

# Software Guided Telescope System

## Introduction

JMI's software-guided telescope (SGT) system utilizes shaft encoders, a decoder with computer interface, related cabling and TheSky astronomy software to provide the user with a real-time, on-screen display of the telescope's position. The decoder usually takes the form of Software Bisque's Plastic BBox ("Bisque Box"), JMI's NGC-MAX, or any of several other BBox-compatible devices.

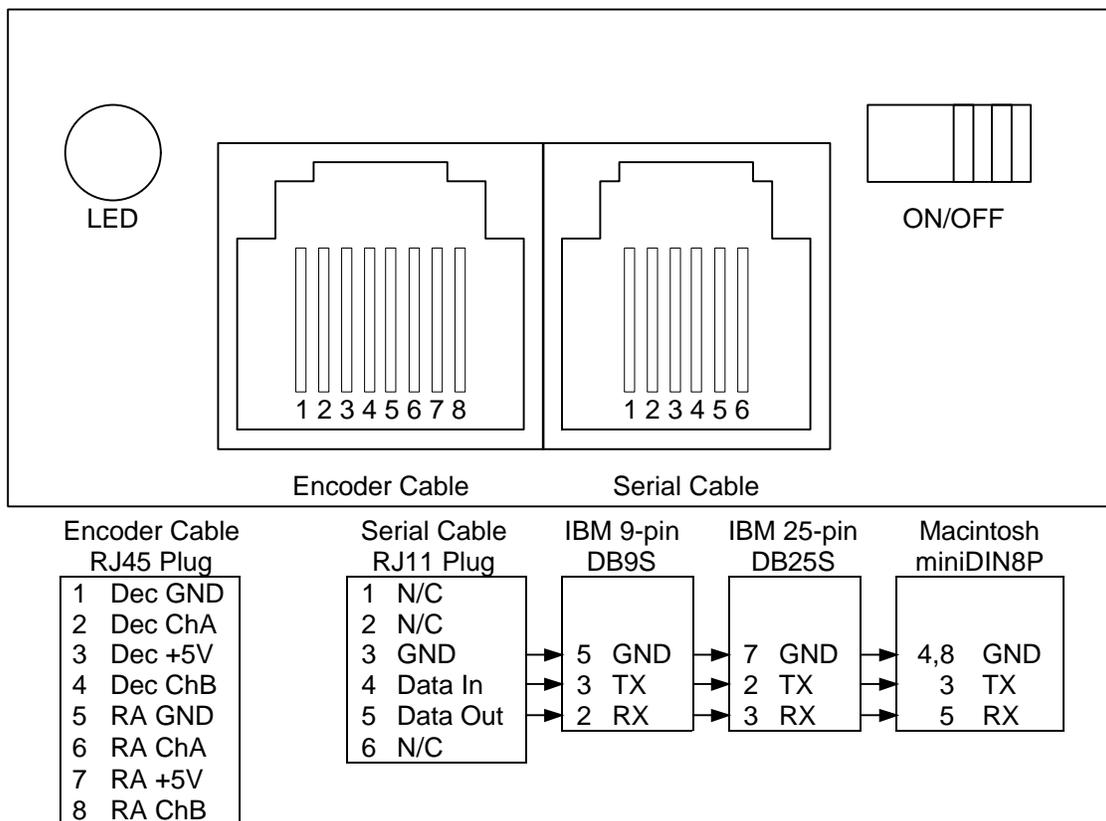
The information provided in this document is written specifically for the BBox, with references to the NGC-MAX. However, the same information will apply to most BBox and NGC-MAX "look-alikes."

Both the BBox and NGC-MAX are designed to monitor two TTL-level incremental encoders, and provide rotational information to a host computer utilizing standard RS-232 serial communications. The serial port utilizes a modular phone-type connector (RJ-12 jack) requiring a special cable per the pinout information below. Communications is conducted at 9600 bps, 8 data bits, 1 stop bit, no parity. An internal 9-volt alkaline battery is normally used to power the unit.

