AVALON INSTRUMENTS

M-tre

USER MANUAL

Version 1.0.0. October 2023

SAFETY RECOMMENDATIONS AND WARNINGS

- **Read carefully the manual before installing and using the mount.**
- **Use the power cable supplied with the mount or a 12V- 3A stabilized power supply as suggested in the manual.**
- **Connect the power cable correctly and securely to the power socket.**
- **Do not bend, pull or press the cable as this may damage it.**
- **For any assistance or repair, please contact only the manufacturer.**
- **Be sure to remove the power supply at the end of its use or before any cleaning or maintenance.**
- **This mount must be used exclusively by adults, do not allow use to children or to people with reduced mental capacity.**
- **Avoid to operate the mount except as strictly indicated in the manual.**
- **Modifying or altering in any way the characteristics of the mount will void the manufacturer's limited warranty.**
- **Never modify the tension of the belts (by dedicated screw), these is set in the factory and any unauthorized change will void the manufacturer's limited warranty.**
- **After using it, avoid to store the mount in areas exposed to sunlight or in wet places.**

IMPORTANT NOTE: DO NOT USE ANY KIND OF LUBRICANT, SPRY, LIQUID OR OIL ON THE BELT DRIVE SYSTEM!!!

Any use of lubricants will void the manufacturer's limited warranty.

Table of Contents

Technical Specifications

Type of mount	Single Arm Equatorial Fast-Reverse
Mount weight	35 Kg
Maximum load	38 kg single telescope setup, 50 kg double telescope setup
Motion System	Four-step reducer via pulley timing belt system on ball bearings, with no play on both axis. (Belt Drive System)
Construction Materials	Machined from solid blocks of anodized aluminum with high precision CNC machines
Transmission System	Pulleys made with special polymer + fiber glass and high quality toothed belts
Encoder	21 bit Absolute encoders
Control System	StatGo2 Pro Multiplatform Astronomical Control System
Dovetail Plate	Losmandy, 3" (75mm) dovetail, single knob with 2 tightening points
Warranty	2 years from the purchase date, 5 years for the transmission system (Belt Drive System)

Forewords

This manual describes the Avalon M-Tre mount, the procedures for its mounting on the Adjustable Angle Pier and for the installation of a telescope. Additional Information on the M-tre mount and on the StarGO2 Pro control system, containing also the procedures for the use with third-party software and in particular with the INDI and ASCOM and Alpaca ASCOM drivers, are reported in the StarGO2 Pro manual which is part of the mount supply.

A careful reading of this manual will enable the use of your mount safely and with the maximum satisfaction.

The mount design and its configuration could be subject to modifications, without prior notification, based upon designer's improvements and the requests, if applicable, by the mount users.

1. Packing Content

Open the box to take all the content out. Extract all the components from the small cardboard box and from the mount bag side pocket putting them on a clean, flat surface.

Component List

- Mount Head
- StarGo2 Pro Box
- StarGO control Keypad
- 125/240 VAC / 12 VDC power supply
- Metric Hexagonal key set
- RS232 Cables
- USB Flash drive with softwares and manuals
- RJ11 RA/DEC motor cables
- Attachment screws

Package picture

2 Mount Description

The M-tre is a single arm fork Dual Dec mount devoted to deep-sky imaging in the capacity range up to 35 kg single telescope setup and 50 kg in double telescope setup.

The M-tre design was developed on the basis of the M-uno, making use of the same technical concepts:

- Fast Reverse technology
- Computer aided design (CAD)
- High quality manufacturing with digital control 5 axes CNC machines (CNC + CAM)
- Absolute quality materials: Anodized aluminium from milled mono-bloc, stainless steel components and screws, brass components, techno-polymers

The M-tre motion transmission technology is based on pulley-tooth belt without play, while its peculiar geometry makes easy the imaging at the meridian crossing regardless the typical problem affecting the classic German Equatorial Mounts, for both the risk of touching the tripod and the need of waiting for the object cross the meridian.

