



# **GS-5B User's Manual**

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Cubic Global Tracking Solutions

400 E 16<sup>th</sup> Street

Panama City, FL 32405

USA

<http://www.cubic.com/Solutions/Cubic-Global-Tracking-Solutions>

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## Revision History

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2	7/5/11	Bryan Shah	Initial draft reviewed and revised.
3	8/30/11	Jamie Shepard	Draft reformat
4	9/2/11	Bryan Shah	Revised and prepared for final review

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BEFORE FINALIZING  
MANUAL**



# GS-5B USER'S MANUAL

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## 2 Regulatory Compliance



### FCC STATEMENT:

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his/her own expense.

Changes or modifications not expressly approved by Cubic Global Tracking Solutions, referred to hereafter as CGTS, for compliance could void the user's authority to operate the equipment.

This product includes two modular radios: The Enfora GSM0308 Enabler III (FCC ID: MIV GSM0308) and the Iridium 9602 (FCC ID: Q639602). These modules have been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications.

Further regulatory information for the Enabler III can be found at: <http://www.enfora.com/>

Further regulatory information for the 9602 can be found at: <http://www.iridium.com/>



### EUROPEAN UNION:

This product complies with the R&TTE Directive and the EMC Directive (89/336/EEC) issued by the Commission of the European Community

This product has been tested to verify compliance to the following European Standards:

EN 300 328 – Technical Requirements for Radio Equipment

EN 301 489 –EMC Emissions and Immunity

### INDUSTRY CANADA:

This Class A digital apparatus complies with Canadian ICES-003.

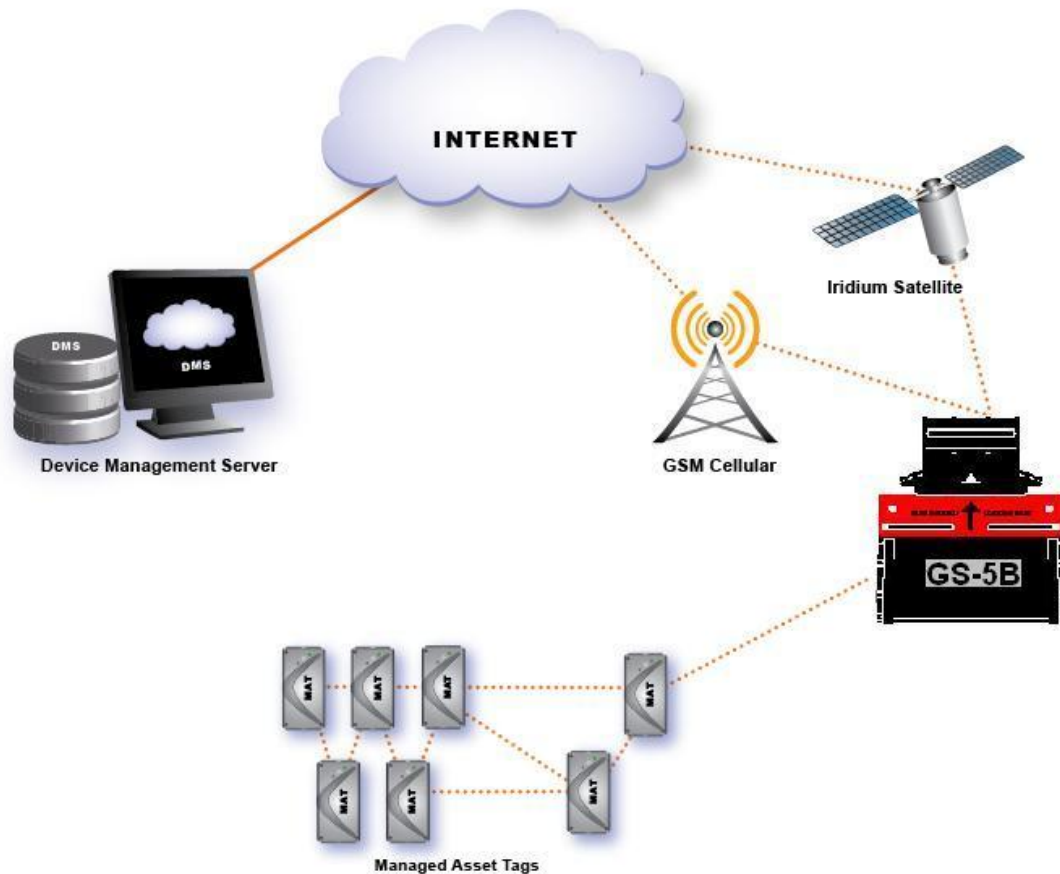
Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada.

