GlobalTrak™
GT Lite Operation and Maintenance Manual

System Planning Corporation
1000 Wilson Boulevard
Arlington, VA 22209
(703) 351- 8200

GlobalTrak™ GT Lite Operation and Maintenance Manual

This purpose of the GlobalTrak™ GT Lite Operation and Maintenance Manual is to:

- Familiarize the user with the functions and capabilities of the GT Lite
- Provide a guide to the complete operation and maintenance procedures for GT Lite

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Section 1: GT Lite Overview

Rename figures

Add section numbers for references

1.1 GT Lite Overview

The GlobalTrak GT Lite enables location tracking and monitoring of assets in real-time or near real-time over GSM. Using a high sensitivity Assisted GPS receiver, this can be done from within containers or trailers with no external antenna and no need for line of sight to the sky. The GT Lite uses wired and wireless sensors to monitor asset status. If a sensor goes into an alarm condition, an alarm is immediately sent to the Information Management Bureau (IMB). Along with sensor alarms, the GT Lite sends periodic location reports using its internal GPS module. On request polling can also be executed from the IMB. These reports are received at the IMB where they are compared against stored routes. Using this method alarms can be programmed to alert the operator when a shipment goes off route. All batteries needed to keep the GT Lite operational are enclosed in the body of the main unit.

Feature List

The product is designed to monitor fixed and mobile assets and report important sensory events regardless of its location. This is accomplished by equipping the GT Lite with the following features:

a) **Communications:** The GT Lite can communicate bidirectionally over the GSM cellular network.

b) **Optional Satellite Communications:** The GT Lite has the option to add Orbcomm or Iridium satellite communication.

c) **Optional RFID:** The GT Lite has the option to add Wavecom or SAVI active RFID or GEN2 passive RFID.

d) **Sensor Suite:** The GT Lite has sensors to send alarms in the event of unusual or unexpected shock, light, door open, temperature or device tampering.

e) **Simple Installation:** There is as little as one component to install anywhere inside or outside of an asset.

f) **Location Reporting**: The on board high sensitivity Assisted GPS receiver calculates its position within a few meters of accuracy even from within containers or trailers.

g) **Industrial Grade**: High temperature rating (-40°C to +85°C) and minimum IEC shock and vibration rating.

h) **ZigBee Equipped**: The wireless standard for low-power short-range bi-directional communications, suitable for mesh networks and sensor reads.

Asset Tracking and Monitoring

GT Lite communicates all information to the Information Management Bureau (IMB), a server-based application used by operators and customers to track and monitor assets equipped with the GT Lite. The interaction between the IMB and the GT Lite is based on the existing GlobalTrak V3d protocol, enabling polling of the device, over-the-air configuration, scheduled and event reporting.

GT Lite Exterior Hardware Description

GT Lite case is an IP66/67 designed enclosure. The standard enclosure has one exterior connector, one keyed power switch, 4 indicator LED's, and one light sensor.

Figure 1 shows the front face of the enclosure which contains the key switch and interface connector. As shown in the figure, the key turned to '0' means off and the key turned to '1' means on. The interface connector is a multi-use connector used for charging, diagnostics, programming, and external sensors.

Figure 1

Figure 2 shows the top face of the enclosure. The top face of the enclosure contains the 4 LED's and the light sensor. The operation of the LED's is described below.

1: USB
2: Charging
3: GSM
4: Activity
5: Optic Sensor

Figure 2

LED Description

USB: The USB LED indicates when the USB diagnostic interface is connected to a computer. The LED will illuminate green when connected and dark when not.

Charging: The Charging LED indicates the status of the battery charger. While charging, the LED will illuminate red. When charging is complete, the LED will turn off.

GSM: The GSM LED indicates the status of the GSM connection. When searching for a GSM network, the LED will illuminate solid green. When a network is found, the LED will blink green. When there is no GSM activity or the device is sleeping, the LED will turn off.

Activity: The activity LED indicates the overall status of the device. While sleeping, the LED will be off. While awake, the LED will blink according to the code below (*Note: this LED is currently disabled)*

Dot = 0.5s on
Dash = 1.0s on
Space = 0.5s off

The blink codes are repeated continuously until another condition is met.

Condition	Blink Code
Boot	Dash Dash
Acquiring GPS	Dash Dash Dot
Successful GPS Fix (2D or 3D)	Dot Dot Dash Dash
Unsuccessful GPS Fix	Dash Dash
Successful transmission	Dot Dot
Unsuccessful transmission	Dash Dash

The standard GT Lite includes two internal antennas. Figure 3 shows the location of these antennas for reference. The antennas can also be used externally. In this case, the enclosure would have additional antenna connectors.

Figure 3

The final feature to note on the enclosure is the mount sensor location. The mount sensor is located on the bottom lid of the enclosure and marked by indentations. The mount sensor is between those indentations. Figure 4 shows the location of the mount sensor

Figure 4

Also shown in Figure 4 is the GT Lite label. It is shown in more detail in Figure 5 below. It contains the device serial number in text as well as barcode forms, safety warning, and part number.

GT asset monitoring unit serial numbers are 12 character numbers that begin with a letter to signify the device type. All GT Lite serial numbers begin with the letter 'L'.

The GT Lite part number is 202964 as shown below. Different dash (such as -01 shown below) numbers signify different configurations of the product. The base configuration is -01. Other configurations are described in Section 2.