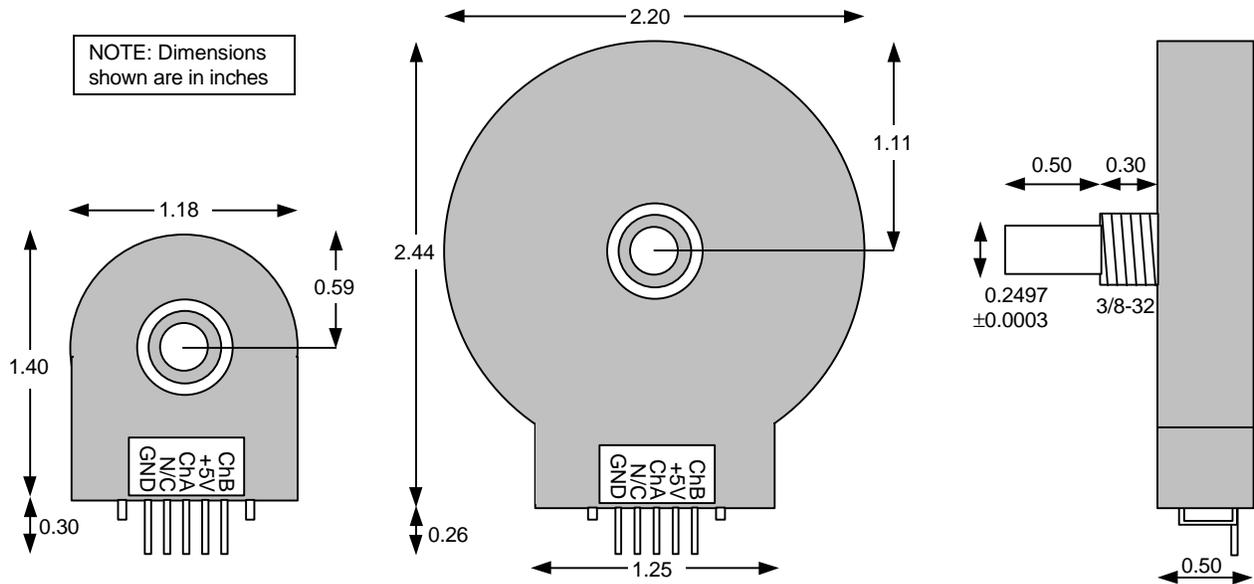
If a factory-designed encoder installation kit is being used, refer to the separate instructions provided with the kit for information on installing the encoders. For assistance with TheSky astronomy software, refer to the "Configuring TheSky" section on page 3, as well as the appropriate section of TheSky's manual.

## Connector Pinouts

Communications and encoder cables may be made from the following pinout information, or they may be purchased from JMI in standard or custom lengths.



## Encoder Specifications



**S1 Series** (small body)  
Resolutions\*: 2160, 4096  
Weight: 0.7 oz. (20 g)

**S2 Series** (large body)  
Resolutions\*: 4000, 8192  
Weight: 1.3 oz. (37 g)

### S1 and S2 Series

\*Resolutions are expressed in *post-quadrature* tics- (a.k.a. codes) per-revolution. Other select resolutions are available by special order. Actual system resolution can be increased by external gearing.

Operating temperature range: -40°F to 212°F (-40°C to 100°C)

Shaft speed: 100 RPM max., continuous  
Shaft torque: 0.5±0.2 in. oz. (5.6±2.2 cm·g)  
Shaft loading: 2 lbs. (0.9 kg) max., dynamic  
20 lbs. (9.1 kg) max., static

Shaft runout: 0.0015 T.I.R. max.  
Vibration: 20 G, 2 KHz max.  
Acceleration: 250 000 rad/sec<sup>2</sup> max.

## Factors affecting Apparent Encoder Polarity

The following factors impact the resulting apparent polarity of an encoder. Each factor is titled in a "[normal] or [reversed]" manner (the first-listed possibility is "normal," the second "reversed"). These are additive, so that an even number of reversing factors will result in normal polarity. Additional factors may exist.

