

ASTRO-PHYSICS

MODEL 800 GERMAN EQUATORIAL MOUNT (800HDA) WITH DUAL AXIS STEPPER MOTORS

MODEL 800 PARTS LIST

- 1 Polar axis assembly (right ascension – R.A.) with stepper drive
- 1 Declination (Dec.) axis assembly with cradle plate / tangent arm with stepper drive
- 1 Stainless counterweight shaft with washer stop and black plastic knob
- 1 Dual axis controller, model 8010
- 1 Power cord (cigarette lighter adapter)
- 2 Interconnect cords (connect to the motors)
- 2 Hex bolts / washers for declination axis
- 3 Black plastic knobs with 5/16-18 threaded rod
- 1 3/8" long arm allen wrench
- 1 5/16" short arm allen wrench
- 1 3/16" short arm allen wrench

ASSEMBLY INSTRUCTIONS FOR MODEL 800

Please read all instructions before attempting to set up your 800 mount. The model 800 mounting is very rugged, but like any precision instrument, it can be damaged by improper use.

The following terms and abbreviations are used interchangeably in these instructions:

Polar axis = right ascension axis = R.A. axis
Declination axis = Dec. axis

ASSEMBLE PIER OR TRIPOD

Begin by assembling the pier or tripod at the desired observing location.

PIER: Slide the three legs onto the nubs of the base, orient one leg to the north. Place pier post on the base and attach the tension rods. The turnbuckles should be drawn tight until the whole assembly is stiff enough to support your weight without movement.

ADJUSTABLE DAVIS AND SANFORD TRIPOD: We suggest this lightweight tripod for the 6" f9 StarFire and smaller scopes.

Adjust legs to the desired height and spread of the legs. Lock in position with the hand knobs.

ASSEMBLE POLAR AXIS ASSEMBLY TO PIER

If you examine the POLAR AXIS ASSEMBLY, you will see that the center of the axis is hollow. You can look through the axis to the other side. The end with the large knurled clutch knob is threaded to accept the optional polar alignment telescope used for polar alignment.

In order to track the motion of astronomical objects, the polar axis must be positioned so that an imaginary line drawn through the hollow axis points toward Polaris. At this stage of the assembly process, you want to position the mount so that it points roughly north. Place the entire polar axis assembly into the top of the pier or tripod so that the large knurled clutch knob is on the south side of the pier (opposite the pier leg that you placed pointing north). Line up the holes of the mount and pier. Screw in the three hand knobs to hold the mount in place.

ALTITUDE AND AZIMUTH ADJUSTMENTS

Follow these instructions if you want to polar align your mount. If not, you may skip this section and move onto “Assemble Declination Axis”.

IMPORTANT: Do not attempt to polar align with the telescope and counterweights attached to the mounting. The added weight makes the adjustments very difficult and you may damage both the mount and telescope.

1. With no weight on the mounting, loosen the socket head cap screws on each side of the mount using the 3/8” hex key provided. Use the same hex key to loosen the center bolt of the base of the casting.
2. Move the polar axis up or down and the entire pier east or west until Polaris is visible through the hollow shaft of the polar axis.
3. Fine azimuth adjustments: With the mount now oriented approximately towards the pole, use the two thumbscrews at the right side of the mount to make fine adjustments in azimuth.
4. Fine altitude adjustments: These adjustments are made with the knurled knob moving the polar axis up and down. We have found that fine altitude alignment can be made also by using the turnbuckle on the north leg of the pier.

POLAR ALIGNMENT

Follow these instructions if you want to polar align your mount, if not, you may skip this section and move onto “Assemble Declination Axis”.

1. Polar alignment telescope – The pole can be viewed through the polar axis with our optional polar alignment telescope. Please read the instructions that were included with the polar alignment telescope.

Alternatively, you may clamp a small polar alignment scope of your own onto the cradle plate to view the pole.

2. If you don't have a polar alignment telescope, you may use the star drift method.
3. When the proper alignment has been achieved, snug the two side bolts and single center bolt lightly to secure the polar axis. Recheck alignment. If no movement has occurred, finish tightening the two bolts as much as possible to prevent movement when the telescope and counterweights are attached.

IMPORTANT: Failure to tighten the side bolts can cause the axis to slip, with resultant damage to the mount.

ASSEMBLE DECLINATION AXIS

Attach the declination axis assembly to the polar axis with the two bolts provided. The declination motor should be on the north side of the mount; (i.e. in the direction the telescope will point). Screw the counterweight shaft to the Dec. axis.