Figure 5

GT Lite Operational Description

To conserve battery life, the GT Lite stays asleep as much as possible. The device wakes to send messages due to timed reporting or alert reporting.

Timed reports are based on a configurable reporting interval. When the interval is up, the device wakes, creates a report and if a network is available sends the report. If no network is available, the report is stored until it can be sent. The reporting interval can automatically change based on the availability of external power and whether or not the device is in motion. These intervals can all be changed remotely.

Alert reports occur when a sensor is read in an alert condition. If this happens, the device immediately sends creates and sends the report if a network is available. If no network is available, the report is stored until it can be sent.

Between reports, the device is in deep sleep over 95% of the time, waking slightly to take sensor readings.

GT Lite Sensor Suite

GT Lite contains 7 onboard sensors; 4 digital and 3 analog. Additionally external analog and digital sensors can be wired to the device. Below is a description of the standard sensor suit.

Temperature Sensor

GT Lite includes an onboard temperature sensor accurate to ± 1.5°C over its entire range of -40°C to + 85°C. A high and low threshold is user configurable. If the temperature crosses a threshold, an alarm is immediately generated. The alarm is only re-armed after crossing back into a non-alarm state.

Optic Sensor

GT Lite includes an optic sensor to read ambient light through the sensor shown in Figure 2 above. A high threshold is user configurable. If the light level crosses the threshold, an alarm is immediately generated. The alarm is only re-armed after crossing back into a non-alarm state.

Shock Sensor

GT Lite includes a shock sensor to detect impacts on the device. A high threshold is user configurable. If there is an impact on the device above the threshold, an alarm is immediately generated. The alarm is immediately rearmed.

Door Sensor (optional)

GT Lite has an option to include a door sensor. The door sensor is typically a magnetic proximity sensor that is either installed internal to the device or external via the external connector. There is also an option for a plunger switch for container door mounting. If enabled, alarms are generated when the sensor changes state (ex. door open to door closed).

Mount Sensor

GT Lite has an internal mount sensor. The sensor is an internally mounted magnetic proximity sensor. If enabled, alarms are generated when the sensor changes state (ex. mounted to unmounted). The location of the mount sensor is shown in figure 4 above. In order for the device to be considered mounted, the magnet must be within 2 inches (5 cm) from the sensor.

Motion Sensor (Note: Motion sensor not currently enabled)

GT Lite has an internal motion sensor to detect when the device is moving. The motion sensor has configurable timeouts to determine when the device is moving or stopped. For example, the device must be moving for X number of seconds before it is considered in motion or it must be stopped for Y number of seconds to be considered stationary. As noted above, being in motion can trigger a different reporting interval.

External Power Sensor

GT Lite has an internal sensor to detect when external power is present. When the device wakes for report (alarm or timed), it checks to see if external power is connected. If the power state has changed, an alarm is generated. As noted above, the presence of external power can trigger a different reporting interval.

GT Lite GPS

The GT Lite uses a high sensitivity Assisted GPS system to give the highest GPS performance. Once the device knows its initial location, it can be placed in very harsh GPS environments with no direct view to the sky. These environments include inside of cargo in trailers or containers. Some care should still be taken to ensure proper GPS function. The device should be placed as high as possible in the cargo and it should be placed as close to the door as possible.

Reports from the GT Lite all have a GPS mode that qualifies the type fix received. This is called the GPS mode. It allows the user to quickly determine whether or not the GPS location can be trusted. There are three modes reported:

3D: Accurate fix. Can be completely trusted.

2D: Normally accurate fix, but can be very far off.

Previous Valid Fix: No fix received. In this case, GT Lite reports the last valid fix.

GT Lite Wireless Sensors

GT Lite has the ability to wirelessly connect to additional sensors using built in ZigBee wireless. Wireless sensors include the Remote Sensor Node (RSN) for sensing cargo condition (temperature, shock, humidity, custom sensors) and wireless seals. Both a barrier bolt seal and a cinch type seal are available. Before using these devices, the user must notify the GT Lite of the device address so they can pair together. This can be done remotely or locally. Once the devices are paired the remote sensors act just like onboard sensors. For more information about using wireless sensors, consult section XXXXXXXXX.

Section 2: GT Lite Detailed Description

Rename figures

Add section numbers for references

Add weight

Add material

Add mechanical drawings

Add connector pinout

Add connector drawing

Add connector P/N

2.1 GT Lite Detailed Hardware Description

Functional and Electrical Systems

This section details the general functional and electrical systems of the GT Lite, including the higher-level application functions, sensor response and GPS.

System Design

GT Lite is designed with low power usage in mind. To keep to that design, two processors are used: A main processor and a low power controller.

Main Processor

The main processor controls all higher level processes. Some examples of these are GPS control, creating and sending of messages, configuration control. To keep power usage down, this processor is normally in a state of sleep, waking only for periodic transmissions or when woken by the low power controller.

Low Power Controller

The low power controller handles all sensor and external inputs to the device. All sensors are interfaced through the low power controller, allowing the main processor to sleep while sensors are monitored. When a sensor enters an alarm condition as determined by the low power controller, it wakes the main processor to take appropriate action.

Wireless sensors are also interfaced through the low power controller which also contains the ZigBee stack and radio. Wireless sensor alarms are generated from the wireless devices themselves. If a wireless device alarms, the low power controller wakes the main processor upon receipt of the alarm message.

