Instruction Manual

Morning calm 300GE

RainbowAstro Co., Ltd.

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1. About the Product

1.1 Features

1.1.1 Mechanical Part

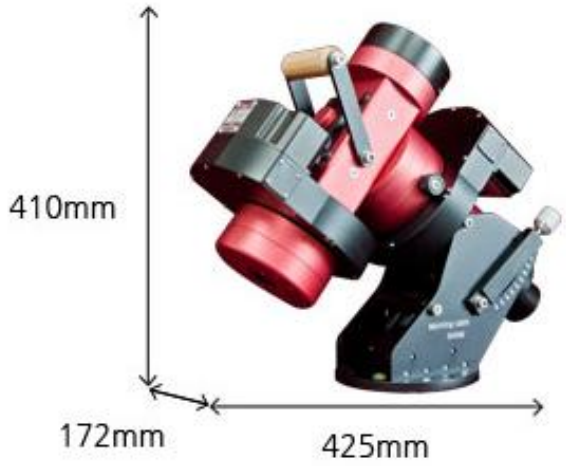
- Duralumin hub-embedded worm wheels made through the use of private hoppers were utilized, securing high stiffness and precision compared with the gross weight.
- One taper roller bearing, three ball bearings, and one thrust bearing were assigned per axis to maintain stiffness against the distortion of axis and load.
- Products were made using domestic technologies, and satisfactory technical support and after-sales service are provided.
- All parts are processed through MCT and CNC lathe; stiffness and precision are superior to those of products made through casting or diecasting.
- The drive system of the DEC axis was positioned at the bottom of the axis to maximize weight on-board considering utility wherein less counterweights are required.
- Wooden knobs are used for convenience during mobile observation.
- A free after-sales service is provided for 1 year, covering the mechanical and electronic systems.

1.1.2 Hubo-I Telescope Control System

- The power supply shutting location is designated as the parking position, enabling precise automatic introduction and tracking again at any time. This is the most remarkable and advanced function for building remote observatories. Furthermore, users can directly designate various parking positions.
- This system converges users' synchronization and input errors when a number of stars are synchronized, precisely controlling the automatic introduction function. These errors include the error range of polar axis adjustment, error range of the DC motor, and error ranges of worm wheels and warm gears. This guarantees precise automatic introduction and tracking during stationary observation semi-permanently.
- Users can maintain the weight balance by measuring the micro-amperage of the DC motor.
- Users can schedule the objects to be observed or photographed. This can be used to decide the order of observation or to take mosaic photographs of heavenly bodies.
- Users can set up the identification speed. You can select the speed through the simple manipulation of the keypad. The display shows the current speed.
- This function is designed for astronomical photographers; you can move the telescope toward east even before reaching culmination. This is a German-style equatorial mount that enables greater exposure when taking pictures.
- Since an electronic clock using ultra-high precision gear is embedded, precise automatic introduction is possible even after several months.
- High-performance, low-power CPU is used to reduce power consumption to a minimum.

- To resolve the inconvenience of connecting the PC through the use of RS232, fast interface of USB 2.0 is used.
- The case made using a high-precision extruder has greater stiffness than ordinary plastic products. In addition, rubber band was used to promote durability to protect the system from side impacts.
- Silicon was used for the keypad to protect it from dew and to maximize the sense of touch. Furthermore, visibility is excellent even during dark nights because a red light-emitting keypad is used.
- A mini-lantern using a red LED is installed on the back of the controller.

1.2 Specifications



Model	German-style equatorial mount (Right Ascension [RA] and Declination [DEC] motor-embedded)
Worm gear	RA 150mm (210 screw thread) / DEC 150mm (210 screw thread)
Weight on-board	50kg from steady point and 30kg at 15cm above the steady point
Automatic introduction speed	1,000 times sidereal time (may be adjusted by the user)
Available latitude	20 ° ~ 60 °
Automatic introduction method	Hand controller, PC control (interlocking with astronomical programs)
Operating voltage	DC 12~16V
Power consumption	~3A
Body weight	20kg
Motor performance	DC 12V, Rated=250gf.cm, 1/50, No Load=10,000rpm
After-sales service	1 year