### 3 Introduction

Cubic Global Tracking Solutions' Global Sentinel GS-5B is a remote container tracking device intended to mount on the ceiling beam of a shipping container's door frame. With its wide variety of sensors, the GS-5B can detect unauthorized door openings and other intrusions into the shipping container. With its various radios, it can report the status and location of the shipping container from virtually anywhere in the world.

It is also capable of acting as a node and/or as a Gateway in CGTS's MiST™ Mesh Network, thus allowing lowest-cost reporting and enabling the formation of Mesh networks anywhere, anytime.

Figure 1: GS-5B Reporting Path, Acting as a Gateway for a Mesh Network



#### 3.1 GS-5B

The Global Sentinel 5 – Beam Mount (GS-5B) is a container tracking device with a number of sensors to confirm the integrity of the shipment, a GPS radio to tracking the location of the container it is on, a cellular radio for low-cost reporting in urban areas, a satellite radio for use outside of developed areas and CGTS's own Mesh radio to either report through a Mesh network for lowest-cost reporting or to act as a Gateway to the internet for a Mesh network. See [The Global Sentinel 5 – Beam Mount \(GS-5B\)](#) for more information.

### **3.2 The Device Management Center**

The Device Management Center (DMC), sometimes called the Device Management Server, can be located at a CGTS facility or at an authorized user's site. When the GS-5B sends a report, the data's final destination is the DMC. With the purchase of a CGTS tracking device, the customer will be provided log-in credentials to the DMC.

The DMC provides the following services:

- Secure storage of data that is transmitted from CGTS tracking devices.
- Secure system management and configuration of CGTS tracking devices.
- Worldwide health monitoring of CGTS tracking devices.
- Routine and Unscheduled/Unplanned Event notifications to authorized individuals via email or short messaging service (SMS).
- Software upgrade of deployed devices (future functionality).

### **3.3 Managed Asset Tags**

The Managed Asset Tags (MATs) are small asset tracking devices capable of forming and joining with other MATs to form CGTS MiST™ Mesh Network through a fixed or mobile Gateway to the DMC. MATs have a number of sensors to monitor its or its asset's condition, as well as humidity, light, etc. It may also have a GPS receiver to track its location.

### **3.4 CGTS MiST™ Mesh Network**

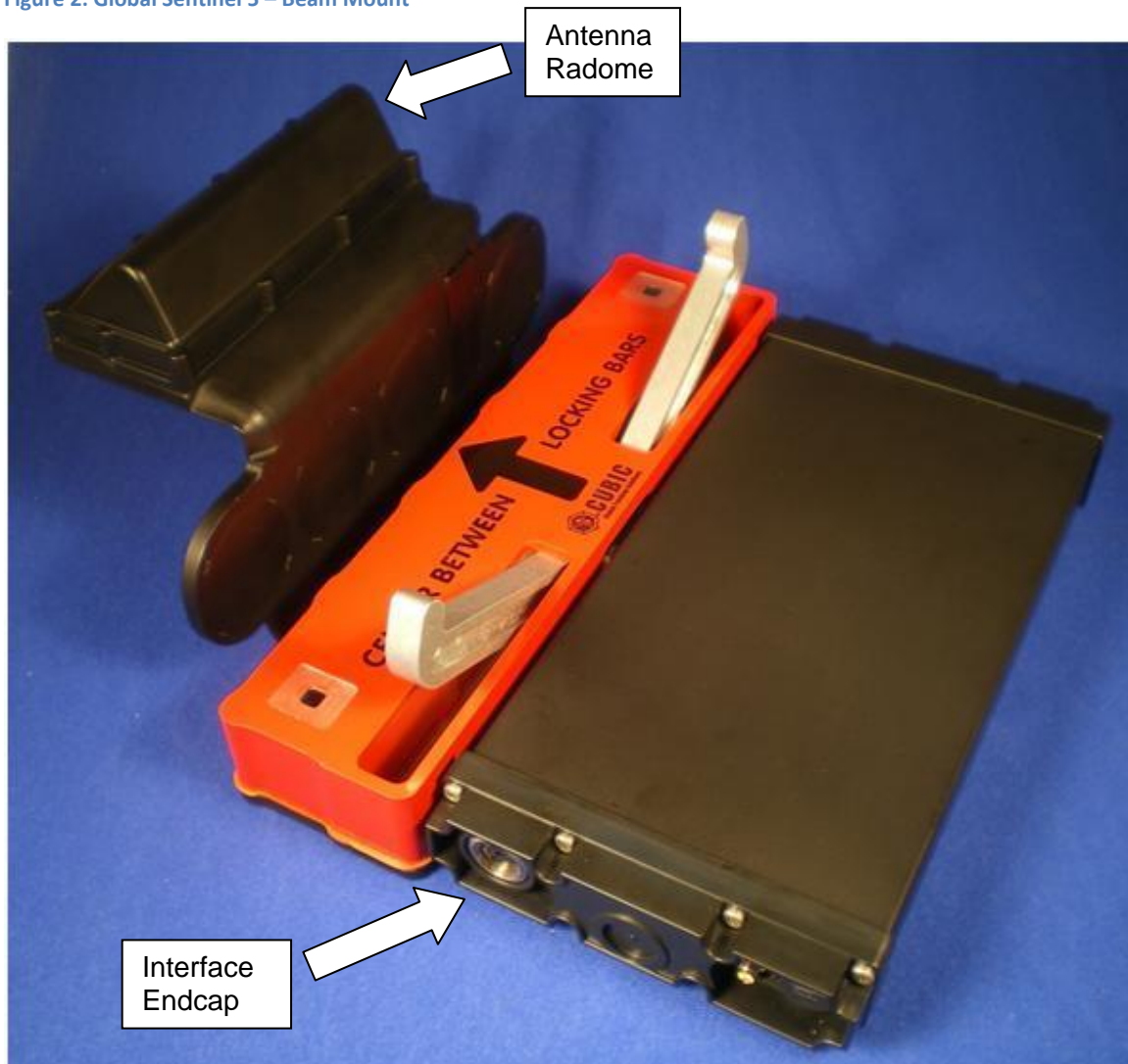
CGTS MiST™ Mesh Network is an ad-hoc, self-forming, self-healing Mesh network formed by MATs and Gateway devices. MATs and other node devices report status and location data to the DMC through Gateways devices.