Sensors

Optic Sensor

The sensor has a spectral response wavelength range from 320 to 840 nm λ, with sensitivity greater than 0.3 A/W across the range.

The sensor output is be sampled by the low power controller at a rate of 1 reading per second, even when the GT Lite is in its lowest power state. The measured value is to be compared against a stored threshold, and when exceeded, a message is immediately generated and sent to the IMB. The value returned to the IMB in each message is the peak of the sensor output over the previous interval. The sensor is re-armed after the sensor level returns from the alarm state. At the point where the sensor level crosses the threshold back to a typical level the sensor alarm is once again active.

The threshold is user programmable, changeable over-the-air through the GSM network or locally. Also the threshold can be disabled, such that no event message is generated.

The optic sensor is mounted interior to the enclosure, with exterior light presented to the optic sensor through a light pipe or optical window, to preserve the enclosure environmental seal.

Door Sensor (optional)

The door sensor is a digital input to the device. If the input is open or floating, the door state is reported to be open. If the input is connected to ground, the door state is reported closed.

The sensor output is constantly monitored and edge triggered, even when the GT Lite is in its lowest power state. Following first indication of a possible change of state, the sensor is sampled for an additional number of seconds, and an event is declared only after all consecutive readings indicate such. For a door open or closed event, the GT Lite immediately generates a message and sends to the IMB. The door sensor is immediately re-armed after any event.

The sensor can be enabled or disabled over-the-air through the GSM network or locally.

The door sensor can be either externally wired or mounted internal to the GT Lite. The external sensor can be any contact closure switch between the input and ground. The internal door sensor is a reed-based, magnetic proximity sensor, implemented as a single pole, single throw (SPST) normally open contact switch. Circuit is closed when the actuator is within 1.5". The circuit is open when the actuator is outside of 1.7". This sensor is placed at the edge of the enclosure for applications where GT Lite is mounted on, or next to, a door.

Temperature Sensor

The sensor range is from -40°C to +85°C, with accuracy within <1°C across this range.

The sensor output is be sampled by the low power controller at a rate of 1 reading per second, even when the GT Lite is in its lowest power state. The measured value is compared against a stored upper and lower threshold, and when either is crossed, an event message is to be immediately generated and sent to the IMB. The sensor is re-armed after the sensor level returns from the alarm state. At the point where the sensor level crosses the threshold back to a typical level the sensor alarm is once again active.

All thresholds are user programmable, changeable over-the-air through the GSM network or locally. Also the thresholds can be disabled, such that no event message is generated.

Mount Sensor

The sensor is a reed-based, magnetic proximity sensor, implemented as a single pole, single throw (SPST) normally open contact switch. Circuit is closed when the actuator is within 1.5". The circuit is open when the actuator is outside of 1.7".

The sensor output is constantly monitored and edge triggered, even when the GT Lite is in its lowest power state. Following first indication of a possible change of state, the sensor is sampled for an additional number of seconds, and an event is declared only after all consecutive readings indicate such. For any change in mount status, the GT Lite immediately generates a message and sends to the IMB. The mount sensor is immediately re-armed after any event.

The sensor can be enabled or disabled over-the-air through the GSM network or locally.

The location of the magnetic sensor located inside the GT Lite cover is marked. The actuator is located in line with the sensor making on the GT Lite cover. The actuator and GT Lite enclosure are to be mounted separately so if the GT Lite is removed, the actuator stays.

Motion Sensor

The motion sensor is a normally closed sensor that detects vibration of GT Lite. While the GT Lite is moving, the sensor reports the motion state as In Motion. While still, the motion state is reported as Stationary.

The sensor output is constantly monitored and edge triggered, even when the GT Lite is in its lowest power state. Following first indication of a possible change of state, the sensor is sampled for a configurable time period, and an event is declared only after all consecutive readings indicate such. The sampling period for a high to low (begin motion) and low to high (end motion) are separately configurable. For a confirmed motion event, the GT Lite immediately generates a message and sends to the IMB. Both sampling periods (begin motion and end motion) shall be user programmable, changeable over-the-air through the GSM network or locally. Also the threshold can be disabled, such that no event message is generated.

The motion and stationary reporting intervals are also user programmable, changeable locally or over the air through the GSM network.

The motion sensor also allows for different reporting intervals whether in motion of stationary. This allows for still assets to report less frequently to conserve battery.

Accelerometer

The accelerometer is a three-axis MEMS device within the GT Lite enclosure. The accelerometer is available in ±18g, ±6g, and ±3g varieties, depending on the application. The standard configuration contains the 18 variety.

The accelerometer can function in two modes: A low power threshold detect mode and a higher powered sampling mode.

The threshold detect mode sets the accelerometer to internally read the acceleration data and compare it to a set threshold. Once the threshold is crossed, the accelerometer wakes the GT Lite processor because of the event. The GT Lite immediately creates an event and sends it to the IMB. Normal acceleration data is not available in this mode.

In sampling mode, the low power processor reads from the accelerometer to determine if a threshold is crossed. Once the threshold is crossed, the GT Lite immediately creates an event and sends it to the IMB. Normal acceleration data is available in this mode, allowing for real-time acceleration data if needed. The sensor is re-armed after the sensor level returns from the alarm state. At the point where the sensor level crosses the threshold back to a typical level the sensor alarm is once again active.