NOTE: During disassembly, the cradle plate may remain attached to the declination axis or removed as desired.

IMPORTANT: Always attach the counterweights before mounting the telescope to prevent sudden movement of an unbalanced tube assembly, which may cause damage or injury. Remember, counterweights are heavy and will hurt if they fall on your toe.

Remove the hand knob and washer from the base of the counterweight shaft. Add sufficient counterweights to the declination shaft to balance the telescope you intend to use. Always use two hands to attach or move them on the shaft. Reattach the hand knob and washer to the end of the declination shaft. This will help to prevent injury if someone accidentally loosens the counterweight hand knob.

NOTE: A firm tightening of the counterweight knob will not damage the surface of the counterweight shaft. The pin that tightens against the stainless counterweight shaft is constructed of brass. Likewise the bronze sleeve that has been press fit into the center of the counterweight will prevent marring of the shaft as you move the counterweight up and down.

OPERATION OF THE MOUNTING

The mounting has a set of clutches on both axes.

Right Ascension Axis Clutch: The large knurled knob on the back of the polar axis is the clutch for that axis. It can be adjusted so that light pressure at the telescope will move the assembly easily, or it can be tightened fully to prevent motion during a photographic exposure. This clutch should not be set too loose, or the motor will not drive the scope.

Declination Axis Clutch: This clutch is built into the tangent arm assembly. The black plastic hand knob on the back of the tangent arm engages the clutch. The declination motor will not drive the declination axis unless the black plastic hand knob is locked tight.

For proper operation, the telescope must be adequately counterbalanced. Start with the tube assembly balance. Loosen the declination axis with the black plastic tangent arm knob so that the tube moves in the motion of the declination axis. Slide the tube up or down in the cradle rings until it stays put with no clutch drag. Now, tighten the declination axis and loosen the large knurled knob (right ascension axis clutch). Move the counterweights up or down to achieve balance in R.A. Remember to allow for the extra weight of diagonals, eyepieces and finderscopes. If the scope moves by itself, even when the clutches are tight, the scope is not counterbalanced properly.

OPERATION OF THE 8010 CONTROLLER

The push button controller contains all the circuitry for driving the two motors.

Power Cord: Attach the 3 pin power cord to the mount and plug the other end into your car's cigarette lighter or into the portable battery pack. Plug the R.A. control cable into the controller's right hand jack (as seen from above). Plug the Dec. cable into the left-hand jack. No damage will result from reversing the cables; the controller simply will not operate. With the cables in place, one of the lamps will light to indicate operation. It is not necessary to attach the Dec. cable to the controller to run the R.A. axis.

Push Buttons: The four red buttons are arranged so that the left and right buttons control the right ascension and top and bottom buttons control the declination. This is the normal orientation of objects in the eyepiece. The buttons may be used to move an object to the desired location in the field, or to keep a guide star on a crosshair by making tiny guiding corrections.

Pushing the upper button will cause the object to move "up" in the eyepiece field. If the star moves down when you push the "up" button, move the DEC switch into the other position. Pushing the right hand button will cause the star to move to the right. If it moves to the left, move the R.A. switch to the other position. When properly set up, the controller buttons will cause the object to move according to your commands.

Mode Switch: There are two guiding modes (rates), 2x guide and 8x slew rates. The slew rate is for positioning objects in the field; the guide rate is for fine guiding at high powers during astrophotography. Move the switch to select the mode that you prefer.

Select Button: The controller has a select button with four LED indicators that allow you to choose the driving rate. Three of them are internally set for SID (sidereal), SOL (solar) and LUN (lunar). The VAR (variable) is adjustable with the right hand knob. When you push the SELECT button, one of the LEDs will light up, indicating your selection. Push the button again and the LED to the left will light.

VAR Rate Knob: When the VAR LED light is lit, you may turn this knob to vary the drive rate of the motors. This is very useful for tracking planets and comets.

LED Knob: There is an LED output in this hand controller. The output is located at the declination axis in the form of a 2-wire phono connection. You may wire your illuminated LED reticle to this plug. Brightness is controlled with the left hand knob on the controller labeled LED.

ST-4 Modification: The 8010 controller can be modified to accept an autoguider (i.e. SBIG ST-4). If this modification has already been made, you will see an on-off switch and male 15-pin D-sub connector on the lower side of the box. Please call Astro-Physics if you need modification # ST4MOD.

MOUNT MAINTENANCE AND ALIGNMENT

Under normal operating conditions, no maintenance is required. For customer convenience, we have added certain adjustments that will keep the mounting in top shape, but only if the adjustment procedures are understood.

