OPTICSTAR AZ-GOTO TELESCOPES

Instruction Manual for Opticstar AZ80-GOTO and
AZ90-GOTO Computerised Telescopes

OPTICSTAR

CAUTION!

Never look at the Sun through your telescope or through the telescope's finder 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 the telescope as described in this manual. Read the safety instructions below carefully to avoid damage to the telescope and to avoid injury to yourself and others.

Attention
Never disassemble the telescope, there are no serviceable parts inside. Disassembling the telescope 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 telescope under the supervision of adults.

Intended Use
The telescope has been designed primarily for astronomical observing. It can be used once attached to its tripod or alternatively it can be used on a table without the supplied tripod. Do not leave the telescope under direct Sunlight as this can damage the scope and the optics, in addition the telescope can focus Sun light into point and cause a fire.

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

Always use a full aperture Solar filter if you intend to observe the Sun with a telescope, never use 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 telescope as described in the manual. Do not disassemble the telescope as there is a risk of electric shock. The telescope is powered by 6 x AA 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.

Opticstar Ltd
87 Washway Road, Sale, Greater Manchester, M33 7TQ. United Kingdom
Web: www.opticstar .com – Email: info@opticstar.com

AZ90-GOTO & AZ80-GOTO Overview 1/2

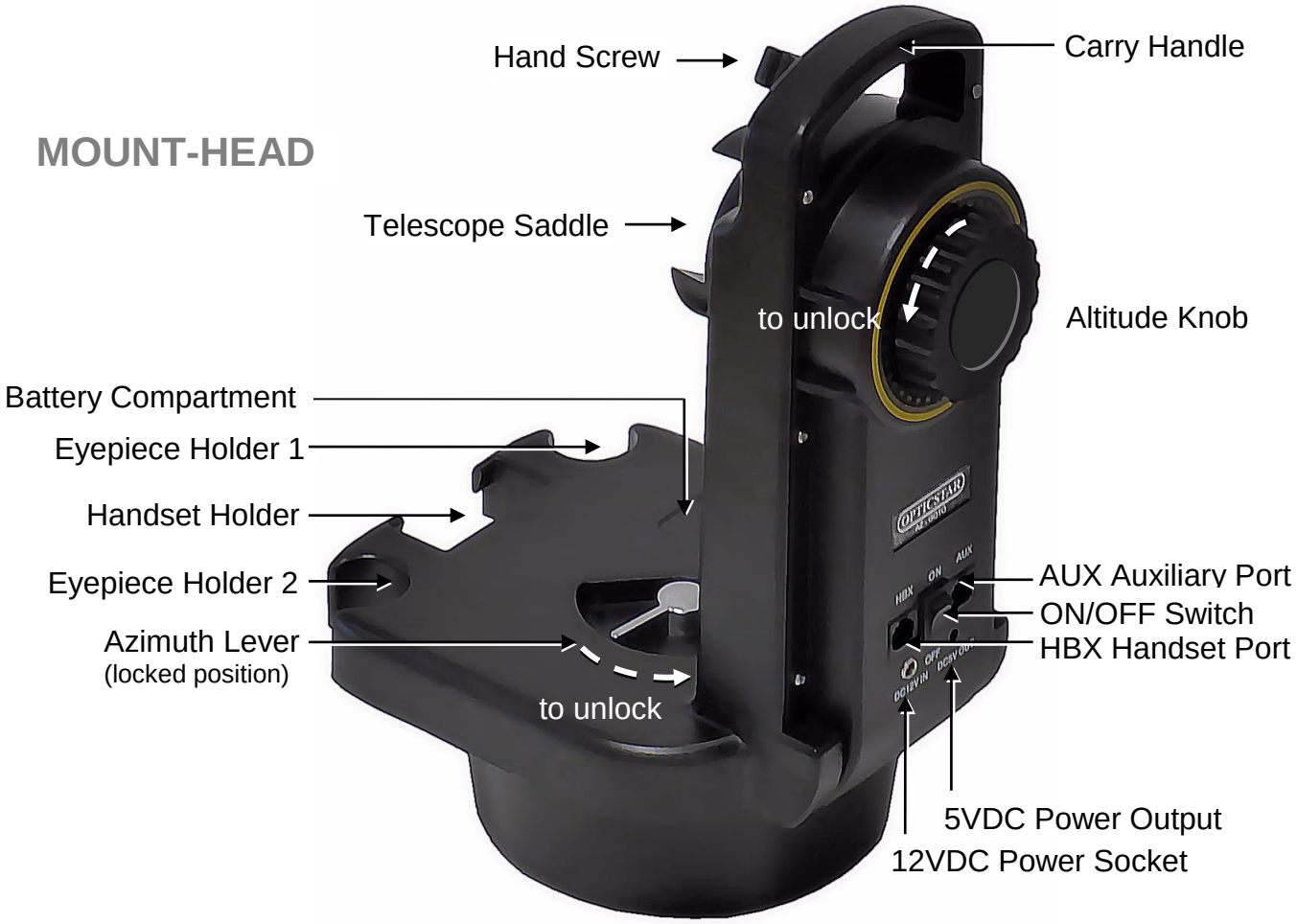
AZ90 GOTO Telescope Parts

1. Optical Tube & Lid (not shown)
2. Eyepiece Drawtube
3. Locking Screw
4. Focus Knob
5. Red Dot Finder
6. Tripod
7. Tripod Platform
8. Leg Spreader
9. Accessory tray
10. 1.25” 10mm eyepiece
11. 1.25” 25mm eyepiece
12. Handset
13. Handset cable
14. Bubble level & Compass Accessory
15. This Instruction manual

AZ80 GOTO Telescope Parts

1. Optical Tube & Lid (not shown)
2. Eyepiece Drawtube
3. Locking Screw
4. Focus Knob
5. N.A.
6. Tripod
7. Tripod Platform
8. Leg Spreader
9. Accessory tray
10. 1.25” 10mm eyepiece
11. 1.25” 25mm eyepiece
12. Handset
13. Handset cable
14. Bubble level & Compass Accessory
15. This Instruction manual