Moreover, considering that at the meridian the sky is less subject to light pollution and to atmospheric turbulence, the M-tre is the ideal tool to shoot deepsky objects in their best conditions, close to the meridian, especially when the time is short and the sky is not so dark and clear.

Another M-tre basic advantage is that counterweights may be not required.

Its declination axis can be quickly balanced like in an equatorial mount, while, for the RA axis, it is possible to fix the arm on several possible positions and to make the fine balance using a very small counterweight.

The M-tre mount, is equipped with the new StarGo2 Pro Multiplatform Astronomical Control System.

The use of pulleys and toothed belts has allowed to obtain several advantages: a really steady motion without play (no backlash) and sudden peaks, factors of paramount relevance for long guided exposures and during high magnification visual observations. These features are of particular relevance especially for the declination axis motor that can now quickly reverse the motion without breaks to recover the plays: from here the mount name FAST REVERSE. The toothed belts used in the M-tre have the structure made of special material with steel strands to avoid any deformation, elongation and stress, much better than those used in the automotive engine distribution system (which are generally made of rubber with nylon strands). Considering that the service time for the automotive toothed belts is around 100.000 km (60.000 miles), assuming a medium regime of 2.000 rpm and thermal stress from 0 to 90°C (30 to 195 F) in a few minutes, we can think that the life cycle of the M-tre toothed belts will be extremely long ! It is important to underline that in the gear-worm systems the motion transmission has only one tangent point of contact, any errors on each of the two components will, sooner or

later, result into a tracking errors. On the contrary, in the pulley-toothed belt system, no direct contact occurs between the pulley and the motion is transmitted by the belt engaging from 50% to 90% of the girth surface. Consequently any error, eventually present, is averaged among the cogs, moreover soft, greatly reducing the tracking error.

No wearing effects since no relevant frictions occur. In fact, all the pulleys and the axes rotate on roller bearings that allow to reduce the total friction almost to zero.

Another significant advantage of very low frictions is that the risks of motor slipping during GOTO operation is virtually null. On the contrary, it is well known the difficulty to regulate the coupling between gear and worm in the conventional mounts. If the coupling is tight the motors can stuck with consequent loss of the position, if the coupling is too loose the plays increase. On the other hands, the absence of significant play in the M-tre makes the initial calibration of guiding CCD quick and easy.

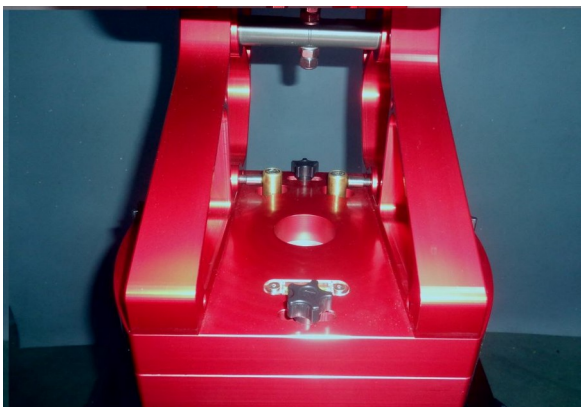
Since there are no gears, there is no need of periodical lubrication of the internal components and therefore the maintenance is extremely reduced and limited to the external cleaning.

3. M-tre Initial Setup

The M-tre can work at latitudes range from about 35° to about 60°. This mount comes with the latitude preset adjusted at 45°, so the first operation to perform, is the regulation of the latitude to the value related to the site in which the mount will be used. The same operations will be carried out in the case the mount is transferred in a site with a different value of latitude. This operation will be described in the section 3.1 below.

It is strongly recommended that the M-tre mount is used with the Avalon Instruments T-pod tripod which has been designed to guarantee maximum performance. If a different kind of tripod is used, it must have dimensions and characteristics compatible with the mount weight and with the astronomical load to be installed. Section 3.2 describes the mount installation on T-Pod tripod.

In order to contain as much as possible the overall packaging dimension, the mount comes in the package with the t-pod adapter flange already assembled.