1. **R.A./Az<sub>m</sub>** or **Dec./Alt** Axis. Most astronomical CPSs (computerized pointing systems) interpret each axis in an opposing manner. It is also worth noting that the R.A./Az<sub>m</sub> axis' polarity is referred to in an azimuthal sense, which runs opposite to R.A. measurement.
2. **Inward** or **Outward** Facing. The encoder shaft can be made to face inward (toward the telescope) or outward (away from the telescope).
3. **West** or **East** Bearing. The Dec./Alt encoder can oftentimes be mounted on either the West or East side of the mount.
4. **Odd** or **Even** Gears. When gear-driven, an even number of gears causes the encoder to rotate in a direction opposite that of a direct or pulley drive (all other factors being equal).
5. **Rotating** or **Static** Shaft. Normally the encoder body is stationary, and the encoder shaft rotates. Sometimes the mounting is designed to keep the encoder shaft stationary, while the body rotates.

6. **A-B** or **B-A** Wiring. The encoder can be wired with Channel A leading Channel B, or Channel B leading Channel A. If the encoders are wired with opposite sense, swapping them (axis-for-axis) will reverse the resultant polarity.
7. **Normal** or **Reversed** Configuration. The decoder (e.g. BBox or NGC-MAX) can usually be configured for normal (positive/clockwise) or reversed (negative/counter-clockwise) sensing of each axis. This can be used to "normalize" an otherwise reversed encoder polarity.
8. **North** or **South** Hemisphere. Southern Hemisphere operation results in an apparent polarity reversal of both encoders.

The encoder mounting kits from JMI are designed to be "normal," such that all encoders have positive/clockwise polarity — provided installation is followed correctly. Only Southern Hemisphere observers should need to configure TheSky for reversed (negative/counter-clockwise) polarity.

## Configuring TheSky

This information is useful when preparing TheSky astronomy software for use with your particular model and version of decoder. Find the listing for the version of TheSky you are using in the left column, then look across to the column headed by the decoder version you have. The letter shown at this junction corresponds to the appropriate configuration listed below.

TheSky version	BBox version						
	0.93	1.00	1.10	1.71	1.72	2.00	3.03
v2.00-5.00 for DOS	a	a	a	b	b	c	c
v1.00<2.00 for Windows	a	a	a	b	b	c	c
v2.00-2.03 for Windows	a	a	a	d	d	c	c
v2.04-2.11 for Windows	a	a	a	d	d	e	e
v4.00 for Windows 95	a	a	a	d	d	e	e
v5.00 for Windows 98	a	a	a	d	d	e	e

TheSky version	NGC-MAX version						
	2.93	2.94	3.03	3.13	3.50	3.52	3.62
v2.0-5.0 for DOS	b	b	b	b	c	c	c
v1.0<2.0 for Windows	b	b	b	b	c	c	c
v2.0-2.11 for Windows	b	b	b	b	c	c	c
v4.0 for Windows 95	b	b	b	b	c	c	c
v5.0 for Windows 98	b	b	b	b	c	c	c

- a. The decoder needs no configuration, TheSky uses actual<sup>†</sup> tics/rev, clockwise.
- b. The decoder is manually configured with encoder ratios\*, TheSky uses 32768<sup>‡</sup> tics/rev, clockwise.
- c. The decoder is manually configured with actual<sup>†</sup> tics/rev, TheSky uses actual<sup>†</sup> tics/rev, clockwise.
- d. The decoder is configured by TheSky with encoder ratios\*, TheSky uses 32768<sup>‡</sup> tics/rev, clockwise.
- e. The decoder is configured by TheSky with actual<sup>†</sup> tics/rev, TheSky uses actual<sup>†</sup> tics/rev, clockwise.

\*This encoder ratio is found by dividing 2048 tics by the actual<sup>†</sup> resolution for each axis. For example, a 2160-tic encoder geared 2:1 results in an actual resolution of 4320 tics. Dividing 2048 tics by 4320 tics yields the requested ratio of 0.4740.

<sup>†</sup>Actual tics/rev means the total number of encoder tics per revolution of a corresponding axis of the telescope. This value must reflect the ratio of encoder-to-telescope rotations, and may therefore be different from the encoder's inherent resolution.