AZ90-GOTO & AZ80-GOTO Overview 2/2



Telescope Assembly

You will need a fair amount of space to unpack the parts and assemble the telescope. You will also need a surface like a table to rest the parts and this manual during assembly.

Start by carefully removing all the parts from their packaging and laying them out on the table. Use the diagrams on the previous pages to check that no parts are missing. Look carefully through the packaging materials as it is sometimes easy to miss smaller parts. Pick up the tripod and slowly pull the legs apart. Never force the legs open as this can damage the tripod.

Place the open tripod on a flat floor. Place the Accessory Tray centrally on the Leg Spreader so that it fits and turn it clockwise until it locks in place. Never collapse the tripod without removing the Accessory Tray first, always remove the Accessory Tray before collapsing the tripod

Place the Mount-Head on its tripod making certain that the threaded mounting holes on the base of the Mount-Head match the two screws on the Tripod Platform. Now hand-tighten the screws to secure the Mount-Head on its tripod. It is worth periodically checking that these screws remain tight.

Loosen the Altitude Knob with your hand by rotating it counter-clockwise, then rotate the Telescope Saddle until the hand-screw points upwards and tighten the altitude knob by rotating it clockwise.

Loosen the hand screw on the Saddle so that it does not protrude. Place the Optical Tube in the Saddle and tighten the hand screw firmly to secure the Optical Tube as shown in the picture on the right. Make certain the Optical Tube is horizontal to the floor. You can reset its position by loosening the Altitude Knob, adjusting the position of the Optical Tube and re-tightening the Altitude Knob.

Pick up the 25mm eyepiece that came with the telescope and remove the covers at either end. Remove the dust-cover from the Eyepiece Drawtube near the back of the Optical Tube and loosen the eyepiece Locking Screw so that it does not protrude in the inside of the Eyepiece Drawtube. Place the 25mm eyepiece in the Eyepiece Drawtube and finger-tighten the Locking Screw to secure the 25mm eyepiece in place. Remove the Optical Tube Lid and make certain that you do not point the Optical Tube to or near the Sun.