Remove the three flange fixing knob.	
Remove the flange from the mount bottom and fix it on the T-pod or on a Pier as shown in the image on the right.	

3.1 Latitude Range Setting

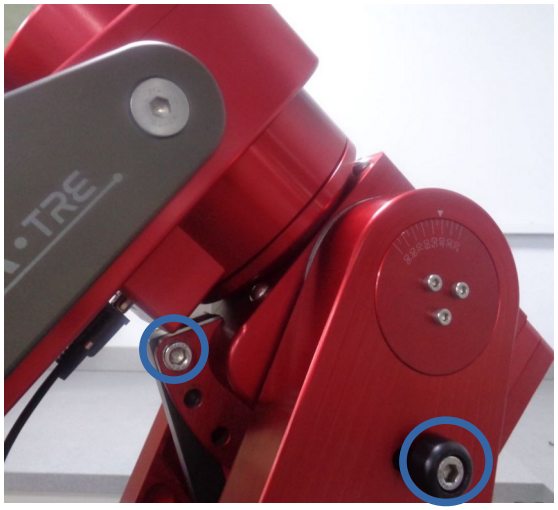
This section describes in detail the procedures to switch set the correct range of latitudes of the site where the mount will be used.

The following are the steps to adjust the mount's latitude range

Rough latitude range setting. Choose the correct hole

Loosen the lateral bolts that is currently holding the mount lateral base flange, then loose and remove the bolt that is holding the adjustment cylinder in it's position hole position hole.

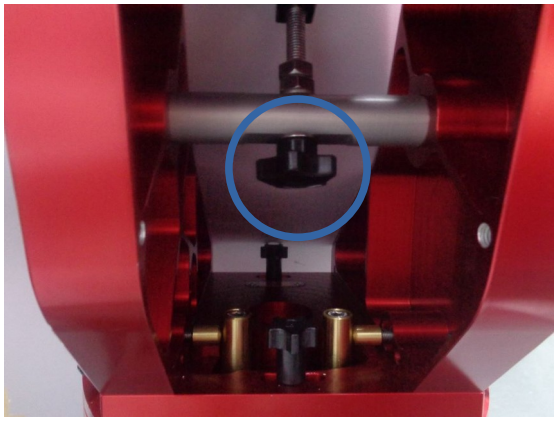
NOTE: due to the M-tre weight it's better to perform this operation in at least two people, while one unscrew the bolts, the other should hold up the mount.



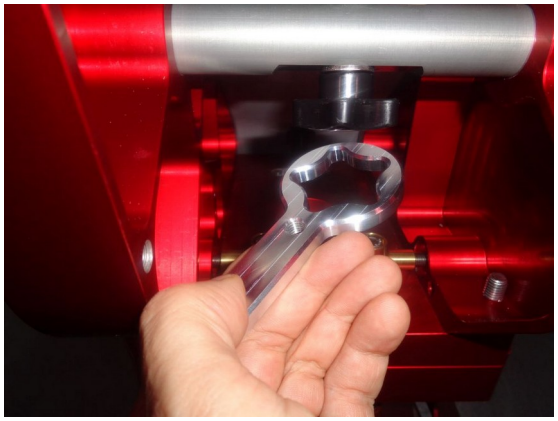
Move to upper holes for low latitudes area, move to lower holes for higher latitudes area.

Fine latitude range setting.
Rotate the knob

Once the correct latitude range hole has been set, is possible move of few degrees up or down by rotating the latitude knob shown in the picture on the right.