The mode of operation and shock threshold are both programmable, changeable over-the-air through the GSM network or locally. Also the thresholds can be disabled, such that no event message is generated. Disabling the threshold and setting the mode of operation to threshold detect, turns off the accelerometer for power saving.

Note, sampling mode is not currently available.

Analog Input

The single analog input is translated to 10-bit digital representation. Furthermore, the analog input provides for the following:

i) ESD protection (8 kV contact, 15 kV air)

ii) Circuits interface to the analog to digital converter (ADC) through a voltage conditioning circuit, which includes individually selectable voltage divider and amplifier gain stage.

iii) Circuits are easily accessible on the GT Lite board in order to allow customization of the circuits for different inputs.

The sensor output is be sampled by the low power controller at a rate of 1 reading per second, even when the GT Lite is in its lowest power state. The measured value is compared against a stored upper and lower threshold, and when either is crossed, an event message is to be immediately generated and sent to the IMB. The sensor is re-armed after the sensor level returns from the alarm state. At the point where the sensor level crosses the threshold back to a typical level the sensor alarm is once again active.

All thresholds are user programmable, changeable over-the-air through the GSM network or locally. Also the thresholds can be disabled, such that no event message is generated.

The circuit enables physical customization of the inputs to adapt to varying sensors. The basic diagram is shown below. Rectangular blocks represent spaces where SMT 1/8W resistors can be placed (possibly 0 ohm). Production values are shown in the blocks. The translation of voltage to the full range of 10-bit digital values at point B is to be included in subsequent design documentation.

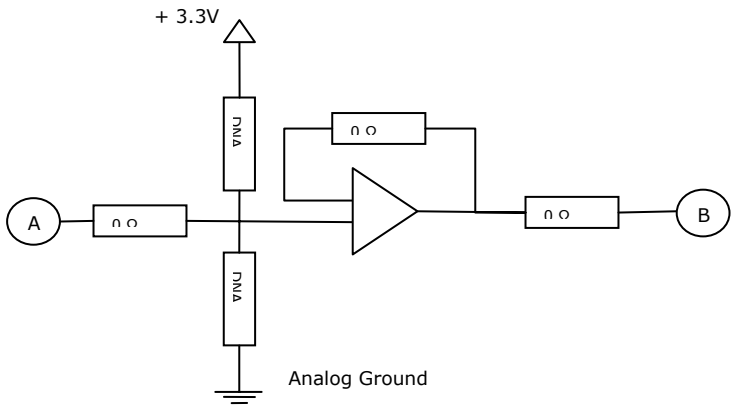


Figure 6

Digital Output

A single digital output circuit is to be wired to the front panel connector. It is a simple 3.3V digital output, ESD protected, and limited to 100 mA.

External Communications

GSM Cellular

GT Lite uses both Short Message Service (SMS) and General Packet Radio Service (GPRS) over GSM to communicate with the IMB. The redundant communication allows least cost routing wherever a GSM network is available.

The GSM transceiver used within the GT Lite must be capable of communicating on any of the four globally regulated GSM frequency bands, commonly referred to as the 850, 900, 1800 and 1900 MHz bands, making it usable across the globe.

GT Lite defaults to US frequencies. Switching to other frequencies is handled by the main application using the time since last transmission and GPS data. Rough GSM based geo-zones reside in GT Lite memory. After a failed GSM transmission, the application uses these geo-zones to determine which frequencies to search. If no GPS information is available or if there are 5 consecutive failed transmissions, the application will switch back and forth between US and EU frequencies every other transmission attempt until a successful transmit. If the device is determined to be in a cellular dead zone (e.g. on a vessel at sea), the application code delays frequency searching until entering a geo-zone with cell communications.

The frequencies are also selectable locally at the device. If US or European frequencies are selected at the device, GT Lite will default to the selected frequency.

Orbcomm Satellite

GT Lite has the option to add Orbcomm satellite communication for near real time communications anywhere in the world. The ORBCOMM system is a Low Earth Orbit (LEO) constellation that allows two-way communication to and from mobile or fixed Subscriber Communicators (SCs). In most applications, a message or other data is first generated by an SC. From that source, the data is transmitted to the nearest ORBCOMM satellite. The satellite downlinks the data to the selected Gateway Earth Station (GES), which then transmits the data to the desired Gateway Control Center (GCC). Within the GCC, the data is processed and forwarded to its ultimate destination by the Gateway Message Switching System (GMSS). The destination may be another SC, a pager, a corporate resource management system or any personal or business e-mail or Internet address. If the satellite is not in view of any GES, it will store the message until a GES is seen and forward it at that time. For more information about the Orbcomm option, please consult Section XXXXXXX.

Iridium Satellite

GT Lite has the option to add Iridium satellite communication for real time two way communications anywhere in the world. The Iridium system is a LEO constellation that allows real-time, two-way communication between the GT Lite and the IMB. The data is passed from satellite to satellite before reaching an earth station, so there is no need for a store and forward system. For more information about the Iridium option, please consult Section XXXXXX.

ZigBee Wireless

The ZigBee wireless link is a low-cost, very low-power, two-way wireless communications standard. The IEEE 802.15.4 standard defines the lower two layers: the physical layer and the medium access control (MAC) sub-layer. The ZigBee Alliance builds on this foundation by providing the network layer and the framework for the application layer.