To get an object in clear view you will need to first focus the telescope. With an eyepiece in place point the telescope to a landmark far away and turn the Focusing Knob on the back of the Optical Tube a number of times to bring the target into focus. If you feel mounting resistance while turning the Focusing Knob it means that it has come to the end of its travel. Simply turn the Focusing Knob the other way to reach focus and assuming that the target is within focal range. Keep in mind that the minimum focusing distance for the telescope is over 20 meters.

Eyepieces with longer focal lengths (i.e. 25mm) offer lower magnifications and wider fields of view and are ideal for locating targets. Once the target is in clear view place it in the centre of the field of view and replace the 25mm eyepiece with a 10mm eyepiece, this will increase magnification by 2.5 times and decrease the field of view by a similar amount. Changing to different eyepiece may require refocusing the telescope.

NOTE: The AZ80 GOTO optical tube consists of two moveable parts. When focusing, the front part where the objective lens is fixed will move in or out for the telescope to reach focus.

Red Dot Finder

If your telescope has a Red Dot Finder (RDF) you would need to mount in on the back of the Optical Tube as seen in the image on the right. Because the AZ90 GOTO telescope has a relatively long focal length, and is capable of high magnifications, its field of view is relatively small. This can make it hard to know where the telescope is pointing. The Red Dot Finder makes pointing your telescope easy.

To switch on the Red Dot Finder, rotate the Power Knob clockwise until it clicks on. Turning the Power Knob clockwise increases the dot brightness, anticlockwise reduces the dot brightness.

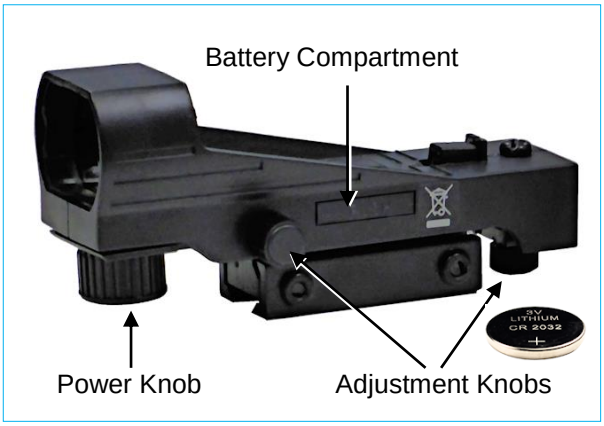
Adjust the brightness of the red dot so that it can just be seen so as not obscure faint nearby stars when observing the night sky.

Once the RDF has been fitted it would need to be aligned to the Optical Tube so that both the Optical Tube and RDF point to the same direction. Point the telescope to a target a few miles away and centre the target in the field of view using a high power eyepiece (i.e. 10mm).

Switch on the RDF and place your head around 30cm (12”) behind it. Look through the RDF with both eyes open until you see a bright red dot superimposed on your view. Without moving the telescope, adjust the two Adjustment Screws until you have placed the red dot on the object you were looking at.

You can now easily point the telescope to distant targets with the aid of the RDF.

The Red Dot Finder requires a single CR2032 type battery to operate. To replace the battery use a pen to push out the sliding battery tray before removing it completely. Replace the battery and slide the battery tray back in place. Please note that with regard the battery’s polarity the positive side should face up.



Powering the Telescope

To power the telescope you will need 6 1.5VDC AA type batteries. We recommend high quality batteries including Alkalines. Rechargeable batteries do not provide enough power over a period. If you decide to use AA rechargeable batteries they will need to be of high capacity and quality. To insert the batteries first check that the ON/OFF telescope power switch is at the OFF position. Locate and remove the rectangular Battery Compartment cover on the top side of the Mount-Head's base, this will reveal the battery holder. Remove the battery holder and insert six AA batteries into it observing the polarity, replace the battery holder and close the Battery Compartment cover.

The telescope requires 12VDC to operate. Never use batteries or any power source at Voltages above 12VDC as this can seriously damage the telescope and invalidate the warranty.