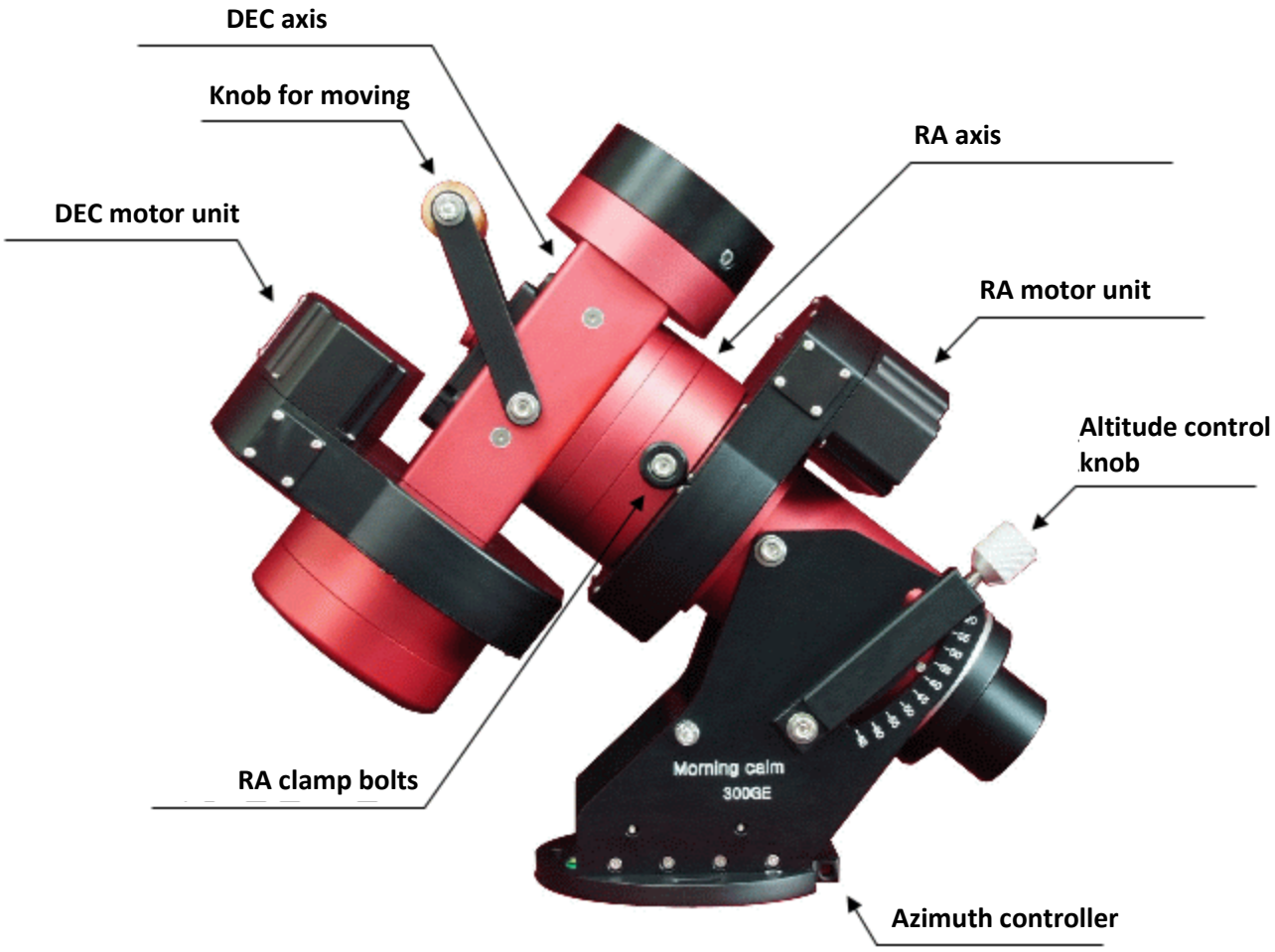
2. Configuration and Components

2.1 Configuration

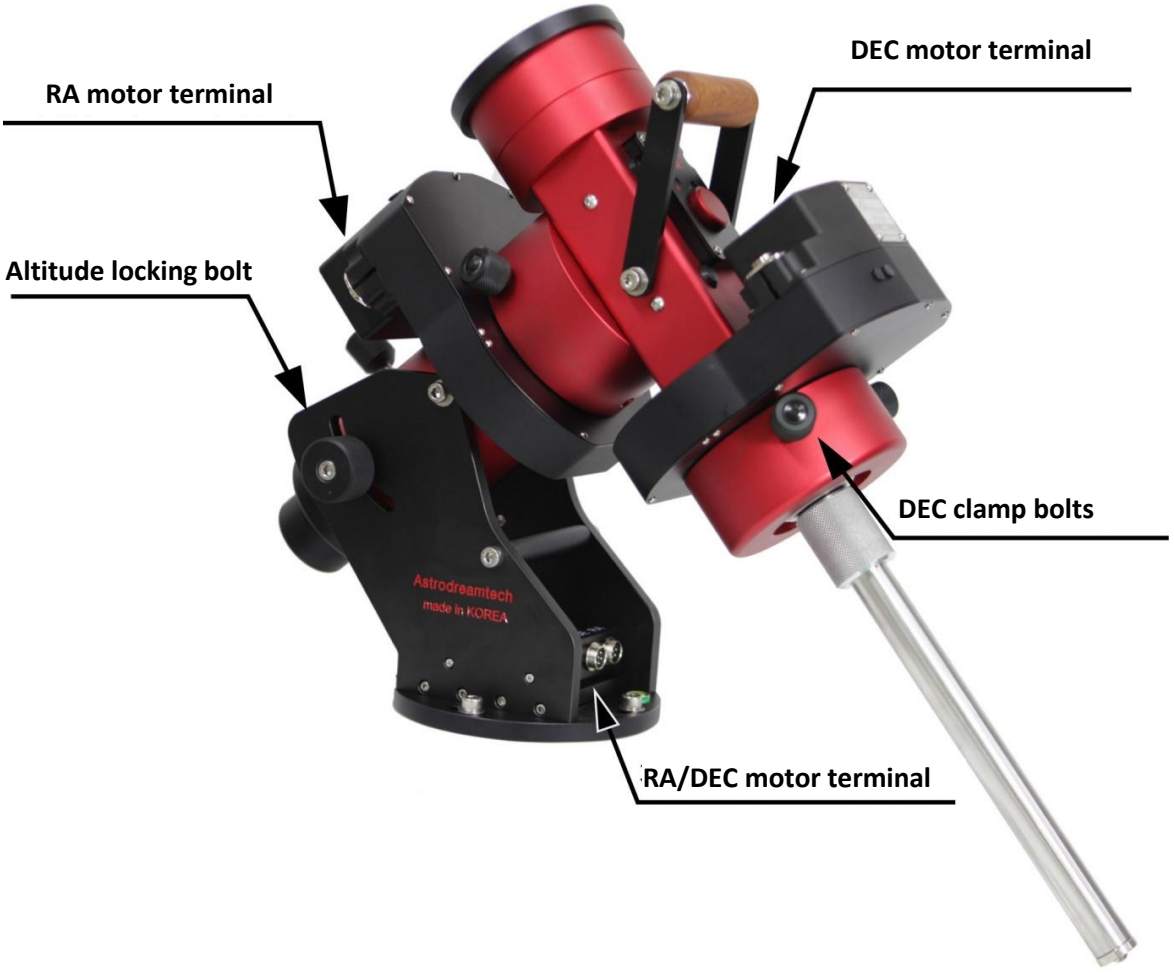
- MorningCalm 300 main body: 1 ea
- Counterweight bar: 1 ea
- Polar axis telescope: 1 ea
- Hubo-i controller: 1 ea
- Hubo-i controller equatorial mount connecting cable: 1 ea
- Hubo-i controller PC connecting USB cable: 1 ea
- RA motor connecting cable: 1 ea
- DEC motor connecting cable: 1 ea
- Equatorial mount power supply cable (crocodile clip): 1 ea