The IEEE 802.15.4 standard has two physical layers that operate in two separate frequency ranges: 868/915 MHz and 2.4 GHz. The lower physical layer covers both the 868 MHz European band and the 915 MHz band that is used in countries such as the United States and Australia. The higher frequency layer, 2.4 GHz, is used virtually world-wide, and is the band to be used for GT Lite functions.

Mesh Communications

ZigBee allows GT Lite includes wireless communications with enabled devices and other GT Lites. The mesh network configuration allows buried GT Lite devices may be able to

communicate or receive GPS signals to gain access to a communication link or GPS data through a neighboring GT Lite device.

Star Communications

ZigBee also allows the GT Lite to communicate with wireless sensor devices. The wireless sensors allow GT Lite to talk to virtually any sensor without a need for cabling or wires. For more information on ZigBee star communications, please consult Section XXXXXXXXX.

Transmit Power Level

Allowable ZigBee transmit power, in the 2.45GHz band, varies by country. In the U.S., the FCC maximum is 1000 mW, ETSI (Europe) is 100 mW, and Japan is 10 mW. The upper transmit power used in the GT Lite is to be determined, based on field tests and regulatory constraints. The lower transmit power is to be a minimum of 1 mW.

Local Access and Monitoring

Main Serial Interface

The main serial interface provides device management, configuration, and monitoring using a USB connection. Monitoring and local configuration is done with HyperTerminal. The connection specifications are as follows:

Baud Rate: 115200 bps
Stop Bits: 1
Parity Bits: none

For more information on local monitoring and configuration, please consult section XXXXXX.

Device Activity Indicator

Four LED illuminating indicators are located on the case to indicate device health and status. The LED's are located on the PCB and visible through light pipes. The functions of the LEDs are as follows:

USB LED (Green): Illuminated when USB connection is made.

Charging LED (Red): Illuminated when charging. When charging is complete, the LED goes out.

Network LED (Green): While device is awake, blinking when GSM network is available, solid when no network is available. While sleeping, the LED is off.

Status LED (Red):

Upon cold boot, additional LED blink codes are added to aid in installation and troubleshooting. The blink codes are repeated continuously until another condition is met.

Dot = 0.5s on
Dash = 1.0s on
Space = 0.5s off

Condition	Blink Code
Boot	Dash Dash
Acquiring GPS	Dash Dash Dot
Successful GPS Fix (2D or 3D)	Dot Dot Dash Dash
Unsuccessful GPS Fix	Dash Dash
Successful transmission	Dot Dot
Unsuccessful transmission	Dash Dash

Auxiliary Serial Port

An auxiliary serial port is available on GT Lite. This serial port can be selected as an external RS232 port or an internal UART through a software controlled switch. The switch selects between an RS232 driver to the Power I/O connector and a UART to the internal expansion header. Serial data is carried on the Transmit (TX) and Receive (RX) lines. The specifications are as follows (all are software configurable):

a) Baud Rate: 9600 up to 115200 bps

b) Stop Bits: 0, 1, 2

c) Parity Bits: odd, even, none

Use of the auxiliary serial port requires additional software on the device and IMB for proper behavior.

Power Management

The main processor and low power control are provided with power control of the various subsystems. This includes the GPS receiver, the onboard sensors, and the cellular modem. This high degree of control is needed to enable very low power modes, thus reducing battery power requirements.

Main Battery Switch

The exterior key switch enables complete disconnection of the internal batteries from the electronics, to preserve shelf life and minimize battery recharging / replacement events. The switch is keyed to reduce the opportunity for deviant or accidental behavior resulting in deactivation of the GT Lite.

Battery Level Reporting

The remaining power is reported by the GT Lite. A voltage vs. capacity curve is stored on the GT Lite. GT Lite uses this curve to determine remaining capacity.

While external power is applied, the battery will be reported as maximum capacity and external power will be reported as present.

Real-Time Clock Function

The GT Lite maintains date and time information even when in its lowest power state. The clock is updated following a successful GPS location estimate as well as through the GSM network.

Without contact with GPS system time reference, the RTC maintains accurate time to within 3 seconds per 1 year interval. Time base shall be Coordinated Universal Time (UTC), formerly known as Greenwich Meridian Time (GMT).

Always On/Polling Mode

Always On mode allows the GSM receiver to remain on in an idle state. This allows for incoming SMS messages to be received be the device at any time. When an SMS is received the main processor wakes to process the message. Incoming messages can be used to poll, reconfigure, or send other commands or data to the device. Message types are listed in Section XXXXXXXXXX.

GPS Receiver

The GPS receiver within GT Lite has a very high sensitivity for use in outdoors and indoors. GPS can achieve consistent hot and warm fixes from far less than ideal scenarios such as within a pallet on a stuffed shipping container. The GPS receiver will use a combination of highly sensitive receiver, internal correlators, and assistance data (A-GPS) to achieve this performance.

Time to First Fix

The GPS receiver takes no longer than 45 seconds (95%) to get a position fix from a cold start and no longer than 10 seconds (95%) from a hot start (i.e., less than two hours since the last fix).

Position Accuracy

The selected GPS achieves Standard Positioning Service (SPS) accuracy: 95% of position measurements within 10 meters of the true location.

Antenna Connection Status

The antenna status is sensed, either connected or open circuit, only during the attempt for GPS fix. If the antenna status goes from connected to disconnected, an alert is sent to the IMB.

Assisted GPS (A-GPS)

The GPS receiver is able to use assistance data received over the GSM network to aide in acquiring a GPS fix. This data is received from Ublox, AssistNow service.