Aligning the Telescope

Your telescope should now be fully assembled and ready to use for the first time. The next few pages take you through the process of setting up, Star-Aligning and using your telescope for the first time, i.e.

1. Set the telescope to the Home Position.
2. Enter the data required in the handset.
3. Star Align the telescope
4. Issue GOTO commands to the telescope.

Home Position

Use the supplied compass/bubble-level accessory in order to set the telescope to its Home Position.

1. Place the bubble-level on the top side of the mount's base and level the mount by adjusting the tripod legs.
2. Place the bubble-level in the place of the eyepiece and level the Optical Tube by loosening the large round Altitude Knob found on the side of the Mount-Head's arm, then re-tighten the Altitude Knob.
3. Loosen the silver Azimuth Locking Lever on the upper base of the mount-head and with the help of the compass point the optical tube North, re-tighten the Azimuth Locking Lever (red compass arrow points North).
4. Remove the compass/bubble-level and place the 25mm eyepiece in the eyepiece drawtube, secure it in place.
5. Remove the lid from the front of the telescope.

You are now ready to input your location/site data into the handset and Star-align your telescope.

Telescope Handset Setup and Telescope Star-Alignment

The following text describes the procedure of setting up the handset and aligning your AZ-GOTO telescope. The diagram in page 9 outlines the same but in a concise graphical form.

Handset Setup

With the power switch in the OFF position insert 6 AA batteries into the battery holder or connect the telescope to a regulated mains PSU (12VDC ~1A, pin positive).

Plug one end of the coiled RJ-45 cable in the port labelled HBX on the telescope panel 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 to the Main menu from where you can issue GOTO commands once the telescope has been Star Aligned.

Time & Date

You will be prompted to enter the date and time. 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 Arrows to select Daylight Saving time by selecting the status (ON/OFF). Press the Confirm Key to proceed.

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 the Site 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
OTA:	0	0	OTA: 0
Azi:	000	000	Azi: 000
Alt:	00	00	Alt: 00

The Azi (Azimuth) and Alt (Altitude) values define the starting position (Home Position) of your telescope prior to alignment; at 000/00 the telescope should point North (000) and the optical tube should start level to the ground (00). For example if the telescope was in a location listed below on the 1st of December 2014, the time was 8:10pm, the telescope was pointing North and the optical tube was level 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
OTA:	00	000	000	000	000	000	000	000	000
Azi:	000	00	00	00	00	00	00	00	00
Alt:	00								

Date: 12:01:2014 (mm/dd/yyyy) 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.

Please remember that the telescope expects the Longitude and Latitude in degrees:minutes:seconds and not in decimal form.

Slewing the Telescope

You can use the four arrow keys on the handset to slew the telescope. The telescope defaults to a low speed but you can change that by pressing keys [1] to 9 on the keypad, press key [1] for slow slewing and key [9] for fast slewing. Note that if the speed is set to a low value you would only notice any movement through the eyepiece.

In general, a low speed setting will enable you to accurately centre your target, a high speed setting will enable you to manually slew the telescope to a target at high speed.

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 around three minutes to complete once you are familiar with the procedure.

With the telescope set at the Home Position (page 6) 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 of the three 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.

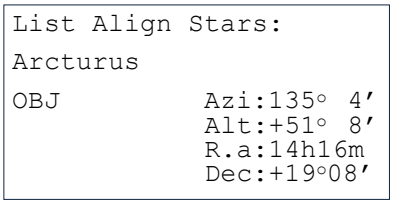
The diagram on the following page shows all the steps involved in setting up the handset and aligning your telescope on a single star. It assumes the telescope is switched ON to start and that it is set at the Home position. The text below outlines the Star-Alignment process and other relevant operations.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

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 down Arrow Keys to go through a predetermined list of bright stars, before pressing the oval Confirm Key to choose an Alignment star of your choice.