2.2 Names of Components

2.2.1 Right Side



2.2.2 Left Side



2.2.3 Back Side

3. Caution

- Read this instruction manual carefully before using the equatorial mount. Inappropriate use may cause malfunction.
- When the main scope tube is installed on the equatorial mount, do not remove the counterweight, this may cause main scope tube damage.
- Take care not to allow the main scope tube to collide with the tripod or pier, this may cause gear and motor damage.
- Use the product after verifying that the equatorial mount is properly connected to the pier or tripod to prevent the equatorial mount from falling.
- Do not exceed the recommended weight on-board, this may cause the deterioration of equatorial mount performance or cause damage to the equipment.
- In a cold environment, wear gloves prior to operating the equatorial mount to prevent frostbite or other injuries.
- Verify the polarity prior to connecting power supply to the equatorial mount to prevent damage to the electronic systems.
- Do not disassemble the equatorial mount arbitrarily.

4. Installation and Basic Usage

4.1 Installing the Pier (tripod) and Equatorial mount

① Install a pier on solid, flat ground. One of the pier legs should face north.

② After installing the pier, put the equatorial mount on the pier. At this time, the counterweight bar should be aligned with the north side leg of the pier.

③ Tighten the 2 wrench bolts on top of the pier by manually turning them; finally, tighten one of the knob bolts firmly.

④ Bring the equatorial mount into a horizontal position by adjusting the socket set screws of the pier legs.

tip. If the ground of the installation site is not solid, the level of the pier will be distorted over time after installation, and the function of automatic introduction and automatic guiding will deteriorate.

4.2 Installing the Counterweight and Counterweight Bar

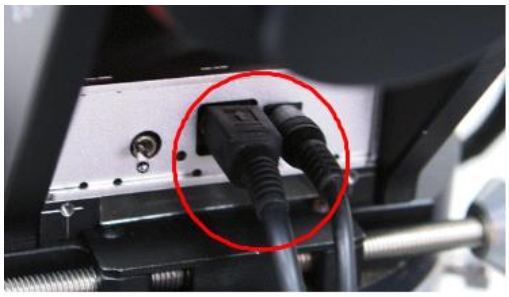
① Connect the counterweight bar to the bottom of the RA axis by turning the weight bar clockwise.

② Turn the weight bar nuts clockwise and fix firmly.

③ Unfasten the anti-fall bolt installed on the edge of the counterweight bar by turning it counterclockwise and connect the weight to the weight bar.

④ Lock the weight anchor bolt by turning it clockwise and the anti-fall bolt to the edge of the weight bar by turning clockwise.

4.3 Connecting the Cable



① Using the cable, connect the DEC motor terminal to the DEC terminal of the control box.

② Using the cable, connect the RA motor terminal to the RA terminal of the control box.

③ Using the cable, connect the motor control box and the HUBO-i controller.

④ Connect the power supply cable to the motor control box and to the battery or other DC power supply system, paying particular attention to the polarity.

tip. For the motor connecting cable, the long cable is for DEC and the short one is for RA

tip. The inside of the power supply terminal has +polarity, and the outside has -polarity.

4.4 Installing the Main Scope Tube and Setting the Balance

① Connect the main scope tube to the equatorial mount head.

② Unfasten the RA axis clamp bolts to loosen the RA axis. Turn the RA axis to maintain the level between the weight and the main scope tube, and then lock the RA axis clamp bolt again.

③ Unfasten the DEC axis clamp bolts to loosen the DEC axis. Adjust the position of the main scope tube and lock the DEC axis clamp bolts again to obtain the weight balance between the front side and the rear side of the main scope tube.

④ Unfasten the RA axis clamp bolts to loosen the RA axis. Adjust the position of the weight so that the weight balance is maintained between the weight and the main scope tube, and then lock the RA axis clamp bolts again.

