning it round the R.A. axis in 90° increments. Repeat this process until the centre cross stays over the target object, tighten the three hex screws.

Precise Polar Alignment for the EQ1300 GT Mount

You would need to use the rear and front latitude adjustment T-bolts (**14,15**) and the two Azimuth adjustment knobs (**17**) to perform the fine adjustments required. Please prepare your telescope for precise alignment as follows:

1. Set the telescope to Polar Home Position and remove all dust caps.
2. Loosen the DEC locking lever, turn the DEC axis by 90°; tighten the DEC locking lever.
3. Loosen the R.A. locking lever. The mount and telescope need to have been already balanced!
4. Switch ON the viewfinder LED illuminator.
5. Focus the Polar scope viewfinder if you have not done so already.

First determine the longitude and latitude of your observing site, for Manchester this would be 2°14' W, 53°28' N. Now determine the longitude of the central time meridian according to your local time which for the UK is 0:00 hours, ignore Daylight Saving. Calculate the difference between both longitudes which is -2 (0 - 2 = -2). Negative values indicate West; positive values indicate East. Now set the longitude scale dial (W 20 10 0 10 20 E) to *W 2* for Manchester UK. Follow the instructions below to precisely Polar align the mount within a few minutes of arc.

1. Loosen the R.A. setting circle locking thumb-screw and turn the setting circle to "0", re-tighten the R.A. setting circle thumb-screw.
2. Loosen the R.A. locking lever and turn the mount-head round the R.A. axis until the actual date of the month on the R.A setting circle matches with the local time on the Date scale dial.
3. Re-tighten the R.A. locking lever and make certain that the DEC locking lever is also tight.
4. Finally adjust the mount using the two Azimuth knobs (**17**) and two latitude T-knobs (**14, 15**) until Polaris fits into the small circle between the 40' and 60' markings in the viewfinder.
5. Once Polaris is in position loosen the R.A. Setting circle locking thumb-screw, during normal operation this thumb-screw should be loosened.

Handset Utilities & Setup Menu Reference

The following text elaborates on the currently available functions found on the handset under the Utilities and Setup menus. Many of the functions require that the Location, Date and Time has already been correctly set.

Utilities Menu: Current Objects
Lists the planets, visible at your location with their actual rise and setting times. Also the time of the object's culmination when it is best observed.

Utilities Menu: Object Rise/Set
Calculate rise, setting times and time of culmination (object's highest position in the south) visible at the set location. rise, setting times and time of culmination of a selected object that is visible at your location.

Utilities Menu: Current Lunar Phase
Displays the Moon phases of the currently selected month in graphical form. Use the Arrows on the keypad to change the year and month.

Utilities Menu: Timer
The timer can be set in terms of the number of seconds before it goes off in which case a long beep will sound when the counter reaches zero. Key in the number of seconds and press the Confirm key to start the counter.

Utilities Menu: Alarm
The alarm function can be set in 24-hour format. Enter the desired time and press the Confirm Key to activate the alarm. To deactivate the alarm, select Alarm from the menu press the Confirm Key (Close).

Utilities Menu: Eyepiece FOV
Enter the focal length of a telescope (MF), the focal length of the eyepiece (SF) and the apparent visual field of the eyepiece (E-FOV). Now press the Confirm Key to calculate and display an eyepiece's field of view.

Utilities Menu: Eyepiece Magnification
Enter the focal length of a telescope (MF) and the focal length of an eyepiece (SF). Press the Confirm Key to calculate and display the resultant magnification.

Utilities Menu: Display Illumination
Use the Up and Down Arrows to select a suitable level of illumination level.

Utilities Menu: Park Scope
Select this option to allow the telescope to slew to its park/starting position, then switch OFF.

Setup Menu: Time and Date
You can set the current date and time in YYYY:MM:DD / HH:MM:SS format respectively.

Setup Menu: Daylight Saving
You can set daylight Saving ON or OFF as outlined earlier in this manual.

Setup Menu: Tracking Rate
You can set the tracking speed to a desired value, the default value is Star Speed (Sidereal speed).

- Star Speed
- Solar Speed
- Moon Speed
- Customize Speed (n.a.)