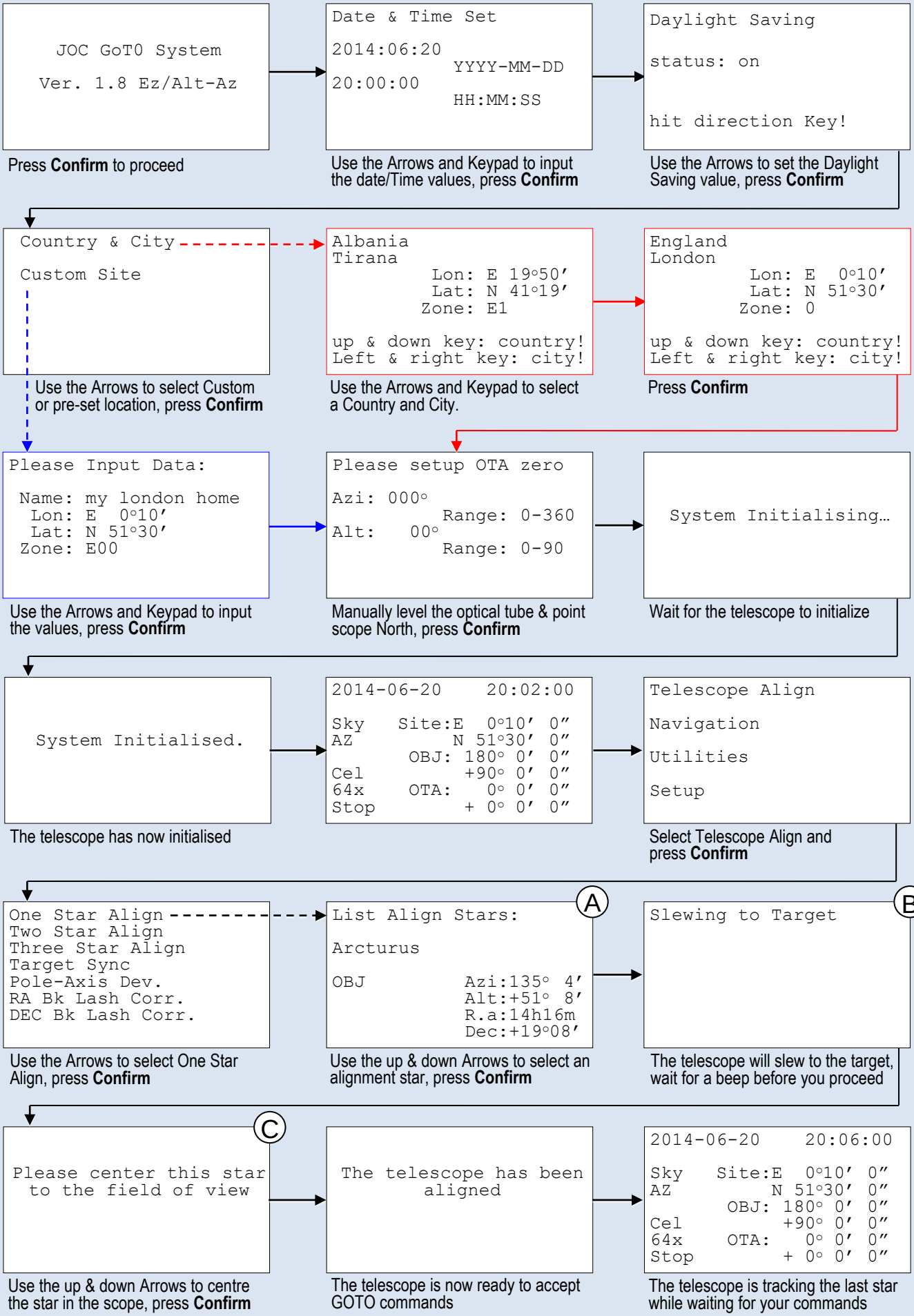
2. Once an Alignment star has been selected the telescope will automatically slew to the chosen star and prompt you to centre it in the field of view using the Arrow Keys, once centred press the oval Confirm Key to finish.

Please note that you can change the slewing speed at any time by pressing keys [1] to [9] on the handset, press [1] for slow and [9] for fast.

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.

TIP It is recommended that you perform a two or three-star alignment as this will substantially increase the pointing accuracy of the mount.



