

# ASTRO-PHYSICS

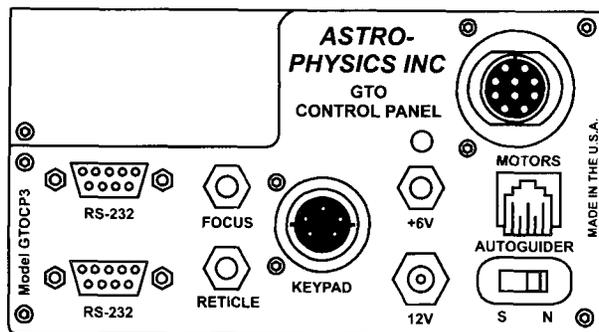
## GTO SERVO MOTOR DRIVE

### Optical Guidance Systems

#### GTO Control Box – GTOCP3

The GTO control box contains all of the circuitry to drive the two servo-motors and the logic required to navigate the sky. It will be operational and track at the sidereal rate when connected to both motors of the mount and a power source. In order to control the movement of the mount, you will need to connect at least one of these:

- GTO Keypad
- PulseGuide by Sirius Imaging. The CD for this program is included with the mount. For the most updated version of the software, check out the website [www.pulseguide.com](http://www.pulseguide.com). Please refer to the section in the GTO Keypad Manual for further information regarding the capabilities of this program.
- Computer with astronomical software such as *DigitalSky Voice* or planetarium programs such as Software Bisque's *TheSky™*, Nova Astronomics' *The Earth-Centered Universe (ECU)* version 3.1 or later, and Chris Marriot's *Sky Map Pro* (at least version 6) or any ASCOM compatible telescope software (all purchased separately).



Please remember that this box contains advanced electronics and must be treated with the same care given to other fine equipment. You can see that the unit is built to be rugged, however it is not indestructible. Be sure that your control box is supported in a secure manner so that it does not fall and do not place it in the wet grass or dust.

#### R.A. and Dec. Cable Connections

A "Y" cable with 10 pin connectors is included with your mount. Attach the connector from which the two cables emerge to the GTO Control Panel. Consult the documentation for your mount to determine which cable is RA and which is Dec. Lock all connectors.

#### 12V Connector

Place the DC power cord (included with your mount) into the phono plug outlet marked 12V on the GTO Control Panel and lock in place. Plug the cigarette lighter plug end of the cord into your power source.

For the smaller mounts with correspondingly smaller motors, the acceptable voltage range is 12 to 16 volts. Suggested power sources include: portable rechargeable battery pack, auto or marine battery, or power supply (filtered and regulated) for 110 volts with a minimum output of 5 amps at 12V DC.

If your mount has larger motors, we recommend that you use an 18V power supply. If you attempt to use a lower voltage, the mount may move with erratic motion, stop abruptly and emit a warbling sound.

Please check with the manufacturer to determine which power source is appropriate for your mount.

There is no on-off switch. We recommend that you plug the power cable into the servo box after the keypad controller. To turn the unit off, simply disconnect the power cable.

**Considerations for observatory installations:** We suggest that you disconnect your GTO Control Box from 110V and any other device (CCD camera, computer, etc) when you are not using your mount so that if your observatory experiences a power surge or lightning strike, your mount electronics will not be damaged. If you operate your mount remotely, you will have to leave your power cable connected just as you do for the rest of your electronic equipment. You may want to consider surge protectors or other protective measures to protect from voltage spikes. A disconnect relay to remove power from both the 12-volt and ground wire is highly recommended in this situation.

## **POWER Indicator Light**

This LED will remain illuminated when your power source has sufficient output to drive the motors. If the voltage falls below 10.5 volts, the power light will go out and the motors will stop. The keypad controller will not function properly.

If your LED turns yellow, your motors are overloaded, probably due to an unbalanced load on your mount. Refer to the Troubleshooting section below for the solution.

## **KEYPAD Connector**

Attach the 5 pin male connector of the keypad controller and lock in place (push in the knurled ring then turn).

## **RS-232 Connectors**

These serial port connections are used to connect your mount to your PC computer. You must provide your own straight-through (non-crossing) cables with a 9 pin (DB9) male connector to interface with the GTO panel. We have provided the locking posts to secure the cable firmly. If your serial cable does not have a 9-pin connector, you can use a gender changer or adapter to convert it. If your computer has USB ports, use a quality adapter to gain a serial port.

When you are controlling the position of the mount with a computer program such as PulseGuide, *DigitalSky Voice*<sup>™</sup> or *TheSky*<sup>™</sup>, the microprocessor chip located in the servo drive box will send continual RA and Dec. coordinate data via the cable connections to your computer. When you use the software to give instruction to slew to a new object, the commands (RA and Dec. coordinates) are sent to the mount.

We provide two serial port connections on the mount so that you can use two software programs simultaneously. For instance, you can use PulseGuide for advanced mount control while using *TheSky* as a planetarium program. The telescope control functions of *TheSky* are more limited so using both in a remote application is advantageous. Since the mount will update the RA and Dec. coordinates simultaneously, both programs are continually updated with the data from the mount. You can watch the screen display of *TheSky* to see where your telescope is pointing as it slews. This is most effective if you have a reasonably fast computer with plenty of RAM. If you try this with a 100MHz processor and only 32 MB of RAM, the response time will be slow since both programs must be continuously updated with position data.

You must have two serial ports available on your computer to use take advantage of this feature. If you use a laptop, you may need to purchase a PCMCIA adapter to gain an additional serial port. Socket Communications offers adapters for many computers. Check out their web site at [www.socketcom.com](http://www.socketcom.com).