Modes of GPS operation

There are two modes of operation for the GPS receiver: Acquisition mode and tracking mode. They are explained below.

Acquisition mode only powers the GPS module when a fix is needed. This is typically with every wake cycle of the GT Lite, including periodic reports and aperiodic events.

Tracking mode constantly powers the GPS module to always have a fresh fix. This mode can be used if real time tracking is required. Tracking mode starts in acquisition mode to get the first fix. After the first fix is complete, the GPS receiver remains powered and tracking. If the GT Lite loses the GPS fix while in tracking mode, it will enter acquisition mode to gain a new fix.

GPS Configurable Parameters

1. GPS mode
   GPS mode sets the GPS receiver to be in acquisition mode or continuous tracking mode.
2. A-GPS mode
   The use of assistance data can be configured in three ways: Always, never, or on cold fix. If 'on cold fix' is selected, GT Lite will only request assistance data on boot or if a hot or warm fix fails. With the firmware addition of AssistNow Offline, this mode will be added to the configuration, as well as an assistance download interval.
3. Hot/Warm start timeout
   The hot/warm start timeout is used if there is sufficient data for a hot or warm start. The GPS receiver will attempt to acquire a 3D fix for the time allotted. If the hot/warm start timeout is 0, GT Lite will always use the cold start timeout
4. Cold start timeout
   The cold start timeout is used on boot, or after a hot or warm start fails. It is typically much longer than the hot/warm start timeout to accommodate longer fix times. If A-GPS mode is set to 'on cold fix', GT Lite will download assistance data before attempting the cold fix. If the cold start timeout is set to 0, GT Lite will not attempt a cold fix after a failed warm fix and all fixes will be attempted using the hot/warm start timeout.
5. Cold Start Lockout
   To conserve additional battery used from long cold start timeouts, GT Lite will only use the cold start timeout for a configurable number of consecutive attempts (Cold start lockout). If the cold start lockout is reached, the GT Lite will only use the hot/warm start timeout. The lockout is reset after a successful fix is acquired. Setting the cold start lockout parameter to 0 never locks the GT Lite from using the cold fix timeout.

Data Storage and Logging

The GT Lite stores all sensor data in the form of Logging Records to non-volatile memory at a programmable interval as well as any alarms. The logs contain peak sensor data over the logging interval along with a time stamp. The alarm logs contain the sensor data at the time of the alarm with a time stamp.

Log Storage Capacity

The GT Lite allows for the storage of up to 500 messages in NV memory.

Log Storage Viewing

The GT Lite shall allow for viewing of the Logging Record storage, initiated by command over the main serial port.

Log Storage Clearing

The GT Lite shall allow for clearing of the Logging Record storage, initiated by command over the main serial port.

Power Source

The main GT Lite power source is an internal battery, capable of sourcing sufficient pulse current for RF transmission with output voltage not less than 3V (even during RF transmission) and not more than 4.2V. The battery used is one lithium ion cell providing a nominal voltage of 3.6V. This is a rechargeable battery; however charging is possible over a limited temperature range compared to discharging.

Battery Life

The GT Lite supports a wide range of applications, including some where sleep periods extend to 12 hours or more and some where sleep period is minutes. Battery life extimates are:

- 365 days at 12 hour reporting
- 15 days at 5 minute reporting

Battery Charging

GT Lite contains an internal charging circuit to properly charge the battery while external power is applied. The charger is a single cell lithium ion, three stage charger, capable of a vehicle power inputs. The charger's characteristics are as follows:

Input Voltage: $7V \leq Vin \leq 18V$

Input Current: 1.5A Max

Internal Antenna

To reduce install time and complexity, the GT Lite will feature an internal, integrated GPS/GSM antenna. The antenna will be placed in the top of the enclosure and oriented for optimal GPS performance.

GPS Antenna

The GPS antenna will be an active antenna with the following characteristics.

Parameter	Specification
Antenna Gain	Minimum: 20dB Maximum: 30dB
Antenna Noise Figure	1.5dB
Antenna Supply	3.3V

GSM Antenna

The GSM antenna is a quad-band GSM antenna using the following frequencies: 850, 900, 1800 and 1900 MHz.

Mechanical Description

The relevant mechanical requirements for the intended product use are detailed below.

Physical Parameters

Enclosure Size

The standard GT Lite enclosure measures: 5.93" X 3.49" X 1.92".

Weight

The GT Lite weights XXXXXXX.

Mounting

There are various mounting brackets and scenarios for GT Lite please consult Section XXXXXXXX for more information.

Labeling

The GT Lite manufacturing label includes the GT Lite serial number, both in bar scan format and in plain text.

Enclosure Material

The enclosure is constructed of XXXXXXXXXXXX.

GT Lite Mechanical Drawing

Add Mechanical Drawing
Figure XXXXX

External Connectors

One connector is for sensors, serial and power. All pins are ESD protected.