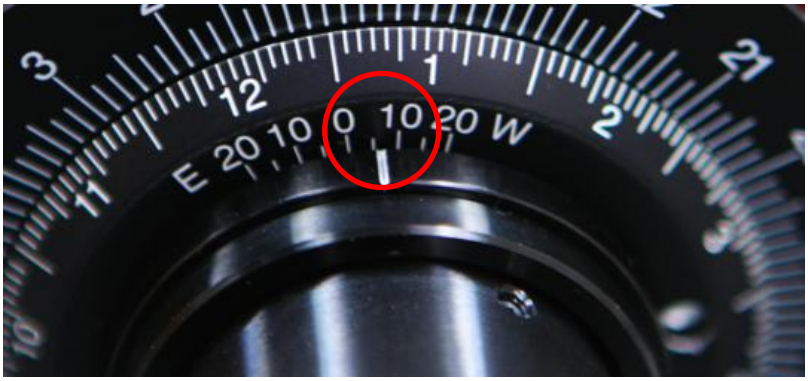
⑤ Repeat the process described in steps ③ and ④ if necessary to set the balance accurately.

tip. Turn the RA/DEC clamp bolts clockwise to lock them and counterclockwise to loosen them.

tip. The more accurately you set the balance, the better the performance of automatic introduction and automatic guide becomes.

tip. The HUBO-i controller provides additional functions for accurate balance adjustment.

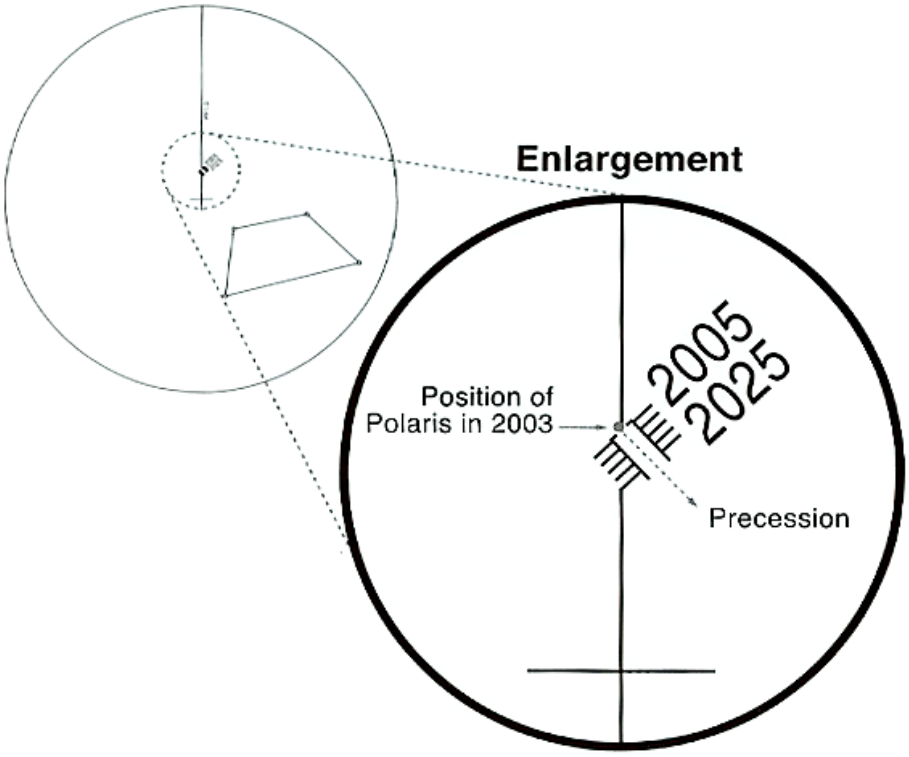
4.5 Aligning the Polar Axis



① Move the longitude reference line of the polar axis telescope by as much as the longitude difference of the surveyed area based on longitude 135°E. Move toward W by 8.5 for Seoul and toward W by 5.5 for Busan.

② Turn the eyepiece of the polar axis telescope and set the date ring and the time ring to the current date and time, respectively. One graduation of the date ring indicates 2 days. The photo shows the date and time set as of 0 o'clock (12:00 at night) on January 10.