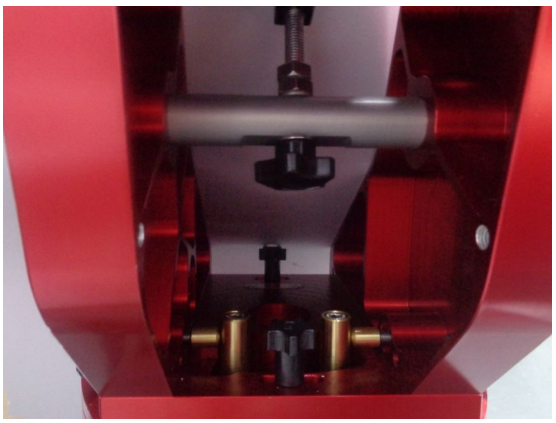
If by hand the knob rotation it may feel to hard to move, it is possible to use the provided knob latitude key, as shown in the picture on the right.



The following are the steps necessary to perform the fine Azimuth adjustment on the M-tre

Loose the azimuth adjustment knobs and perform a few turns of the two lateral Azimuth adjustment knobs by rotating them in opposite directions.

The two lateral Azimuth adjustment knobs press on the corresponding pin, allowing the fine Azimuth rotation.

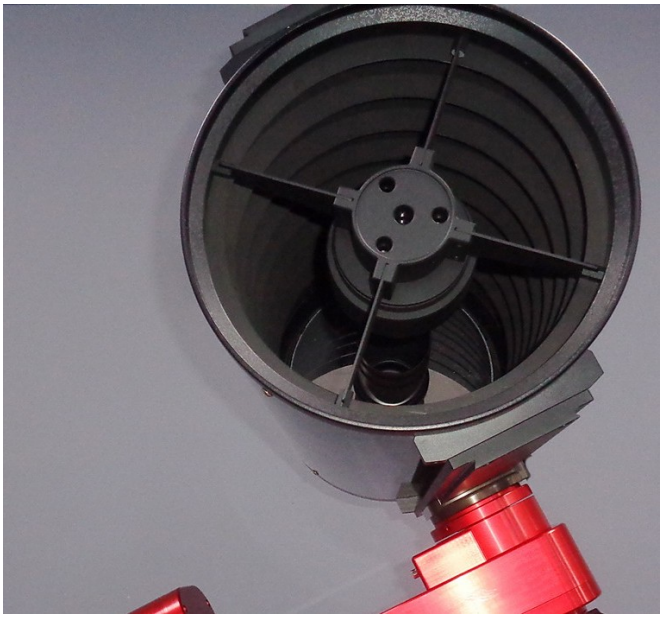


When the fine Azimuth adjustment has been set, is possible to tight the mount fixing knob.

3.3 Telescope installation

After the mount has been placed and secured on the T-pod, the next step will be the positioning of the Telescope on the M-tre. and to perform the Polar Alignment.

Place the mount arm in the position shown on the right picture, unlock the declination bolt and rotate the axis until the female dovetail saddle is horizontal. Firmly lock both the axis bolts. Firmly keep the OTA and insert its male dovetail plate into the female saddle, making sure that the side closer to the ground goes in first, as shown in the picture.



The declination axis can be unlocked by loosening the DEC axis blocking bolt by using the provided key

While holding the telescope with one hand, use your other hand to rotate the knob on the dovetail saddle clamp, as shown in the right picture, until it is firmly locked.

Before leaving the telescope, be sure it has been securely attached by making certain that the male dovetail bar is in close contact with the female saddle and there is no space between them.

Test the saddle's locking knobs as well as the RA and DEC clutch levers to make sure they are tight

4. Telescope Balancing

To guarantee a precise mount tracking it is necessary to correctly balance the telescope in both the rotation axes. To perform this operation is needed to move manually and freely the telescope in RA and DEC. As anticipated, the M-tre is provided of latches in both axes. To freely move the telescope, the latches need to be released by rotating the related levers in the counter clockwise direction.

Note: Before performing the balancing of the telescope be sure to have the full control of it before releasing the latches. An over unbalanced mount can move very quickly causing damages to the optical tube or to the mount itself.

4.1 Dec Balancing

To obtain the best tracking performance from the mount, the telescope must be balanced in both axes. Even if the telescope does not track in Declination, it must be balanced on this axis to avoid sudden movements when the declination knob is unlocked. Good balance also helps to prevent vibrations and overly-quick responses while guiding and reduces strain on the motors. With the M-tre mount it is better to start balancing the DEC axis rather than the RA axis. The M-tre is unique in that it allows the RA axis to be almost automatically balanced with any telescope.