Power I/O Connector

The serial, digital and analog I/O and power are combined into a single positive lock marine-grade connector. The connector is keyed to prevent incorrect pin to socket mating. The pin designations are as follows:

Interface	Description	Pin Count
Li-ion Charging Power	For connection to external Li-ion charger	1
Charging Ground	Ground for external charger, external power	1
Main Serial	RS232 TX, RX, GND	3
AUX Serial	RS232 TX, RX	2
Door Sense & Gnd	Routed to external door sensor	2
Analog In	General purpose 10-bit	1
Power Out	Available 3.3V, low current	1
Analog Gnd	For low-noise analog reads	1
	Total:	12

2.2 GT Lite Detailed Software Description

Device Logic and Event Handling

The GT Lite is designed to enable tracking and monitoring of a container or similar asset no matter its location on the planet, and provide immediate notification through terrestrial communication links when onboard sensors detect an intrusion or suspicious event. This task is generally accomplished on internal battery power only, as such much of the time the main processor is efficiently reading sensor outputs then powering transceivers and the GPS receiver only when necessary.

GT Lite is controlled by two processors a main processor and a low power controller. The main processor handles the application code, including creating messages, transmitting messages, and controlling GPS. The low power controller handles sensor and wireless interfaces. This includes checking sensor outputs against thresholds, recording sensor values, and connecting to wireless ZigBee networks.

Sensor Data Acquisition

The sensor values are made known to the low power controller on a frequent basis; however the sensor data is only recorded into non-volatile memory only when reporting. The sensor data is combined with time and location information to create a Logger Message and is placed into the transmit queue as well as logged into non-volatile memory.

Event Handling

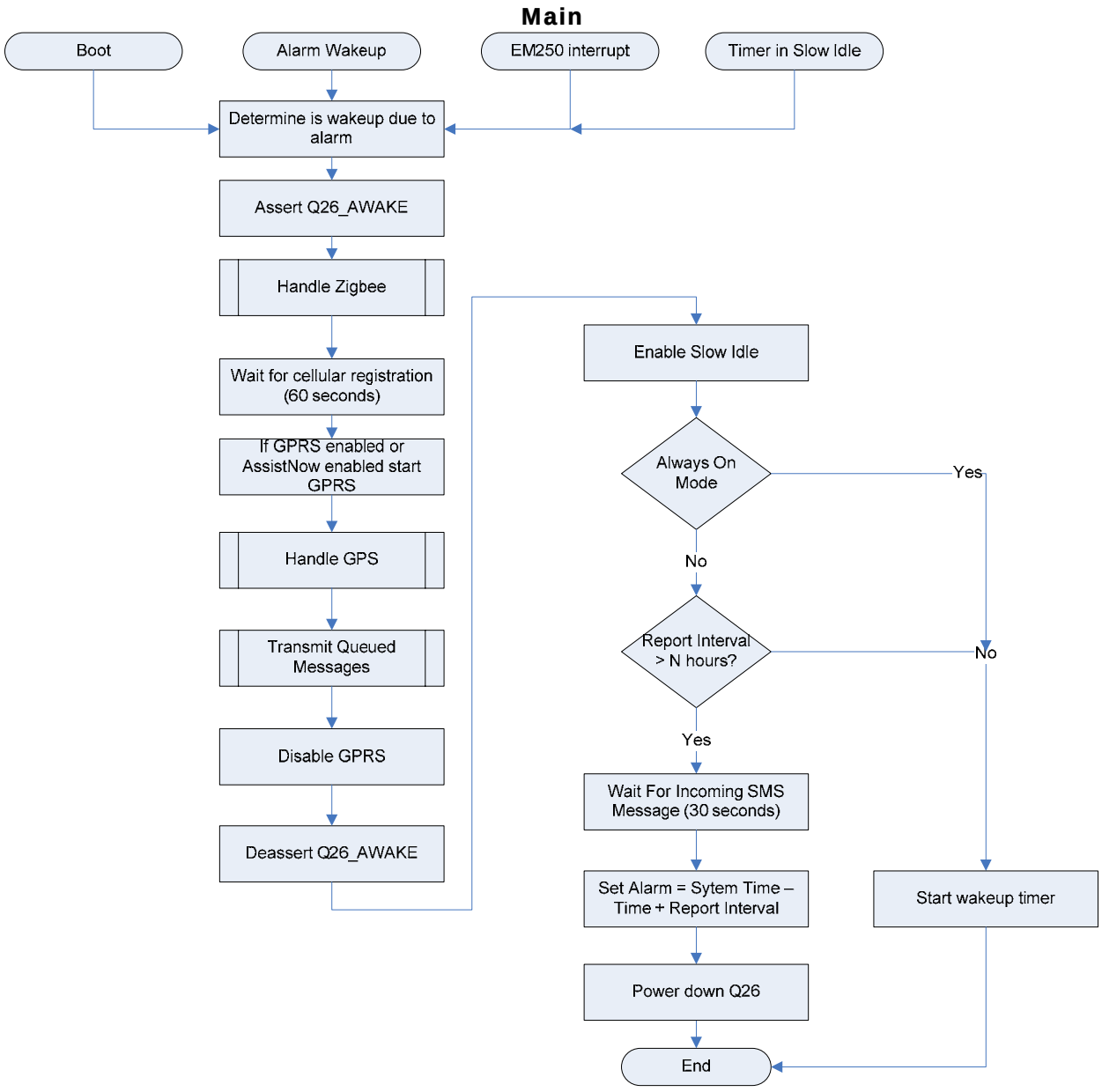
Should the low power controller detect an event, for example if a threshold is exceeded, a Logging Message is immediately generated and handled according to the transmission modes detailed below. The events include the following:

- OPTIC: threshold level reached on the optical sensor
- SHOCK: threshold level reached on the accelerometer.
- DOOR: door open detected.
- TEMPERATURE LEVEL: one of the temperature level thresholds reached.
- LOW BATTERY: when device battery reaches a configurable state of charge
- STARTUP: immediately follows soft/cold boot
- ANTENNA: GPS Antenna disconnected
- MOUNT: Enclosure removed from its mount
- MOTION: GT Lite determined to be moving by motion sensor
- EXTERNAL ANALOG: one of the external analog level thresholds reached.
- EXTERNAL DIGITAL I/O: change of state on the external digital I/O
- EXTERNAL POWER: presence of external power is detected
- ZIGBEE: a ZigBee level threshold is reached.

