The Micro-Guider 5 User Instructions

A Product of Nova Astronomics

Customer Configuration Data	
Serial number:	
Firmware version:	V5.1.0
Manufacture date:	
Azimuth resolution:	4000
Altitude resolution:	4000
Power mode:	On
Power delay:	n/a
Encoder Power jumpers:	By firmware
DC Power Mode:	9-15 volts

INTRODUCTION

The Micro-Guider 5 (MG5) is a telescope to computer interface device, which connects between two optical encoders mounted on the axis of a telescope and a PC's RS232 port. A suitable planetarium program, such as the **Earth Centered Universe**, can interpret the data received on the RS232 port to determine the telescope's position.

DESCRIPTION

The MG5 is a device that connects to a telescope by using two optical encoders (not provided), one attached to each axis of rotation. The optical encoders translate the rotational movements of the telescope into electrical signals that are interpreted by the MG5's microprocessor. The current position of the telescope is transmitted to a computer upon request using an RS232 interface. The MG5 is used in conjunction with a suitable computer program, which translates the telescope's coordinates into right ascension and declination, and act as an aid in locating objects at the eyepiece (preferably in a graphical way).

The MG5 is designed to be compatible with the author's Planetarium and Telescope Control Program for Microsoft Windows: **The Earth Centered Universe** (ECU). It is also compatible with many other programs. ECU provides the interface between the telescope, the MG5, and the user. I will not discuss the operation of ECU in these instructions, since the operating procedures are well-documented in ECU's User's Manual. For use with other planetarium programs, consult their user documentation.

As is normal practice with modern digital setting circles, the MG5 will work equally well with equatorial or alt-azimuth mounted telescopes, since it does not require polar alignment or mount levelling. Once aligned, the PC planetarium program provides all the necessary mathematical

conversions to use the elapsed time and the azimuth and altitude (from the MG5) to calculate the current right ascension and declination. To initialize the system, the user is usually asked to point the telescope at two stars. Polar aligned equatorial telescopes may only need to be aligned using one star.

WHAT YOU RECEIVED

The Micro-Guider 5 is shipped with the follow parts:

1. These instructions
2. The Micro-Guider 5 (the black box)
3. 1-foot long serial cable assembly
4. 12V DC auto-lighter socket cable

If you are missing any of these parts, contact Nova Astronomics or your purchasing dealer immediately.

You may also have received a copy of the **Earth Centered Universe Pro** software and/or encoder cables.

SPECIFICATIONS

Encoder compatibility	Compatible with +5 volt powered, two channel incremental encoders. Electrical encoder connector pin-out matches encoder assemblies sold by **Orion Telescopes and Binoculars** and **Jim's Mobile, Inc.**
Software compatibility	Compatible with Micro-Guider I and III command set. Emulates the "Q" command of the Lumicon NGC Sky Vector, Celestron Advanced Astromaster and other similar devices. Emulates the "Q" and "Z" commands of the Orion Sky Wizard CTI interface.
Encoder sample rate	16,000/sec in "always-on" encoder power mode, 3000/sec in "pulsed" encoder power mode.
Power requirements	+8 to +18 volts DC (unregulated) (a 12V auto lighter socket cable is supplied)
Power consumption	Less than 10mA (excluding encoders) at +9V DC
Power connector	Standard 2.1mm male coaxial (mate is 5.5mm x 2.1mm female coaxial)
Physical Size (MG5 unit only)	3.25" x 1.75" x 0.8"
Weight (MG5 unit only)	~60 grams
Colour	Black
Encoder interface connector	RJ-45
Serial interface connector	DB-9F (transmits on pin 2, receives on pin 3, with ground on pin 5)
Serial protocol	RS232 (DTE) 9600 baud, 8 data bits, 1 stop bit, no parity

HARDWARE INSTALLATION

The Micro-Guider 5 is very easy to install. It is assumed that your encoders are already installed on your telescope and ready to plug in to the MG5. Just refer to the photo and follow these steps:

1. Plug the encoder connector into the MG5 (it will only go in one way)
2. Plug the 12V auto-lighter socket cable into the MG5.
3. Plug the MG5 with its attached 1-foot long serial cable assembly into your PC's 9-pin COM port.
4. Plug the 12V auto-lighter socket cable into a suitable 12V DC power source.

If you require more that a 1-foot length of cable between your PC and the MG5, you can:

1. use a DB9 extension cable which can either be attached to the included 1-foot long serial cable assembly or attached directly to the MG5 (after removing the serial cable assembly).
2. use a four-conductor modular telephone extension cable. Remove one end of the 1-foot long modular cable and insert the extension cable.
3. remove the 1-foot long section of modular cable and replace it with a longer modular cable. Note that this cable must be wired in reverse, which is how standard phone cable is wired to connect between a telephone and a wall outlet.

In all cases above, lengths up to 50 feet are possible.