Before beginning the balancing operation, it is worthwhile to test the saddle locking knobs to make sure they are tight. Telescopes do not like to being dropped!

Perform the following operations:

- Unlock the RA axis knob and move the arm of the mount to an equilibrium position, as seen in the image, and re-tighten the RA axis knob.
- Loosen the DEC knob and move the telescope parallel to the ground as seen in left picture, but do not let go of the telescope.
- Move the tube SLOWLY and CAREFULLY – to see in which direction, if any, it rotates around the DEC axis. If the front end moves down, the telescope must be moved backwards in the mount. If the front end moves up, the telescope must be moved forwards. To do either of these, maintain a good grasp of the OTA and slowly loosen the dovetail knob on the mounting saddle.
- Move the tube back or forth in the saddle, depending on whether it moved up or down, until it stays in a horizontal position by itself when you remove your hand.

Note: Always lock the clamp before checking the balance with the new tube position! If the tube remains stable in a horizontal position when the DEC knob unlocked, the DEC axis will be balanced. Tighten the dovetail clamp to firmly lock the telescope tube in its new position. Do NOT leave the telescope while the dovetail clamp is loose. In the unlikely event that your telescope should fall off the mount onto the ground, it could ruin your entire day.

4.2 RA Balancing

Balancing the M-tre mount in the Right Ascension axis is different from the other German Equatorial Mounts, but it is quite easy to do. The balance is performed in two phases, one raw and the other more precise.

Raw Balancing

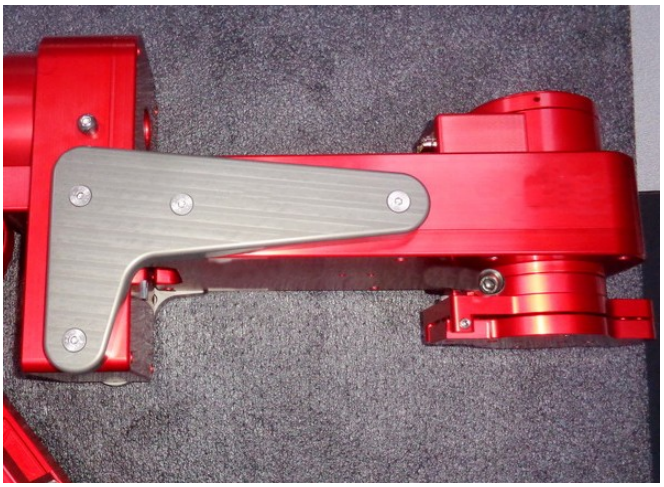
After having placed the telescope on the clamp and having found the fine DEC balancing, the user should have noticed the balancing behaviour on the RA axis.

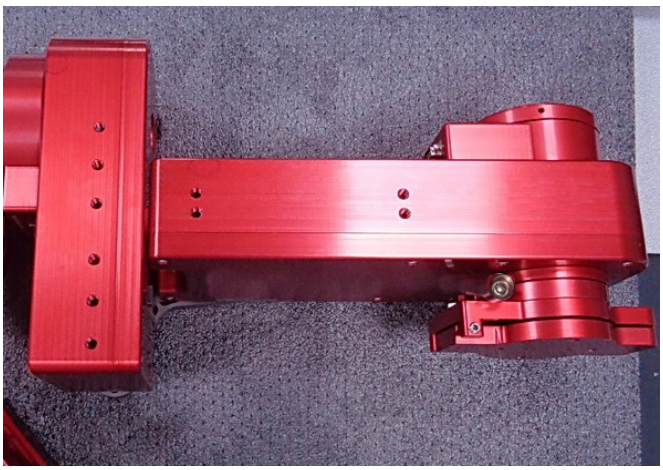
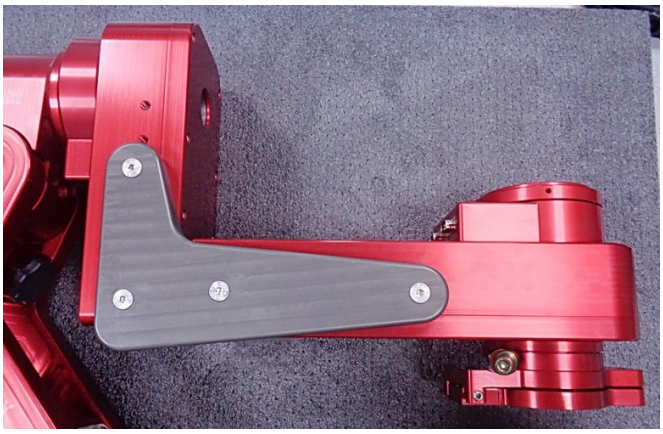
The M-tre (as the M-zero and the M-due mount) allow to move the DEC arm in several positions toward the RA axis. This feature help to find a fine balancing by using as less as counterweight possible.