IMPORTANT: Do not attempt any adjustments to the drive gear with telescopes or counterweights attached to the mounting.

The heart of the mounting is the worm gear drive. For highest accuracy, the alignment of the stainless steel worm against the wheel is critical. This alignment should not be disturbed: do not loosen the four screws on the side of the worm housing. There is provision for adjusting the tension of the worm against the worm wheel. It is advised that you do not make any adjustment unless you are thoroughly familiar with worm gears. Adjustments of the worm should be made with the motor removed from the mount. Tighten the gear engagement only enough to just eliminate backlash. The small worm gear must move freely. If the gear is too tight, it will not drive accurately. The declination axis uses a tangent arm slow motion system. If backlash develops in this axis, the small stainless steel captive nut requires tightening. This is accomplished with the set screw in the nut. Tighten the set screw just enough to eliminate the backlash.

Both R.A. and Dec. have manual slow motion knobs. These allow you to manually move the axes by a small amount. These knobs have friction pads that may loosen in time. If this happens, the motors will slip and not drive properly (especially if the telescope is unbalanced). To remedy this, loosen the set screws on the knob and tighten the knob against the friction pad. The knobs are internally threaded – rotate them clockwise to tighten, counterclockwise to loosen. Tighten the set screws again to lock the knobs to the shaft.

If any problems occur, please don't hesitate to contact Astro-Physics for assistance.

ASTRO-PHYSICS INC
11250 Forest Hills Road
Rockford, IL 61115
Telephone: (815) 282-1513
Fax: (815) 282-9847
www.astro-physics.com

INSTALLATION OF ENCODERS AND ENCODER HOUSINGS 800 MOUNT

Encoders for Digital Setting Circles: The declination axis of the 800HDA must be modified in order to use the encoders (part #ENC800). Later production runs already have this modification. Please call Astro-Physics for information on how you can tell if your mount is already modified and for further information about the (8ENMOD) modification if needed.

PARTS LIST

- 1 Right Ascension (R.A.) Encoder housing (black anodized, with three thumbscrews)
- 1 Declination (Dec.) Encoder housing (black anodized)
- 1 R.A. Axis Adapter (clear anodized, silver), labeled R.A.
- 1 Dec. Axis adapter (clear anodized, silver), labeled Dec.

To install your encoders, first remove your telescope from your mount. Remove your declination counterweight(s) and declination counterweight shaft.

FITTING DECLINATION ENCODER HOUSING

1. In order to use the digital setting circles with the 800 German Equatorial, the engraved analog circles must be replaced with the Dec. axis adapter and Dec. encoder housing. You may switch back and forth between the engraved and digital setting circles, however you will likely find the digital setting circles more convenient once you've become accustomed to using them (provided you always have an extra 9 volt battery on hand).
2. If the encoders were purchased with the 800 mount, it is likely that the declination axis adapter and encoder housing have been installed at Astro-Physics. No further action will be required unless you wish to reinstall the engraved setting circles that are also provided. If so, refer to step 8.
3. If the encoders were purchased separately, you will have to remove the engraved analog setting circle before installing the encoder.

Loosen (don't remove) the set screw of the declination setting circle with a 1/16" hex key. Remove the circle. Follow the same procedure for the Dec. vernier circle. Refer to Diagram 1. Store these items in a safe place in case you wish to use them again.

The silver-colored Dec. axis adapter may be inside the black Dec. axis encoder housing. If it is, remove it now by grasping and pulling it out.

4. Thread the Dec. axis adapter into the end of your Dec. axis (from where you earlier removed the Dec. counterweight shaft). Final tightening should be done with moderate pressure since you may wish to remove it at a later date.
5. If you look into the black encoder housing, you will see the encoder itself mounted at the rear of the housing. When this installation procedure is complete, the encoder shaft will insert into the center hole of the Dec. axis adapter. This allows the encoder to read the motion of the declination shaft as the declination axis moves.
6. Carefully thread the Dec. encoder housing onto the Dec. axis housing of the 800 mount. You may need to wiggle the encoder housing gently to engage the shaft of the encoder with the hole in the center of the Dec. axis adapter. When the threading is complete, tighten with moderate hand pressure so that you can remove it later if you wish.
7. The counterweight shaft may now be rethreaded into the rear of the Dec. encoder housing.
8. If you wish to reinstall the engraved analog circles, reverse the above procedure to remove the encoder assembly.