You can also power the MG5 from a 120VAC (or 240VAC outside of North America) outlet using a AC adaptor that produces from 9 to 15 volts DC. These adaptors are easily available at your local *Radio Shack* or other electronics retailer.

SOFTWARE SETUP

Setup your planetarium software to use the COM port that you connected the MG5 to (usually COM1) and set the baud rate to 9600. Select the telescope type to one of the following (select the

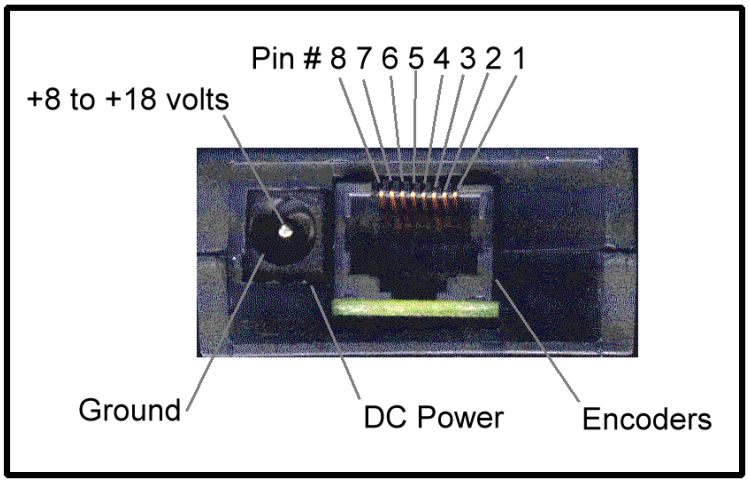
first supported model in the list): Micro-Guider 5, Micro-Guider III, Orion Sky Wizard CTI, Celestron Advanced Astro-Master, Lumicon NGC Sky Vector, Jim's Mobile NGC-MAX, etc.

If the encoders on your telescope do not match that shown on page 1, you will have to program the encoder resolution. **The Earth Centered Universe Pro** software does this automatically when set the telescope type to Micro-Guider III or Micro-Guider 5. Other planetarium programs may provide a method of easily doing this – if not, you will have to do this manually using a terminal program such as "Hyperterminal" (provided with Windows). See the SERIAL INTERFACE PROTOCOL section below for details.

Due to the mechanical arrangement of your encoders or telescope, you may have to adjust the number of counts per revolution if any gears or belts are used to attach the encoders to the telescope. Also, the encoder rotation directions may need to be reversed (which most planetarium software permits you to do). It you need technical assistance in this area, contact Nova Astronomics.

ENCODER WIRING

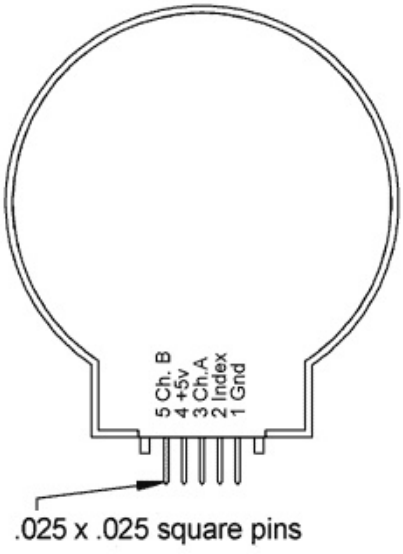
The MG5 is compatible with the encoders and encoder mounting kits sold by Jim's Mobile, Inc. (www.jimsmobile.com) and by Orion Telescopes and Binoculars (www.telescope.com). However if you decide to wire your own encoders this section is for you.



The encoders that I recommend using are available from US Digital (www.usdigital.com). The models S1-1000 (4000 count resolution) or S2-2000 (8000 count resolution) are good choices.

MG5 RJ45 connector pin number	Function Name (and US Digital encoder pin number)
1	Declination GND (pin 1)
2	Declination ChA (pin 3)
3	Declination +5V (pin 4)
4	Declination ChB (pin 5)
5	Right Ascension GND (pin 1)
6	Right Ascension ChA (pin 3)
7	Right Ascension +5V (pin 4)
8	Right Ascension ChB (pin 5)

US Digital Encoder
(S2 series)



Encoders are connected to the MG5 using an RJ45 connector (this telephone-style connector is commonly used for Ethernet computer network wiring) according to the diagram above. Read-made encoder cables are available from Nova Astronomics – these are compatible with the recommended US Digital encoders. If making your own encoder cables, you will need access to the appropriate RJ45 crimping tool to attach cables to this type of connector.