Setup Menu: Guiding Speed
The motor reaction speed can be adjusted to suit an individual mount for auto-guiding via the ST-4 interface and in conjunction with an appropriate guide camera. A setting of say 1000 results in an aggressive reaction of the drive motors where lower values result in a slow response. This setting needs to be adjusted so as to obtain precise and uniform tracking. This will vary for every mount and depends on a variety of factors including the gears and their spacing, type of motor, guide camera pixel size, guide scope and software used.

Setup Menu: Language
Select a language i.e. English, German, French, Italian, Spanish.

Setup Menu: Reset
Reset handset to factory settings. This will erase any data stored in the handset by the user.

APPENDIX I: Monthly Sky Watch

JANUARY		
Gemini		**MGN**
NGC2392	The Eskimo Nebula is a planetary nebula close to the double star 63 Geminorum. It can be viewed in an 80mm telescope but requires magnifications around x120 to make up its shape.	9.35
M35	Large and bright open cluster in the constellation of Gemini. It consists of hundreds of stars and provides excellent views though binoculars and small telescopes.	5.5
Monoceros		
NGC2264	The Christmas Tree Cluster is a large and bright star cluster with nebulosity. It shares the same space with the Cone Nebula.	4.7
M50	An open star cluster in the constellation of Monoceros. larger telescopes will reveal a large number of stars in a 'heart-shaped' figure.	5.9
NGC2506	Open cluster.	7.6
Canis Major		
M41	The Small Beehive in Canis Major is a cluster of approximately 100 stars with some white dwarfs and red giants, the largest of which is a red hue 6.3 magnitude star located in the centre.	5.0
Puppis		
M46	A large and rich open cluster located close to the Orion Nebula. M46 is about a degree east of M47 in the sky, so the two fit well in the field of a wide-angle telescope.	6.5
M47	Open cluster with large numbers of randomly arranged stars.	4.5
M93	Bright open cluster with around 80 stars. Its core resembles an arrowhead.	6.5

FEBRUARY		
Ursa Major		**MGN**
M81	Bode's Galaxy is one of the brightest galaxies in the Messier catalogue, it is located close to the M82.	8.5
M82	The Cigar Galaxy is separated by 150,000 light years from the M81 and is approximately ten times smaller.	9.5
Cancer		
M44	The Beehive cluster is an open cluster that contains many double stars.	4.0
M67	The King Cobra is the oldest cluster known. A 4 to 6 inch telescope will show the fainter stars within the cluster.	7.5
Leo		
NGC2903	This spiral galaxy is one of the best galaxies for small scopes. It shows a halo and bright core.	9.1
Hydra		
M48	An open cluster of around 80 stars.	5.5

MARCH		
Leo		**MGN**
M105	The M105 is an elliptical galaxy with a bright core that grows fainter towards the edge.	11.0
M65	Spiral galaxy that along with the M66 and NGC3628 form the Leo Triplet.	10.5
Coma Berenices		
NGC4565	The Needle galaxy is one of the brightest members of the Coma I Galaxy Cloud. It is a face-on spiral galaxy	9.6
Covus		
M68	Globular cluster low in the sky which makes it more challenging to observe.	9.0
Canes Venatici		
M106	A large and bright galaxy with two spiral arms that are visible in larger telescopes.	9.5
Virgo		
M104	The Sombrero Galaxy is virtually an edge-on galaxy that has a large bright core. A dark lane runs across its length cutting the galaxy splitting it in two.	9.5

APRIL		
Ursa Major		**MGN**
M81	Bode's Galaxy is one of the brightest galaxies in the Messier catalogue.	8.5
M82	The Cigar Galaxy is separated by 150,000 light years from the M81 and is approximately ten times smaller.	9.5
Coma Berenices		
M64	The Black Eyed galaxy has taken its name from a dark dust lane near located its centre.	9.0
Virgo		
M58	A barred spiral galaxy. Large telescopes will reveal it's structure at higher magnifications.	11.0
M85	A bright galaxy that appears as a cross between a spiral and elliptical galaxy.	10.5
M87	A gigantic elliptical galaxy that resembles a very rich star cluster.	11.0
M88	Spiral galaxy that appears as an elongated glow in smaller telescopes.	11.0
Canes Venatici		
M51	The Whirlpool Galaxy is a face-on galaxy. Under favourable conditions it is possible to visually observe its spiral arms.	8.0
M3	Globular cluster with around 500 stars. Best observed at higher magnifications.	7.0