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 to bring the planet into the centre of the field of view and use the silver Focusing Knob on the back of the telescope's Optical Tube to bring the planet into focus. Use a high power eyepiece (i.e. 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 more evident with deep sky objects and especially when using telescopes with smaller apertures.

Choosing your First Targets

During the early stages it is advisable to concentrate on visible 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 observe some 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 M(33) 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 others.

Target Sync

Whether you have 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. 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 Arrow Keys to precisely centre the object in the field of view.
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 is likely to 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 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.

Using your Telescope

This section will help you understand how to get the most out of your telescope and how to care for it.

Eye-pieces and Magnification

The actual magnification capability of a telescope will vary depending on the eyepiece attached to the telescope. Magnification can be changed by simply exchanging eyepieces. Magnification depends on two factors. The focal length of the telescope and the focal length of the eyepiece used. To calculate the magnifying power an eyepiece gives, simply divide the focal length of the eyepiece into the focal length of the telescope.

Magnification = telescope's focal length / eyepiece's focal length

For example a telescope with a focal length of 400mm and an eyepiece with a focal length of 10mm will magnify its target 40 times (400/10=40).

Barlow Lenses

A barlow (image magnifier) can be used in conjunction with most eyepieces to increase magnification. Barlows typically come in x2 and x3 magnification versions but more expensive barlows can typically offer magnifications up to x5 times. This however may prove too much for most telescopes.

To calculate the magnifying power an eyepiece gives in conjunction with a barlow, simply divide the focal length of the eyepiece into the focal length of the telescope and multiply the result with the barlow's magnifying power.

Magnification = telescope's focal length / eyepiece's focal length x barlow magnification

For example a telescope with a focal length of 400mm, a x3 barlow and an eyepiece with a focal length of 10mm will magnify its target 120 times (400/10x3=120).

Please note that the target will darken as magnification increases, this is normal as the same amount of incoming light is now spread over a larger surface. This is important to keep in mind when observing deep sky objects in particular.

Field Of View

The field of view is the portion of the sky that is visible through the telescope and depends on the focal ratio of the telescope, the Apparent Filed of View of the eyepiece also has a role to play. Also higher magnifications result in smaller fields of view.

Short focal ratios (f/4) with wide fields of view greatly favour deep sky viewing, where focal ratios of f/10 and above are better suited for planetary observation. Focal ratios in between these values may be considered appropriate for general use.

It is possible to calculate the field of view of a telescope given a certain eyepiece with the following formula.

Actual Field of View = Eyepiece Apparent Field of View / Magnification

where **Magnification = Telescope Focal Length / Eyepiece Focal Length**

Consider a telescope with a focal length of 1,250mm and a 10mm eyepiece with a 50 degrees Apparent Field of View.

Magnification = 1,250 / 10 = 125

Actual Field of View = 50 / 125 = 0.4 degrees

A 0.4 degrees Actual Field of View is quite small when you consider that the angular size of the Moon is 0.5 degrees.

Filters

A neutral density Moon filter is required to observe the Moon as the Moon is too bright. A Moon filter like any other filter will screw in front of an eyepiece. For a telescope below 120mm in aperture a 25% transparency Moon filter would work well. For larger apertures a 13% transparency filter is recommended.

Variable Moon filters, like the one on the right are also available and are extremely useful as you can set the light transparency to the desired level. This is a worthwhile accessory if you enjoy to observe and study the various Moon features that are far too many to list here.

Planetary filters are used to increase contrast and reveal additional detail on the planets. They do this by blocking certain wavelengths of light that would otherwise blur finer surface detail. The same filter will emphasise a variety of features on the different planets and as such there is no one filter per planet but instead a number filters that will emphasize different features on every planet's surface. Planetary filters can be bought individually or in small sets.

Light pollution filters will help to reduce light pollution if you live near a conurbation. Such filters tend to work better with larger aperture telescopes. They reduce scattered light and block certain wavelengths that have an adverse effect on the quality of the image though the eyepiece.

Please note that your telescope will work with standard 1.25" astronomical filters, these will screw in the front of the eyepiece.

Observing Considerations

There are many factors that will affect the quality of the image through the eyepiece including sky quality in terms of the level or light pollution and sky transparency. Otherwise you will be limited by the type, size and the optics of your telescope in what you can see.