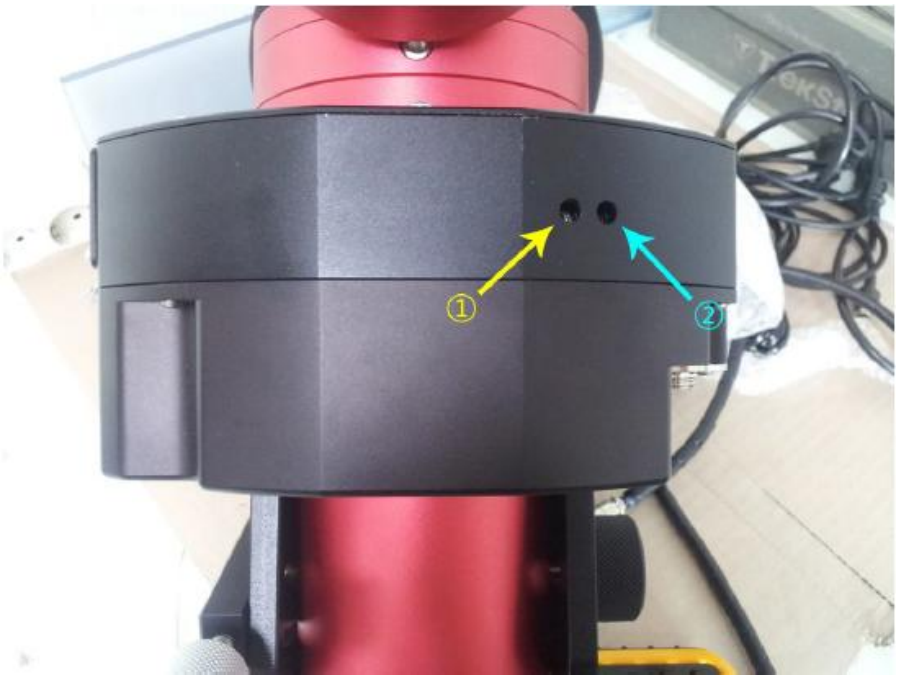
③ Turn the RA axis and make adjustments so that the level mounted on the polar axis telescope becomes level.



④ Turn on the lighting system of the polar axis telescope and introduce Polaris into the field of vision of the polar axis telescope through the use of the equatorial mount's altitude controller and the azimuth controller. Since the position of Polaris changes slightly every year according to precessional motion, position according to year.

5. Adjusting the Worm Gear Backlash

- The RA axis and the DEC axis of the equatorial mount consist of the warm gear and operate in normal condition when there is an appropriate level of backlash. Since the level of backlash may change according to the atmospheric temperature variation, make the appropriate adjustment in case the level of backlash is excessively high or low. If the level of backlash is excessively low, the precision of automatic introduction decreases, and the performance of the guide deteriorates; thus leading to possible gear damage. Pay due attention.



5.1 Description

① Pulling bolt: Tighten clockwise to increase the backlash.

② Pushing bolt: Tighten clockwise to reduce the backlash.

5.2 Reducing the Backlash

1) Loosen the No. ① bolt counterclockwise.

2) Tighten the No. ② bolt clockwise at an appropriate level.

3) Tighten the No. ① bolt completely.

tip. Repeat the process in Nos. 1) and 2) while loosening and tightening the bolts gradually. For best results, adjust the bolts at a level less than 1/10 turn in one operation.

5.3 Increasing the Backlash

1) Loosen the No. ② bolt counterclockwise.

2) Tighten the No. ① bolt clockwise at an appropriate level.

3) Tighten the No. ② bolt completely.

tip. Repeat the process in Nos. 1) and 2) while loosening and tightening the bolts gradually. For best results, adjust the bolts at a level less than 1/4 turn in one operation.

6. A/S Policy

• A free after-sales service is provided for 1 year.

• If the extension of the after-sales period is additionally purchased, the added after-sales period shall be followed.

• If equipment malfunction occurs due to the users' negligence during the free after-sales period, a charged after-sales service shall be provided based on actual expenses.

• If the product is arbitrarily disassembled, no free after-sales service shall be provided.

• For information on after-sales service, contact the place of purchase.