MAY		
Canes Venatici		**MGN**
M63	The Sunflower Galaxy is a barred spiral galaxy. Large telescopes may reveal a degree of detail.	8.5
Coma Berenices		
M100	Face-on spiral galaxy with a low surface brightness. The two main spiral arms are only visible in large telescopes.	10.5
Scorpius		
M4	The Cat's Eye is a bright globular cluster. A large telescope is needed to start resolving individual groups of stars.	7.5
M6	The Butterfly Cluster is a bright open cluster that lies close to the centre of our Galaxy.	4.5
M7	Ptolemy's Cluster is a bright open cluster of around 80 stars.	3.3
Coma Berenices		
M53	Globular cluster. Higher magnifications will begin to resolve some detail.	8.5

JUNE		
Hercules		**MGN**
M13	The Hercules Cluster is perhaps the finest in the Northern Hemisphere consisting of around 400,000 stars.	7.0
NGC6210	Planetary nebula with a blue tint. Higher magnifications will reveal its structure.	9.0
Serpens		
M5	This globular cluster is better observed at medium magnifications.	7.0
Dragon		
NGC6543	The Cat's Eye is a bright planetary nebula. Large telescopes may show its central star at higher magnifications.	8.8
NGC4565	The largest edge-on galaxy as seen from Earth. It appears as a long streak of light with a bright core and a dark lane.	10.3
Ophiuchus		
M9	Dense and bright globular cluster partially obscured by interstellar dust.	9.0
M10	Well resolved globular cluster.	7.5
M14	Large and bright globular cluster.	9.5
M19	Globular cluster.	8.5
M62	Globular cluster at least three fast rotating stars in its centre known as pulsars.	8.0
M107	Globular cluster possibly obscured by interstellar dust.	10.0
IC4665	Open cluster.	4.2

JULY		
Lyra		**MGN**
M57	The Ring Nebula is a great example of a planetary nebula that is visible in a smaller telescope, the M57 takes magnification very well. The M57 is illuminated by a central white dwarf or planetary nebula nucleus of 15.75 magnitude.	9.5
Vulpecula		
M27	The Dumbbell Nebula is the brightest nebula in the sky. Larger instruments may show hints of colour and also its central star. The central region of the nebula is marked by a pattern of dark and bright cusped knots and their accompanying dark tails.	7.5
NGC6885	Open cluster consisting of around 30 stars.	9.1
Scutum		
M11	The Wild Duck cluster with around 3,000 stars.	7.0
Sagittarius		
M8	The Lagoon Nebula can be seen to the unaided eye under dark skies. Larger telescopes will reveal the nebula's interesting structure.	5.0
M17	The Omega Nebula has around 30 stars set in its mass where star formation is taking place. Larger instruments will reveal considerable detail.	7.0
M20	The Trifid Nebula is a hot red emission nebula surrounded by a blue reflection nebular made of dust. It displays 3 radial lanes that become apparent in moderate size telescopes.	5.0
M22	Globular cluster consists of over half a million stars. It will resolve well in larger telescopes. M22 is one of the closer globular clusters to Earth at a distance of around 10,600 light years.	5.1
M23	Open cluster with 150 identified members, the brightest being of magnitude 9.2.	6.9
M25	A loose open cluster of around 600 stars. A pleasant sight in telescopes under low powers.	4.9
M55	Open cluster with a loose collection of stars.	7.0
NGC6603	Open cluster superimposed over a rich stellar region.	11.1
Cerpens Cauda		
NGC6611	Open cluster.	6.0

AUGUST		
Cygnus		**MGN**
NGC6866	Open cluster.	5.5
Pegasus		
M15	Bright and compact globular cluster. Larger telescopes will resolve stars its periphery and also round its centre.	6.2
Aquarius		
M2	Globular cluster with around 100,000 stars.	7.5
NGC7009	The Saturn Nebula resembles the shape of Saturn, it takes magnification well. It is a complex planetary nebula consisting of a halo, jet-like streams, multiple shells and small-scale filaments and knots.	8.3
Vulpecula		
NGC6940	Open cluster over a rich star field. Will show individual stars in a moderate size telescope.	6.5

SEPTEMBER		
Andromeda		**MGN**
NGC7662	A captivating planetary nebulae situated between Andromeda and Lacerta. It has a faint at its centre that is variable. A small telescope will reveal a star-like object with slight nebulosity. A 6" telescope at x100 magnification will reveal a slightly bluish disk.	8.6
Cassiopeia		
M52	Star cluster with hundreds of stars.	10.7
Pegasus		
NGC7320	This galaxy is the brightest member of the so-called Stephan's Quintet.	16.8