Place the Dec. vernier onto the Dec. axis as shown in Diagram 1. We normally line up the "0" with the center of the hole on the front of the Dec. axis so that it is easy to read from either side of the mount. Tighten the set screw with the 1/16" hex key. Ideally, the set screw should be nylon tipped or a small bit of nylon should be inserted under the tip of the screw so that it will not damage the threads of the Dec. axis.

Place the Dec. setting circle on the Dec. axis, lining up the "90" mark with the "0" mark of the Dec. vernier. Tighten the setscrew with the 1/16" hex key.

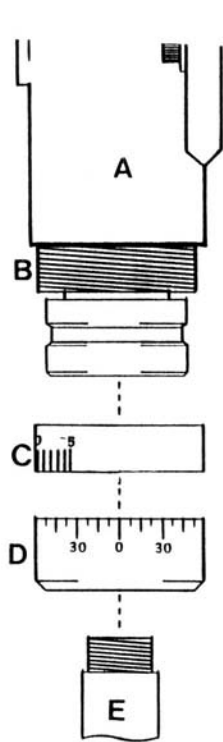


Diagram 1
Remove/Install Engraved Circles

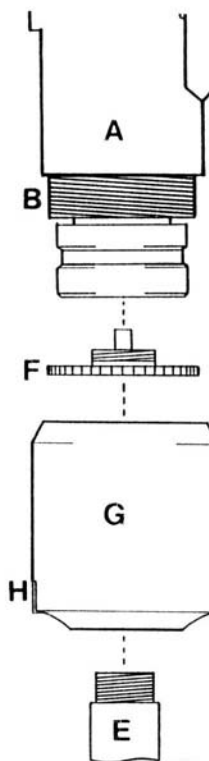


Diagram 2
800 Mount Dec. Encoder Assembly

- A Declination axis housing of 800 mount
- B Location to thread in encoder housing
- C Declination vernier
- D Declination setting circle
- E Declination counterweight shaft
- F Declination axis adapter
- G Declination (Dec.) encoder housing (encoder mounted inside)
- H Encoder lead socket (phone plug input)

FITTING RIGHT ASCENSION ENCODER HOUSING

1. Whether you purchased the encoders with the mount or as a later option, it is likely that you will need to install this encoder. The silver-colored R.A. axis adapter may be inside the R.A. axis encoder housing. If it is, remove it now by grasping and pulling it out.
2. Thread the R.A. axis adapter into the end of your R.A. axis. If your polar alignment scope is already there, you must remove it first. Use moderate hand pressure to tighten the R.A. adapter since you may need to remove it to install the polar axis telescope at a later time.
3. If you look into the black encoder housing, you will see the encoder itself mounted at the rear of the housing. When this installation procedure is complete, the encoder shaft will insert into the center hole of the R.A. axis adapter. This allows the encoder to read the motion of the R.A. shaft as the right ascension axis moves.
4. Now carefully slip the R.A. encoder housing onto the R.A. axis housing. You may need to wiggle the encoder housing gently to engage the shaft of the encoder (located within the R.A. axis housing) with the hole in the center of the R.A. axis adapter. Tighten the three thumbscrews evenly to secure in place.

5. Since the polar axis telescope and R.A. axis adapter thread into the same location, you will need to switch back and forth between them as needed. If you use the JMI "NGC MAX" or "Mini MAX" Digital Setting Circles, you can use the "polar align" mode in these units instead of a polar axis finder scope!

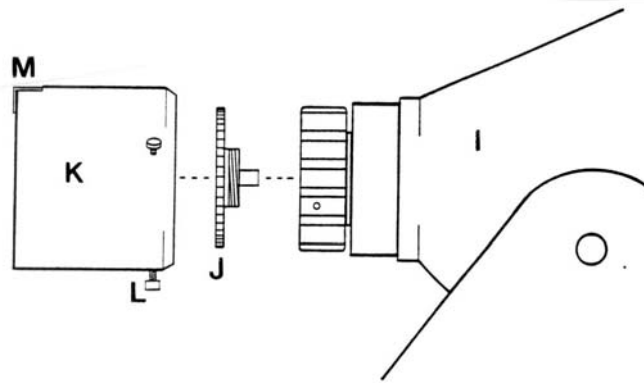


Diagram 3
800 Right Ascension Encoder Assembly

- I Right ascension axis housing
- J Right ascension axis adapter
- K Right ascension (R.A.) encoder housing (encoder mounted inside)
- L Thumbscrew
- M Encoder lead socket (phone plug input)

The hardware for your encoders is now installed. For actual set-up procedures for "Micro MAX", "Mini MAX" or "NGC MAX" digital readouts, refer to the relevant operating manual.