<sup>‡</sup>Early versions of TheSky do not accept a value greater than 32767 (32768 will be changed to -32768). In this case, use 32767.

NOTE: NGC-MAX versions 2.93-3.13 emulate BBox version 1.71. NGC-MAX versions 3.50-3.62 emulate BBox version 2.00. NGC-MAX units do not support configuration via the RS-232 port.

## Troubleshooting the SGT Connection

If you are having trouble establishing a link between TheSky and the SGT (software-guided telescope) system, you should follow this troubleshooting guide for possible solutions. While it is common to suspect the decoder (BBox, NGC-MAX or look-alike) or cable, it is rare for either to be the cause.

**CONNECTION**—Ensure that the RJ11-to-DB9 adaptor (the part on the cable which connects to your computer's serial port) is the correct one. Two such adaptors may have been included with this cable—one for the LX200-series, the other for the BBox and compatible devices. If these adaptors are not labelled, please contact JMI for help in identifying the correct adaptor. If you are unsure which is the correct adaptor, you may try both. **The serial cable must be attached to a 9- or 25-pin D-subminiature *male* connector on the personal computer. Other connectors on the computer (D-subminiature female, RJ11 modem jack, etc.) cannot be used with the SGT system!**

**SETUP**—Verify that the interface COM Port setting under TheSky is correct. Each of your serial ports has a different COM port assignment, most commonly between 1 and 4. If possible, test another serial device on this same COM port to confirm that the port is working properly. If you believe the port to be non-functioning, check the IRQ and base address settings. Here's how:

### Windows 3.1x or Windows NT 3.5x

1. From Windows' **Program Manager**, select the **Main** program group.
2. Run **Control Panel**.
3. Choose **Ports**.
4. Click on the **COM port** you have the decoder attached to.
5. Select **Settings**, then **Advanced**.

### Windows 95 or Windows NT 4.0

1. Choose **Start / Settings / Control Panel**.
2. Open (double-click) the **Ports** icon.
3. Click on the **Port** you have the decoder attached to.
4. Select **Settings**, then **Advanced**.

Make a note of the current *Base I/O Port Address* and *Interrupt Request Line* settings.

If necessary, correct these values. If you don't know what they should be, consult your computer manual or a computer technician. A common problem is two COM ports conflicting with each other.

**TEST**—Check the decoder independently of TheSky. Here's how:

### Windows 3.1x or Windows NT 3.5x

1. From Windows' **Program Manager**, select the **Accessories** program group.
2. Run **Terminal**.
3. From the **Settings** menu, choose **Communications**.
4. Set *Baud Rate* to 9600, *Data Bits* to 8, *Stop Bits* to 1, *Parity* to None, and *Connector* to the COM port that the decoder is attached to.
5. Choose **OK**.
6. From the **Settings** menu, choose **Terminal Preferences**.
7. Set *Local Echo* **active**, and *CR->CR/LF* to **Inbound** and **Outbound**.
8. Choose **OK**. Skip to step 9 below.

### Windows 95 or Windows NT 4.0

1. Choose **Start / Programs / Accessories / HyperTerminal**.
2. Run **HyperTerminal** (Hyperterm.exe).
3. If prompted for a New Connection Name, you may choose **Cancel**.
4. From the **File** menu, choose **Properties**.
5. Set the *Connect Using* parameter to the COM port that the decoder is attached to.
6. Choose **Configure**, then set *Bits Per Second* to 9600, *Data Bits* to 8, *Parity* to None, *Stop Bits* to 1, and *Flow Control* to None.
7. Choose **OK** from the COM Properties window.
8. Choose **OK** from the New Connection Properties window.
9. Turn the decoder on. You should see **V2.00** or similar on your screen.
10. Type an uppercase letter **P**. You should see **P001** or similar on your screen. If instead you see just the letter P, then you may have a problem with the computer, cable, or decoder.

If you are still having problems with your SGT connection after following these steps, please feel free to contact our technical support staff for further assistance. You may be asked to provide information obtained from one or more of the above steps.