OCTOBER		
	Andromeda	**MGN**
M31	A large and bright galaxy. Although it appears more than six times as wide as the full Moon, only the brighter core is visible to the naked eye.	4.5
M32	Situated by M31 in Andromeda the M32 is a dwarf elliptical galaxy about 2.65 million light-years away from Earth.	10.0
Cassiopeia.		
M103	A bright open cluster of 170 stars.	6.4
NGC457	The Owl open Cluster is close to the M103 and consists of approximately 100 colourful stars.	6.7
NGC663	A reasonably bright cluster with around 400 stars found close to the M103.	7.10
NGC7789	A spectacular cluster with over 1,000 stars.	8.28
Cetus		
M77	A near face-on galaxy with an extremely bright centre, its outer parts are difficult to distinguish.	10.5
Triangulum		
M33	The Triangulum Galaxy is a dim face-on spiral 3 million light years from Earth. It can be observed under very good conditions.	7.0

NOVEMBER		
Cassiopeia		**MGN**
M103	Open cluster located in Cassiopeia with around 170 stars.	7.0
Perseus		
NGC869	Open cluster that in small telescopes appears as a beautiful assemblage of bright stars in a rich star field. The cluster is dominated by bright blue stars and also hosts a few orange stars that add to the visual effect.	3.7
NGC884	Open cluster with around 500 stars. It is very close to NGC869, the two can be observed as a pair.	6.1
M34	Star cluster in the constellation of Perseus. In small scopes only the brightest stars are visible forming a X shape.	6.0
Taurus		
M45	The Pleiades star cluster consists of around 500 stars surrounded by gas and dust only visible in large instruments. It is also home to several brown dwarf stars Otherwise the cluster is dominated by hot blue stars of very high luminosity that have formed within the last 100 million years.	1.39
Hyades	The closest open cluster to our Solar System. A V shaped group of its brighter stars outline the head of the Bull in the constellation of Taurus.	0.5
Camelopardalis		
M1	The Crab Nebula is a supernova remnant.	9.0

DECEMBER		
Auriga.		**MGN**
NGC1907	Open cluster.	8.19
M36	Open cluster that consists of a dozen brighter stars against a background of fainter stars.	6.5
M37	An interesting open cluster with hundreds of stars. Fainter stars surround the central 9th magnitude red hue star near the centre adding to the cluster's attraction.	6.0
M38	A 220 million years old open cluster with dark lanes with bright and double stars being present.	7.0
Orion		
M42	An easy object to observe and enjoy with any type of instrument. Will take magnification very well. At its centre, the Trapezium which is a group of four stars causes the nebula to emit light by heating the surrounding gas clouds.	5.0
M43	A bright emission nebula in the constellation of Orion, in reality part of the M42. It takes magnification well to reveal faint stars in the nebula and detail at its edges.	7.0
NGC1981	Open cluster in Orion with around 40 stars.	4.2
Lepus		
M79	Globular cluster.	8.5

APPENDIX II: Handset Menu Structure

Welcome screen
Date and Time
Daylight saving
- Status: OFF
- Status: ON

Custom Site
- Name: user's choice
- Lon: user's longitude
- Lat: user's latitude
- Zone: user's time zone

Country & City
- Country: up and down Arrows to select
- City: left and right Arrows to select

- **Telescope Align**
  - One Star Align — Aligning the telescope on a single star
  - Two Star Align — Aligning the telescope with two stars
  - Three Star Align — Aligning the telescope with three stars
  - Target Sync — increases GOTO accuracy
  - RA BKlash Corr. — Calibrate RA-Axis Backlash
  - DEC Bklash Corr. — Calibrate DEC-Axis Backlash

- **Navigation**
  - Solar System — Catalogue of Solar System objects
  - Constellation — Catalogue of stellar constellations
  - Famous Star — Catalogue of popular stars
  - Messier Catal. — Catalogue of bright deep sky objects
  - NGC Catalog. — Extensive NGC catalogue
  - IC Catalogue — Catalogue of fainter objects
  - Sh2 Catalog. — Catalogue of fainter objects
  - Bright Star Cat — Catalogue with bright stars
  - SAO Star Catal. — Extensive catalogue of stars
  - Customer Objects — For storing user's own objects
  - Input RA and DEC — Insert a custom point in the sky
  - Custom Land Goal — Insert a custom land target