On depending on the unbalancing level noticed in the previous operation, the user can be aware about the best DEC arm position to use for his setup.

Normally, the more the telescope weight, the lower should be the DEC position.

In case the user needs to change the DEC arm position from the one provided, the following procedure must be followed.

Place the mount on a flat and anti-scratch surface. The foam cover that comes with the packaging may be useful for this purpose. Put the arm of the mount parallel to the ground as seen on the right picture.	

Unscrew and set aside the four screws holding the lateral bracket on both sides of the mount. Then remove the lateral bracket.	
In case the lowest position will be required, it is possible to reverse the lateral bracket, as for the M-zero mount.	

Warning: do not use different screws other than those supplied or serious damage to the gear system may occur!!

Precise balancing

Once the mount arm has been set in the correct position for approximate balancing, tighten all screws and, if necessary, perform the fine balancing. This is performed by mounting the small counterweight, its shaft and the female dovetail as shown in the previous picture above. Insert the counterweight in the shaft and slide it in the equilibrium position. When that is accomplished, firmly tighten the counterweight locking knob and the shaft end knob. Of course all the precise balancing operations should be performed with the telescope installed.

NOTE: Most German Equatorial mounts are based on worm gear technology. They need to be slightly unbalanced in the easterly direction to avoid any unwanted pendulum-like behaviour when crossing the meridian. The M-tre's toothed-belt transmission technology eliminates the need for this small amount of east-bias unbalance. This is a major

improvement because once the M-tre is balanced, the counterweights do not need to be moved at all. The design provides a level of stability that is most appreciated during long exposures and remote observing sessions.

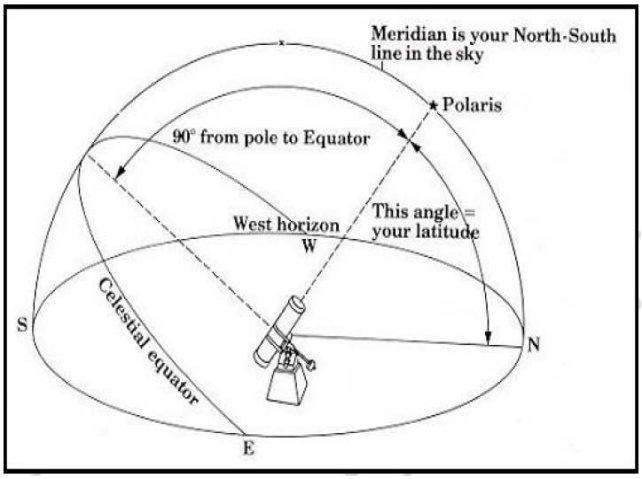
5. M-tre mount stationing

Before using the M-tre mount it is necessary to position its polar axis parallel to the earth's axis of rotation.

In this chapter the operations to trim the latitude and the azimuth and to perform the mount alignment to the celestial pole using the standard polar scope (or the optional alternative) will be described.