The CGTS MiST™ Mesh Network allows for multiple paths between the MATs and the Gateways in the network. This allows the CGTS MiST™ Mesh Network to "heal" itself if a node or number of nodes drop off of the network.

## 4 The Global Sentinel 5 – Beam Mount (GS-5B)

The GS-5B (below) is an autonomous device that can track the location of a shipping container, monitor the integrity of the cargo, report the status and location of itself from anywhere in the world, and act as a Gateway for a CGTS MiST™ Mesh Network. The GS-5B is based on GS-5x hardware platform.

Figure 2: Global Sentinel 5 – Beam Mount



As its name suggests, the GS-5B is intended to be mounted on the ceiling beam of a shipping container's door frame. When mounted, only the radome is visible from the outside of the shipping container and all of the electronics and sensors are inside the container. Refer to the GS-5B Installation Manual for more information.

Figure 3: GS-5B as mounted



Within the Antenna Radome are the antennas for the GS-5B's GPS receiver, Mesh radio, GSM radio and Satellite radio. Antenna patterns for these antennas can be found in [Appendix A: GS-5B Integrated Antenna Patterns](#).

The Interface Endcap contains all of the user interfaces and external connectivity. See [GS-5B Interfaces](#) for more details. Also, a covert Mesh antenna is hidden within it. The purpose of this antenna is to extend Mesh network coverage to the inside of the shipping container on which the GS-5B is mounted, while the Mesh antenna in the radome provides coverage to MAT tags outside of the shipping container.

The GS-5B's standard operating mode is to periodically report its status and location to the DMC. The reporting interval is adjustable both via user settings and through the use of geographically defined "GeoZones". It can also send "alerts" when unplanned deviations from route or unauthorized activities, such as an unauthorized door opening, occurs. Alert conditions are user-settable through the DMC. Refer to the GS-5B Installation Manual for more details.

On a CGTS MIST™ Mesh Network, the GS-5B has two operating modes:

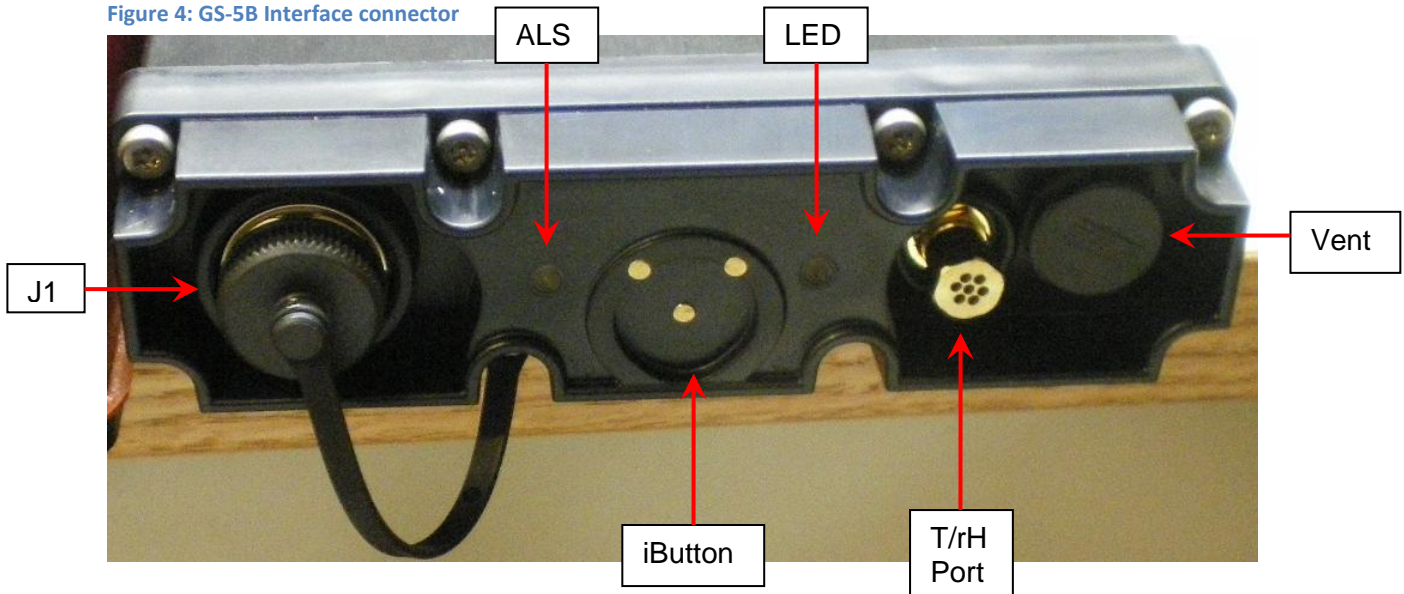
- In Sink mode, the GS-5B provides a connection between the CGTS Device Management Center (DMC) and the MATs in the CGTS Mesh network. In this usage mode, the GS-5B can be referred to as a "Mobile Mesh Gateway" or MMG. MATs communicate to the MMG using CGTS's proprietary mesh technology. The MMG communicates with the DMC through the Internet via Iridium satellite or GSM cellular connection. The GS-5B acts like a MMG when it is the only or the most efficient path to the Internet.
- In Pass-Through mode, the GS-5B behaves as another node on the CGTS MIST™ Mesh Network. It will accept connections from other nodes and forward data to a Gateway but does not communicate with the DMC directly. The GS-5B acts like this when there is a lower-cost Gateway than itself nearby.

Refer to the CGTS Mesh Network User's Guide for more information on Mesh usage modes.



## 4.1 GS-5B Interfaces

Figure 4: GS-5B Interface connector



**J1:** The J1 Connector allows the GS-5B to communicate and source power to external peripherals and sensors. It also allows the user to supply power to the GS-5B and to issue console commands to it. While the connector is sealed to IP-67 compliance when unmated, users should put the cover on J1 when not in use to keep its contacts free of dust, moisture and other contaminants.

Table 1: J1 Pin-out

Pin Number	Signal Name	Signal Direction (with respect to the GS-5B)
1	External Power	Input
2	Power Ground	
3	Sensor Power	Output
4	Sensor Signal	Input
5	Ground	
6	Console TxD	Input
7	Console RxD	Output
8	Ground	
9	RESERVED	RESERVED
10	RESERVED	RESERVED
11	Ground	
12	Ext. Serial TxD	Input
13	Ext. Serial RxD	Output
14	Loopback	Input

Pin-out when viewing the face of J1

The console and serial signals comply with EIA-232 standard voltage levels by default. By request, CGTS can customize either serial interface to operate on TTL I/O levels.

**T/rH Port:** Keep this port free of blockage and grime. Otherwise the GS-5B will not be able to report accurate temperature and humidity readings of the inside of the shipping container on which it is mounted.

**iButton Socket:** The primary control and arming method of the GS-5B. See [iButtons](#) for more information on iButtons.

**Status LED:** A Bi-color LED gives a basic indication of the GS-5B's operational (Arming/On/Off) status.

**Ambient Light Sensor (ALS):** This ALS is used in conjunction with other GS-5B sensors to detect whether an unauthorized intrusion has occurred. The sensitivity of the ALS ranges from <TBD>. See [Appendix B: Sensor Characteristics](#) for more details.