PERIODIC MAINTENANCE

If you remove the R.A. encoder frequently, you may wish to use the very tiniest amount of auto grease on the mating threads.

PRECISION SETTING OF 800 MOUNT WORM GEAR

Step 1 Place mount polar axis assembly in assembled Astro-Physics pier base or other firm assembly. Put in and tighten the three 5/16" retaining knobs.

Loosen the two ½-13 socket cap screws on the polar fork and rotate the altitude adjustment knob until R.A. axis is approximately at the 75 to 80 degree latitude position. Retighten ½-13 cap screws. Tighten the polar axis clutch knob to a setting equal to the way the mount will be used.

Step 2 Remove the two 8-32 cap screws from R.A. stepper motor. Remove the three 4-40 button head screws from DIN receptacle plate. Remove both motor and receptacle plate from mount.

Step 3 Loosen the one or two set screws in the 1 1/8" diameter knurled knob attached to the worm wheel shaft on the motor side. Unscrew the knurled knob from the worm shaft and remove the wave spring, fiber washer, spur gear and bearing stand from washer.

Remount the knurled knob and tighten the set screw.

NOTE: The set screws are nylon tipped and this nylon may come free from the screw. Make certain that it is in place to avoid thread damage.

Step 4 Using a rubber or nylon hammer; rap the center block of the 3-piece worm assembly. The worm will be jammed against the worm wheel so it cannot be rotated. If the center block does not have 2 long set screws in it, use a flathead screwdriver to force the worm assembly a slight amount from the wheel - just enough to allow for worm rotation.

NOTE: If the two 10-32 cap screws holding the worm assembly to the polar axis casting are too tight, then a 5/32" hex key will have to be ground down to fit in between the worm and screw. Taking note of the starting point, begin rotating the worm wheel through its entire circumference. The worm may begin to bind at some point in the worm wheel's rotation. If so at this point pry the worm assembly away from it a slight bit more. Continue worm wheel rotation the full 360 degrees several times to be certain no significant binding takes place. The best fit gives a "gritty" feel to the worm / worm wheel contact as they are rotated.

Step 5 Mount the declination axis assembly to the polar axis assembly. Put the counterweight shaft in the declination assembly.

Remove the cradle plate by unscrewing the four 5/16-18x1 flat socket cap screws. For safety, the tangent arm should also be removed.

Step 6 Use the far end of the counterweight shaft to feel for backlash. Rotate the worm once again until the worm and worm wheel are at their closest position (location of initial binding). Grab the counterweight shaft and rotate the polar shaft 90 degrees. Check for free rotation of worm. Rotate polar shaft another 90 degrees and check for free rotation of worm. Rotate another 90 degrees and check for free rotation of worm. If there was more than one point of initial binding, return to that point and go through the 90 degree rotation series again.

If binding should occur during the 90 degree positioning on Step 6, pull worm away from worm wheel just enough to eliminate the condition. The worm – worm wheel separation achieved after the successful completion of Step 6 provides the smallest amount of backlash possible. The amount of backlash will differ from a minimum amount at the point of initial binding to the maximum amount, at a worm wheel position 180 degrees from the initial point of binding. Elimination of all backlash is not possible or necessary.

Step 7 If the (two) center block 10-32 cap screws were loosened for adjustment, retighten them. Reassemble the worm clutch.

CAUTION: Over compression of the clutch spring will eliminate the clutching function.

Remount motor: make certain that some backlash exists between the motor and worm spur gears. This is best done by firmly holding the motor spur gear and rotating the worm - knurled knob back and forth.

DISASSEMBLY OF R.A. CLUTCH – 800 MOUNT

Problem: Lubricant from the shaft or bearings has migrated onto the clutch pad.

Solution: Please refer to the attached assembly drawing.

1. Remove the counterweights, declination housing, etc.
2. Remove the clutch nut and rear bearing from the R.A. shaft.
3. Grasp the pressure plate. Pull it and the R.A. shaft out of the R.A. housing. Be careful that the worm wheel does not fall out!

NOTE: Step 3 may be possible with the worm gear engaged; however the process is easier if the worm gear is pulled away from the worm wheel.

4. Clean the worm wheel face, the clutch pad and the pressure plate face of any lubricant with a solvent so that they are dry.
5. Reassemble with a minimal amount of grease on the shaft to avoid transfer to the clutch pad.

IMPORTANT: The machining tolerances on the shaft, front bearing, and worm wheel are **very** close and they may seize if not inserted squarely during reassembly.

6. If you have moved the worm gear away from the worm wheel, please refer to the instruction sheet for realigning the worm.