5.1 Latitude Fine Adjustment

During this operation the mount arm must be kept in its equilibrium positiont. After leveling the mount base using built-in the bubble level, the next step in this process consists of approximately setting the polar axis at an angle equivalent to the latitude of the observation site. For example Rome is about 42° North, Milan and Venice 45° North and Palermo 38° North. Refer to the latitude scale on the side of the mount.

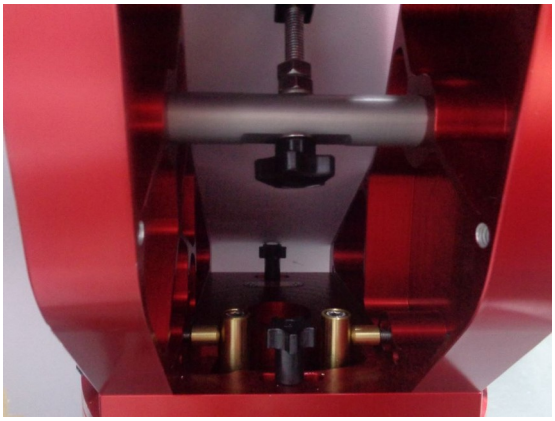


The latitude adjustment must be performed using both hands to turn the two latitude adjustment knobs in conjunction with each other. While one hand is tightening the front knob, the other hand should be loosening the rear knob and vice-versa. To increase the latitude (i.e. raise the polar axis), the rear knob must be turned in the clockwise direction while the front one is turned in the counterclockwise Direction. To lower the axis, the opposite actions are performed.

NOTE: It is generally better to perform the fine latitude operations against the force of gravity, that is, by raising the mount.

5.2 Azimuth Regulation

The azimuth regulation is performed in a similar manner, using both hands to turn the other two adjustment knobs in opposite directions simultaneously. When a knob is rotated in one direction the other is rotated in the opposite direction. Turn them so that the screws attached to the knobs press against the brass adjustment post and move the mount to the right or left by a small amount. The azimuth adjustment knobs are those positioned on both sides of the mount as seen in the picture on the right.



Remember that setting up the mount in both Latitude and Azimuth should be performed only during the important phase of precise polar alignment, before starting an observation or photographic session. Once the polar alignment has been reached, THE MOUNT SHOULD NOT BE MOVED FOR ANY REASON USING ALTITUDE OR AZIMUTH KNOBS OR THE ALIGNMENT WILL BE LOST. After the alignment has been established, moving the mount in Right Ascension and Declination and pointing the telescope to celestial objects should be performed only by using the keypad or the software commands.

5.4 StarGo2 Pro installing

The First step to be performed in the cables connection procedure, is the StarGo2 Pro box assembling. The porocedure is described with picture sequence below.

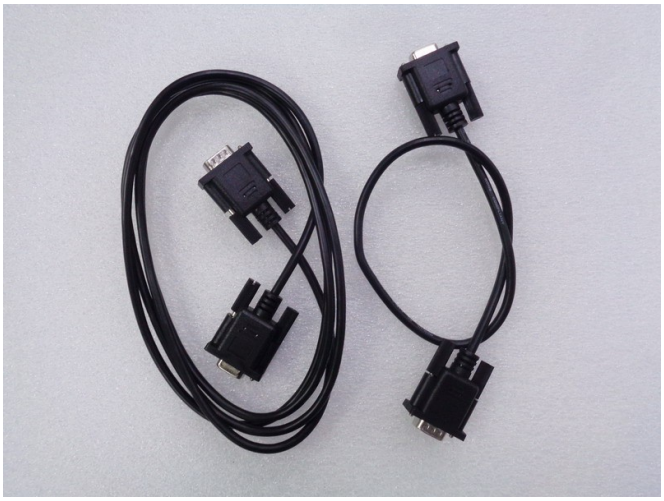
	

5.5 Cables connection

After the StarGo2 Pro box assembling, it is possible to plug the cables required to connect the encoders ad the RA/DEC motors with the box.