## **FOCUS Connector**

Attach the 3.5mm phono plug connector of your electric focuser (optional accessories) here. Refer to the section regarding focus adjustment in the GTO Keypad Manual for instructions on using the keypad controller to adjust focus. Alternatively, you can verbally control the focus using the Focus Mode of *DigitalSky Voice* software.

## **RETICLE Connector**

If you wish to use a plug-in type guiding eyepiece with an illuminated reticle (available from several manufacturers), insert the 3.5mm phono plug into this connector for power. Reticle brightness can be adjusted with the hand control. Refer to the section pertaining to reticle illuminator adjustment in the GTO Keypad Manual for further information.

## **AUTOGUIDER Connector**

This connector interfaces with the RJ-11-6 modular jack of an autoguider cable, purchased separately or as part of a CCD Imaging Camera or Autoguider. The autoguider will be functional and ready to go as soon as you plug it in. Please refer to the appropriate manual from the manufacturer for operation of the autoguider.

## +6V Connector

This 6-volt output accepts 3.5mm phono plugs.

## N and S Switch

Select northern (N) or southern (S) hemisphere as needed. When you slide the switch to the opposite position, the tracking direction of the drive will reverse. The power cord must be removed and re-attached to make this work.

## Prevent the Cables From Tangling

The movement of the mount across the meridian during slewing functions is calculated so that the cables will not tangle if they are set up properly. In addition to the motor and power cables that are provided with the mount, you may have additional cables for other accessories. These may be powered from the GTO Control Panel or from another power source. We suggest that you position your cabling carefully to avoid a tangled mess. When your cables are set up, move the telescope manually throughout the normal range of movement to be sure that the cables do not catch on anything and that you have enough length.

## Accessory Cables

Accessories may include Kendrick Dew Removers, CCD cameras and autoguiders, focus motors, illuminated guiding eyepiece reticles, power cords for the Pentax 6x7 camera, etc. As you attach each accessory, carefully assess the best position to assure complete movement as your telescope slews from one side of the mount to the other. If an external power source is used, determine the optimum location for the battery. We prefer to use tie wraps (not glamorous, but effective) or cable ties (from electronic supply store or catalog) to secure our cables to the mount, mounting plate, telescope, rings or bind them together. Adhesive cable mounts are an alternative choice. These are available from electronic supply stores. We prefer to use ties since we cannot bear to attach plastic adhesive cable mounts to our telescopes or mounts.

If we use tie wraps to secure several cables together and plan to use that same setup in our next observing session, we keep the ties in place when we disassemble our equipment. The setup for the next session is much quicker.

## TROUBLESHOOTING

The troubleshooting issues below relate to the control box function of the mount. Additional troubleshooting questions are in the GTO Keypad manual. Please refer to them. Some symptoms may appear to originate in the keypad, but are really communication problems involving the servo box or other parts of the electronic circuit.

### **The LED on the GTO Control Box changes from red to yellow and the motors stop or go out completely (for mounts shipped after 02-25-00).**

1. The motors are overloaded, probably due to an unbalanced load on your mount.

Rebalance your telescope, and then press one of the N-S-E-W buttons to reset the keypad. Re-enter the last object on your keypad and the scope will slew to the correct position. Even though your motors had stopped, the logic in the control box retained the scope position in memory. As long as you didn't change the pointing position of the scope, you are still calibrated.

If the scope was moved during re-balancing, simply enter a nearby bright star on the hand controller, press GOTO and allow the mount to finish slewing. You can then move the scope manually or with the N-S-E-W buttons to center the star in the eyepiece, and press the #9 RECAL button. This will recalibrate the mount.

*Additional explanation:* The GTO drive circuit includes logic for overload protection to prevent burning out the expensive servomotors in case of severe overload on the two axes. The primary cause is an unbalanced load in R.A. If the extra load opposes the motor rotation, the motor must work harder to track at the sidereal rate and the current will rise to high levels. If the current exceeds the trip point for more than a minute, the logic will shut the motor off and tracking stops. It typically takes about 4 lb. of unbalance to trip the overload, but a very heavy load of scopes, accessories and counterweights on the mount can decrease this unbalance threshold.

2. The voltage of your battery has probably gone below 10.5 volts.
3. The current rating of your AC-DC power supply is too low.

*Additional explanation:* During slewing, the two motors draw up to 3 amps from a 12- volt source. This may increase when the temperature approaches freezing or below. It is recommended that your supply be rated at 5

amps, 12 volts DC minimum (18 volts max.). If you also power other equipment (CCD cameras, dew heaters, etc.) from the same source, you will need a supply capable of up to 10 amps. The more equipment you have, the more current capability you will need. For portable applications, we recommend a heavy-duty marine battery designed for deep discharge applications or multiple batteries. The most common problems are due to inadequate power supply.

**The keypad reset (or locked up) when I plugged my CCD camera, PC (or other equipment) into the same battery as the GTO mount was using. The battery has a meter, which shows 12V.**

The meter is reading an average and will not show dips. Gel cells have internal resistance, which will cause voltage drop when the load changes. When you connect an additional CCD camera and PC the load will drop below 10 volts and the keypad will reset or it may affect the GTO circuit itself and cause the keypad to lock up.

We recommend that you use a large marine battery that is not a gel cell and hook everything up to it before starting up the GTO. Or, better yet, put the dew heaters or other electronic items on a separate battery.

**The motors sound louder and more labored in cold weather.**

As the temperature drops, we recommend that you reduce your slewing speed to 600x. The cold causes lubricants to get stiff. It is very important to have the worm mesh not set overly tight. One symptom of overly tight worm is a chattering sound as the motors try to slew at 1200x or even as low as 600x. Check with Parallax Instruments regarding the proper way to adjust the tension of the worm gear and wheel.

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