**Vent:** This Gore-Tex vent allows the GS-5B to equalize its internal air pressure to the air pressure of its environment without allowing moisture into the GS-5B. THE GORE-TEX VENT IS NOT A CAP OR CONNECTOR. DO NOT ATTEMPT TO REMOVE.

**Covert Mesh antenna:** Behind the interface endcap is a Mesh antenna. It is intended to allow MAT tags inside a shipping container to communicate to a Mesh network outside of the container even when the doors are closed. The radiation pattern for this antenna can be found in [Appendix A: GS-5B Integrated Antenna Patterns](#)

## 4.2 Sensor Box

The Sensor Box of the GS-5B is made to monitor the doors of the shipping container and detect if a door has been opened or removed. See [Appendix B: Sensor Characteristics](#) for full sensor characteristics.

### 4.2.1 Arms

The two arms are the GS-5B's primary method of detecting if a door has been opened. The sensor uses an adjustable algorithm at the start of each trip to determine what constitutes a door opening or closure. This algorithm is automatic, and requires no interaction from the installer. It is also self-adjusting, allowing the same GS-5B to be used on drastically different containers with equal effectiveness.

These arms can detect objects that are perfectly flat against the sensor box and objects that are up to 2" away from the face of the container.

### 4.2.2 Proximity Sensors

In addition to the arms, a pair of non-contacting proximity sensors is also in place to detect if the doors have been opened, and to determine if a malicious party is attempting to fool the sensors.

These proximity sensors can detect objects that are as far as 6" away from the face of the sensor box as well as objects flat against the sensor box.

### 4.2.3 Ambient Light Sensors

The sensor box contains ambient light sensors (ALS) to detect unauthorized intrusion into the shipping container.

The sensitivity of the ALS of the sensor box ranges from 0.0075 lux to 150 lux.

### 4.3 Hookplate Demount Sensor

Hidden in the hookplate is a sensor that determines whether the GS-5B is mounted on the beam of a shipping container. It is located within the radome.

### 4.4 iButtons

The CGTS iButtons offer an authenticated user interface to control a GS-5B. Each GS-5B comes with a set of iButtons containing a:

- Yellow = ON iButton: turns on (disarms) the GS-5B.
- Black = OFF iButton: turns off the GS-5B.
- Red = REPORT iButton: forces the GS-5B to send a report.

Figure 5: CGTS iButtons

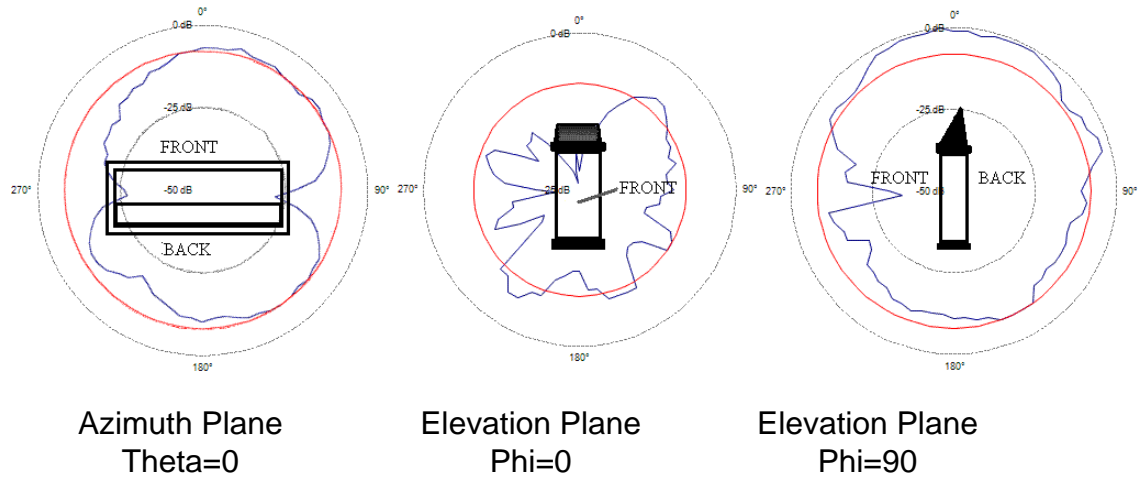


### 4.5 Installing, Configuring and Maintaining a GS-5B

Refer to the GS-5B Installation Manual.

## Appendix A: GS-5B Integrated Antenna Patterns

Figure 6: GS-5B ISM antenna pattern, normalized to Max signal from all orientations



<TODO other patterns>

## Appendix B: Sensor Characteristics

<TODO>