Encoders cable connection. In the picture below are shown the encoder connectors on DEC and RA axis.

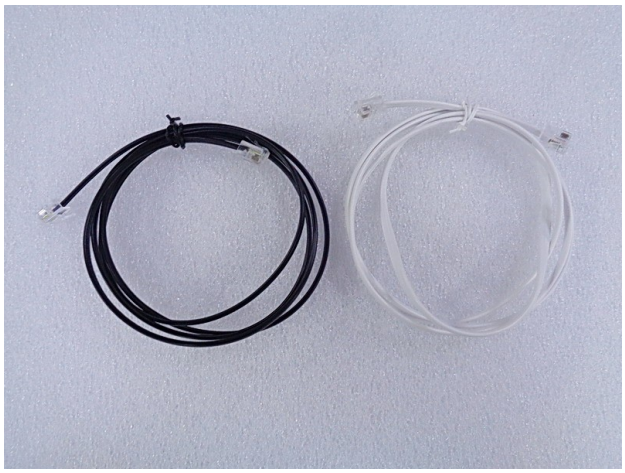
The mount package comes provided with the two RS232 cables required to connect the StarGo2 Pro box with the corresponding connector.



	The shortest cable (0,5 meter length) must be used to connect the RA axis male connector to the DEC female conncetor. As shown in the left picture.
	The longest, must be used to connect the StarGo encders connector to the DEC axis male conncetor. As shown in the picture on the left.

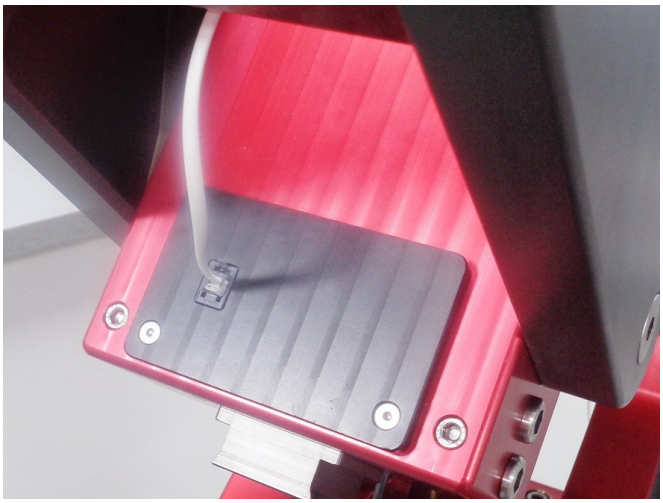
After the encoders has been connected, the RA and DEC motors must be connected with the corresponding plug placed in the bottom side of the StarGo2 Pro box.

The packaging comes provided with two RJ11 cables. The white one it is the one available to connect the RA motor to the StarGo2 Pro RA plug, whereas the black one must be used to connect the DEC motor to the corresponding plug on the StarGo2 box, as shown in the pictures below.



DEC motor cable connection

RA motor cable connection



5.3.4 More modern and precise approaches to Polar Alignment

In the last years a special CCD camera has been commercialised, called Polemaster, to perform a very precise polar alignment using an expressly developed software (requiring therefore a Windows or Mac PC that, however should be available for the successive astrophotography session).

That CCD must be firmly installed on the mount keeping a good parallelism with the polar axis of the mount itself.

5.3.5 Dual Axis Alignment

The M-tre is a Dual Dec mount, so, it is possible to assemble on the bottom side a Secondary clamp in order to allow the installation of a secondary telescope.

It is also possible to perform an adjustment in Azimuth and Altitude in order to allow the telescopes alignment.

The secondary telescope Azimuth and Altitude can be adjusted as described below. For explanation purpose the illustration picture has been taken 180° degrees reverted compared to the starting Home Position pointing towards the North.

The Azimuth axis adjustment is performed tightening one screw and releasing the opposite one. The Latitude adjustment is performed with the two grains and with the exagonal screw.