SERIAL INTERFACE PROTOCOL

This section is for programmers who wish to interface their software to the Micro-Guider 5 (software version 5.1.0) or for those who have to program their encoder resolutions manually. The MG5 supports many commands issued to it from the PC's serial (COM) port. Each command is comprised of ascii characters sent at 9600 baud, 8 data bits, 1 stop bit, and no parity. Are numbers are in decimal. The list of available commands is:

Command sent to MG5	MG5 returns	Description and Notes
Q	+00123<tab>-00456<cr>	Transmit the encoder values where: +00123 is the azimuth (always 6 chars) -00456 is the altitude (always 6 chars) <tab> is a tab character (#9) <cr> is the return character (#13) The resolution of the encoders defines the range of output expected in the azimuth and altitude readings. If the encoder resolutions are <= 32768, the output is transmitted as a signed number. For example, if 4000 count encoders are used, the range of output is -2000 to +1999. If the encoder resolutions are > 32768, the outputs are transmitted as an unsigned numbers. For example, if the resolution was set to 40000, the range of output would be +00000 to +39999.
q	00000<cr>	Transmit the number of encoder errors detected where:

		00000 is a number of errors (always 5 chars) <cr> is the return character (#13) The number of errors is cleared on power up and increases each time an encoder error is detected by the software. There is often 1 or 2 encoder errors detected at power up – this is normal. Other encoder errors can occur if the encoders are rotated too fast, if the encoders themselves are malfunctioning (eg. too much force on their shafts), encoder wiring too long or "noisy."
R01234<tab>04321<cr>	R	Set encoder resolutions (MGIII mode) where: 01234 – azimuth resolution (always 5 chars) 04321 – altitude resolution (always 5 chars) <tab> is the tab character (#9) <cr> is the return character (#13) These values are stored permanently in non-volatile memory in the MG5. Encoder resolutions are accepted up to 65535. Encoder resolutions of 4000 for each axis are programmed at the factory.
Z<tab>+01234<tab>+04321<cr>	*	Set encoder resolutions (CTI mode) where: +01234 – azimuth resolution (always 6 chars) +04321 – altitude resolution (always 6 chars) <tab> is the tab character (#9) <cr> is the return character (#13)

		These values are stored permanently in non-volatile memory in the MG5. Encoder resolutions are accepted up to 65535. Encoder resolutions of 4000 for each axis are programmed at the factory.
r	01234<tab>04321<cr>	Show encoder resolutions where: 01234 – azimuth resolution (always 5 chars) 04321 – altitude resolution (always 5 chars) <tab> is the tab character (#9) <cr> is the return character (#13)
A		Sets the alignment flag: This is intended to be used to determine if the system has been aligned. This flag is read with the "a" command and is cleared on power up or if the encoder resolutions are changed.
a	Y or N	Returns the status of the alignment flag set by the "A" comment. A "Y" is returned if the flag is set (true) or "N" if cleared (false).
P	P	Set encoder power mode to 100% on. This also causes the encoders to be read at a rate of about 16000 Hz. This is the preferred power mode, unless very low power consumption (see "p" command) is desired. This mode is stored permanently in non-volatile memory in the MG5.
p100<cr>	p	Set encoder power mode to "pulsed" with a delay of "100" where: 100 – the relative delay after the

		encoder power is applied before the encoders are read. <cr> is the return character (#13) Pulsed encoder power reduces the power consumed by the encoders (important only if operating on battery power). Pulsed power also reduces the sampling rate of the encoders to about 3000 Hz, which reduces the maximum encoder slew rates considerably. Lower delay values consume less power; higher delay values consume more power. The range of useful values is 25 to 250. The recommended value is 100. Values lower than this can cause encoder errors. Use the "T" command below to experiment before using values below 100. This value is stored permanently in non-volatile memory in the MG5.
V	V5.1.0<cr>	Show version number where: <cr> is the return character (#13)
T	01234,04321,00000<cr>	Encoder test mode where: 01234 – azimuth resolution (always 5 chars) 04321 – altitude resolution (always 5 chars) 00000 – encoder error count (always 5 chars) <cr> is the return character (#13) Transmits continuously the encoder values until a "T" is received.

MANUFACTURER CONTACT INFORMATION

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ONE-YEAR LIMITED WARRANTY

Nova Astronomics warrants that the hardware products it manufactures will be free from defects in materials and workmanship. All the hardware products that Nova Astronomics sells are tested to ensure that they are functioning properly before they are shipped. The warranty term is one (1) year beginning on the date that you, the end user, received the product.

The warranty does not cover damage that is from external causes, including accident, water damage, abuse, problems with electrical power, servicing not authorized by Nova Astronomics, improper usage, and problems caused by use of parts and components not supplied by Nova Astronomics.

During the term of this limited warrantee, Nova Astronomics agrees to repair or replace products returned prepaid to Nova Astronomics. To request warranty service, you must contact Nova Astronomics within the warranty period. If warranty service is required, Nova Astronomics will issue authorization. You must ship the products back to Nova Astronomics prepaid with a copy of your dated purchase invoice. Nova Astronomics will ship the repaired or replacement products to you freight prepaid.

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