- **Utilities**
  - Current Objects — List of currently visible objects
  - Object Rise/Set — Rising and Setting time of an object
  - Curr. Lunar Phase — Shows the current lunar phase
  - Timer — Timer functionality
  - Alarm — Setup an alarm
  - Eyepiece FOV — Field of view of the eyepiece
  - Eyepiece Magn. — Magnification of the eyepiece
  - Display Illumin. — Handset display brightness
  - Parkposition — Slew to park position

- **Setup**
  - Time and Date — Enter time & date
  - Daylight Saving — Enable/Disable daylight saving
  - Site Setting — Set the current location
    - *Country & City* — *Set location to a city*
    - *Custom Site* — *Set location with GPS coordinates*
    - *Sky/Land* — *Switch between sky and land targets*
    - *Sky Target* — *Sky observing*
    - *Land Target* — *Land Target observing*
  - AZ / EQ — Azimuthal / Equatorial mount switch
    - Alt Telescope — Alt./AZ-Mount type
    - Equ Telescope — EQ-Mount type
  - Telescope Mount — Configure Telescope mount settings
  - Tracking Rate — Set the tracking rate
    - *Star Speed*
    - *Solar Speed*
    - *Moon Speed*
    - *Customize Speed*
    - *Guiding Speed*
      - *Speed 1: x0.125* — *Aggresiveness*
      - *Speed 2: x0.250…* — *Aggresiveness*
  - Language — Change language
  - Telescope Model
  - Reset — Reset to factory settings

APPENDIX III: Troubleshooting

Question/Issue	Remarks	Solution
What are the power requirements?		Telescope 1. 8 x D 1.5VDC battery cells *or* 2. A 12VDC ~3A regulated mains power supply Red Dot Finder 1. 2 x LR41 type batteries
The handset gets stuck at the Initialisation phase.		Reset the handset and try again making certain that data inputs are correct.
The telescope does not move.	No power reaches the telescope.	Make certain the telescope is switched on. Check the cables and batteries/power-supply.
The telescope is slewing erratically and/or the handset resets.	Not enough power.	Use new batteries or an appropriate mains regulated (12VDC ~3A) Power Supply.
How do I reset the handset to factory settings and start again?		Follow the menus, i.e. Welcome Screen > Setup > Reset
The telescope misses its target after a 'Successful Alignment'	Not enough power. Loose parts.	1. Use new batteries / regulated 12VDC 3A PSU 2. Check that the longitude and latitude locking levers are tight. 3. Check that cables like the handset and motor cables do not prevent free movement.
It has not been possible to successfully align the telescope.		Telescope 1. Check the batteries/PSU. 2. Prior to Star Alignment … a. the telescope must be in the Home Position. b. Check mount physical latitude setup. Handset 1. Set Time Zone to 00:00:00 (UK). 2. Check the Longitude & Latitude settings. 3. Check the Date & Time settings. 4. Check the Daylight Saving value settings.
Why is the image through the telescope reflected or inverted?		This is normal with astronomical telescopes.
I have removed the Optical Tube lid and I am using an eyepiece but I can still not see anything through the telescope.		1. Astronomical targets that are out of focus will not appear at all. This can also include bright targets like the Moon. 2. The field of view is relatively small. The target may be outside the field of view.
Can I use the telescope as is to observe the Sun?	Observing the Sun without protection will permanently damage your eyes.	You must use a dedicated, full aperture Solar filter.
Can the telescope track the Sun?	Observing the Sun without protection will permanently damage your eyes.	First align the telescope. Then follow the menus to select Solar Rate, i.e. Welcome Screen > Setup > Tracking Rate > Solar Speed.
How does the compass show North?	The compass points to magnetic North.	The Red part of the needle points North.
The bubble level has several smaller bubbles and not a single large one.		Let the bubble level rest for a few minutes, the smaller bubbles will reform into a single larger bubble.

CAUTION!

Never look at the Sun through your telescope, the telescope's finder or the mount's Polar scope as this will cause blindness. Observing the Sun directly, even for a very short period, without the appropriate protection can cause serious damage to your eyes.

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