However there are other important factors to consider that can substantially improve the experience. Always let the optics to cool down, this varies depending on the size and type of your telescope but typically a 100mm telescope will need around 15 minutes depending on its optical design.

Please keep in mind that targets near the horizon will not look as sharp, targets near the zenith will look substantially sharper. Avoid setting your telescope on concrete; grass is better as it does not release substantial amounts of heat. Your line of sight should ideally not pass over a warm house, the rising heat will substantially affect the quality of the image.

Dew shields also useful as they cut stray light entering the telescope, they also protect objective lenses and frontal corrector plates from dew building up on the optics.

Telescope Care

Always disconnect the telescope from its power supply by removing the batteries or plug in case you are using an external power source and prior to cleaning. Clean the telescope (not the optics) with a soft cloth, do not use abrasives or other cleaners as they may have an adverse effect on the telescope's finish.

Clean the eyepieces and lenses only with a soft, lint-free cloth, like a micro-fibre cloth as used for cleaning camera lenses. Do not apply excess pressure to the cloth to avoid scratching the lenses. Alternatively you can use a soft photographic camel type brush to dislodge any dust.

Store the telescope and its accessories in a dry place away from dust and moisture. Note that the telescope and its accessories are not dustproof or waterproof.

External power sources should be disconnected after a session. Batteries should always be removed if you do not plan to use the telescope for long periods. Old batteries can in time leak corrosive acid that could damage the telescope. Handle such batteries with care. Never heat up or throw batteries into a fire as this can cause an explosion.

Useful Accessories

Optional useful accessories for the AZ90-GOTO telescope would include a 25% transparency Moon filter to reduce the glare of the Moon. A 7mm-8mm eyepiece would be ideal and would deliver higher magnifications (x178-x156) that reveal higher levels of detail on the planets and especially on the Moon. Alternatively a 7-21 ZOOM eyepiece would offer a range of magnifications from x60-x179. Alternatively a x3 barlow could be used with the bundled 25mm eyepiece to reach medium/high magnifications (x150).

Optional useful accessories for the AZ80 GOTO telescope would include a 25% transparency Moon filter to reduce the glare of the Moon. A 4mm-5mm eyepiece would deliver higher magnifications (x80-x100). Alternatively a x2 barlow lens in conjunction with the bundled eyepieces would offer a total of four magnifications i.e. x 16, x32, x40 & x80.

APPENDIX 1: Monthly Sky Watch

Introduction

The night sky is filled with a huge number of objects including stars that form constellations and clusters, planets, nebulae, comets, meteors and galaxies. The following tables draw attention to a number of brighter deep sky objects (DSO) that can be observed with small to medium size amateur telescopes and binoculars. Larger telescopes will show more detail and brighter views.

The Night Sky

Under excellent conditions over 2,000 stars can be seen with the unaided eye but only a few hundred of these are prominent enough to be useful in navigating the night sky, these are normally included in amateur sky maps and digital planetarium programs like Stellarium, Cartes du Ciel etc. Some stars will show colour that is useful in identifying them. For example Antares, Betelgeuse and Aldebaran are orange/red where Vega, Rigel and Spica appear as blue/white.

Stars that form easily recognisable patterns have been given names and are referred to as constellations. Of these the brightest stars act as beacons and can be used to effectively navigate the night sky during the different months of the year. To that extent stars can be particularly useful in locating other interesting objects nearby normally viewable through binoculars or telescopes.

However planets and their satellites tend to move independent of the night sky background and at comparatively high speeds. They are therefore very difficult to reference to any star. However planets like Jupiter, Saturn, Venus and Mars as well as the Moon are easy to spot with the unaided eye and in the case of the planets even medium size binoculars will reveal some detail. Of course this is not an issue if you use a computerised telescope.

Sky Conditions

The prevailing sky conditions will have a significant effect on what you can see through any telescope or binocular. As such if you live near a city the light pollution can make it difficult to locate and observe most DSOs. The Moon and a hazy sky will also have a negative effect.

For best results observe from a dark site and under clear transparent skies without the Moon being present. Once your eyes have been accustomed to the dark conditions (this takes around 30 minutes) you should be able to enjoy the night sky at its best.

Filters

Filters will help to an extent and lager telescopes will benefit more from them. Light pollution filters would help and would be ideal for medium as well as for larger telescopes. UHC (nebula filters) however are more useful for larger size telescopes or when imaging at any aperture..

The Monthly Guides

By no means definitive, the twelve mini guides that follow will provide notes for exploring various interesting DSOs and list other items of interest useful to the amateur astronomer for the twelve months of the year.

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. The two galaxies can be seen in the same filed of view.	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. Its core is among the most massive black holes measured in any of the nearby galaxies. Based on infrared spectroscopy, the dust ring is the primary site of star formation within the galaxy.	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. The lane may become visible in large telescopes and only under very good conditions.	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 galaxy has bright core and two main spiral arms visible in large telescopes under good conditions.	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 2: 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

OTA 0

- **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 Object — 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*
  - Language — Change language
  - Telescope Model
  - Reset — Reset to factory settings

NOTE: You can change the slewing speed of your telescope by pressing keys [1] to [9] on the handset, press [1] for slow and [9] for fast.

Appendix 3: Troubleshooting

Question/Issue	Remarks	Solution
What are the power requirements?		Telescope 1. 6 x AA 1.5VDC batteries *or* 2. A 12VDC regulated mains power supply Red Dot Finder 1. 1 x CR2032 type battery
The telescope does not move and the telescope's power LED is OFF	No power reaches the telescope.	Make certain the telescope is switched on. Check the cables and batteries/PSU.
The telescope is slewing erratically and/or the handset resets.	Not enough power.	Use new batteries or an appropriate mains regulated (12VDC ~1A) Power Supply.
When I use batteries and PSU what takes priority?		The telescope will get its power from the mains PSU and ignore the batteries.
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 or a regulated 12VDC 1A PSU 2. Check that the Altitude and Latitude Knobs are not loose. 3. Check that cables like the handset cable 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 point North. b. the mount and optical tube must be level. Handset 1. Set Time Zone to zero (UK). 2. Check the Longitude & Latitude. 3. Check the Date & Time. 4. Check the Daylight Saving value. 5. The OTA, Azi & Alt values must be zero.
Why is the image through the telescope reflected left to right?		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 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. (Always use a full aperture Solar filter)
How does the compass show 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.

APPENDIX 4: Telescope Specification

Model	AZ80 GOTO	AZ90 GOTO	AZ125 GOTO
Aperture	80mm	90mm	125mm
Optical design	achromatic refractor	maksutov	maksutov
Focal length	400mm	1250mm	1900mm
Focal ratio	F/5	F/13.8	F/15
Maximum Practical Magnification	x100	x178	x240
Viewfinder	no	red dot finder	red dot finder
Handset	Advanced GOTO Handset with database of 272,000 objects, 8-line display and built-in red LED light. Features quick star alignment without any knowledge of the star names or constellations.		
Eyepieces	25mm & 10mm	25mm & 10mm	25mm & 10mm
Magnification w/25mm eyepiece	x16	x50	x76
Magnification w/10mm eyepiece	x40	x125	x190
Telescope mounting	Altazimuth fork type	Altazimuth fork type	Altazimuth fork type
Motor drive	dual axis motors	dual axis motors	dual axis motors
Field tripod	aluminium, adjustable	steel, adjustable	steel, adjustable
Accessory tray	included	included	included
Total telescope weight	4.7kg	5.7kg	TBC
Telescope weight (no tripod)	3.6kg	3.6kg	TBC
Batteries	6 x AA batteries (not included)		
Power requirements	12VDC 1A, tip positive	12VDC 1A, tip positive	12VDC 1.5A, tip positive

NEVER POINT THE TELESCOPE
TO OR CLOSE TO THE SUN

Opticstar Ltd
87 Washway Road, Sale
Greater Manchester
M33 7TQ
United Kingdom
WEB: www.opticstar.com - EMAIL: info@opticstar.com