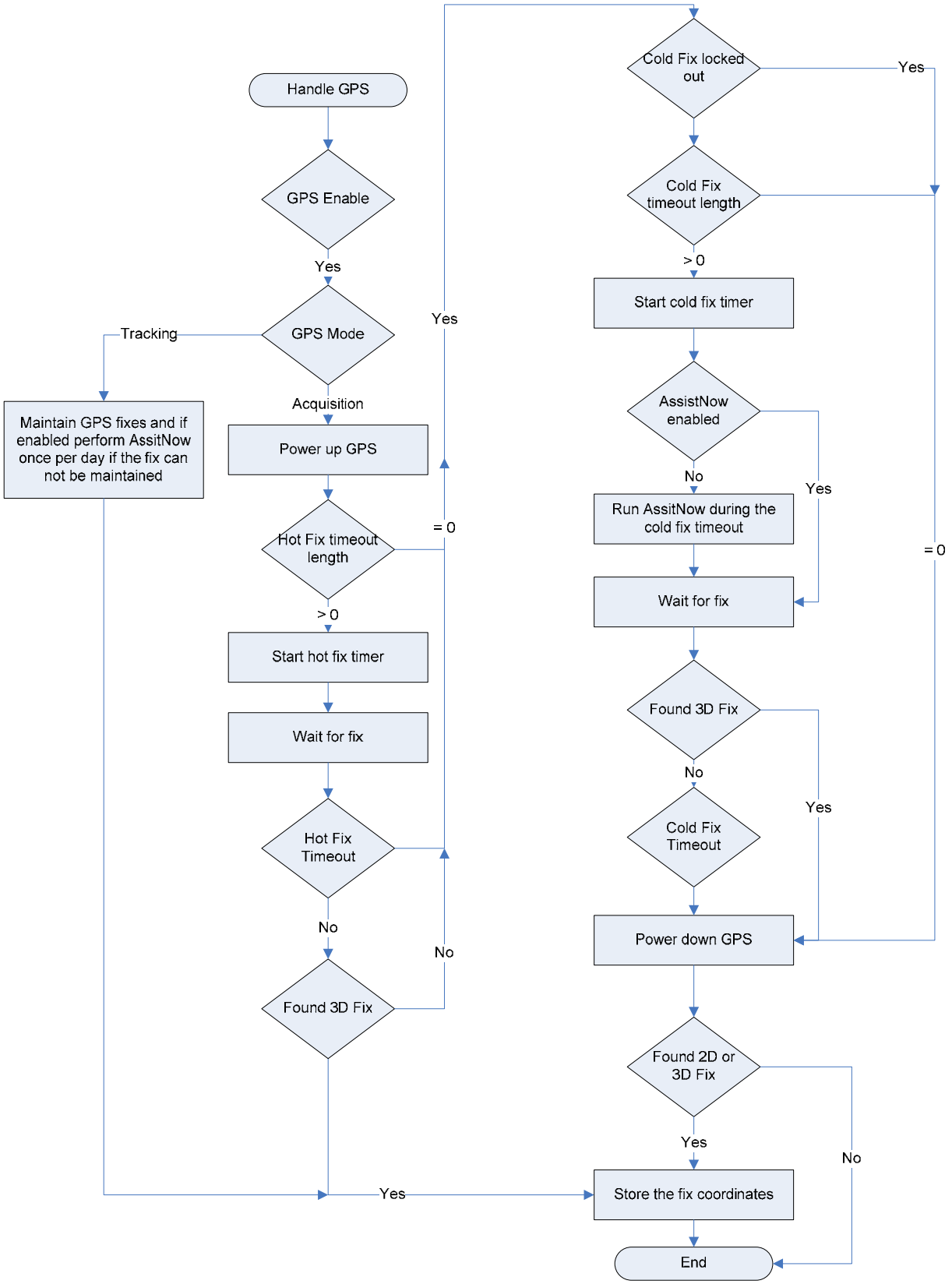
Definitions

- **Logger Message (LM)**: Base record prepared for transmission which contains sensor data, latitude, longitude and time / date stamp
- **Event LM**: An LM created as a result of one of the events, and indicating such in its event type field.
- **Stationary transmission interval**: time between sent messages when device is not in motion as indicated by motion sensor(configurable)
- **Mobile transmission interval**: time between sent messages when device is in motion, as indicated by motion sensor (configurable)
- **Powered transmission interval**: time between sent messages while external power is present, as indicated by the external power input (configurable)
- **Alert reporting**: sending a message during any alert
- **Standard transmission reporting**: reporting standard information at transmission interval (configurable, with minimum = 5 minutes), without involving an alert.
- **GSM send timeout (GST)**: configurable amount of time allowed for SMS transmission
- **ZigBee mesh timeout (ZMT)**: configurable amount of time the ZigBee network is to remain awake.

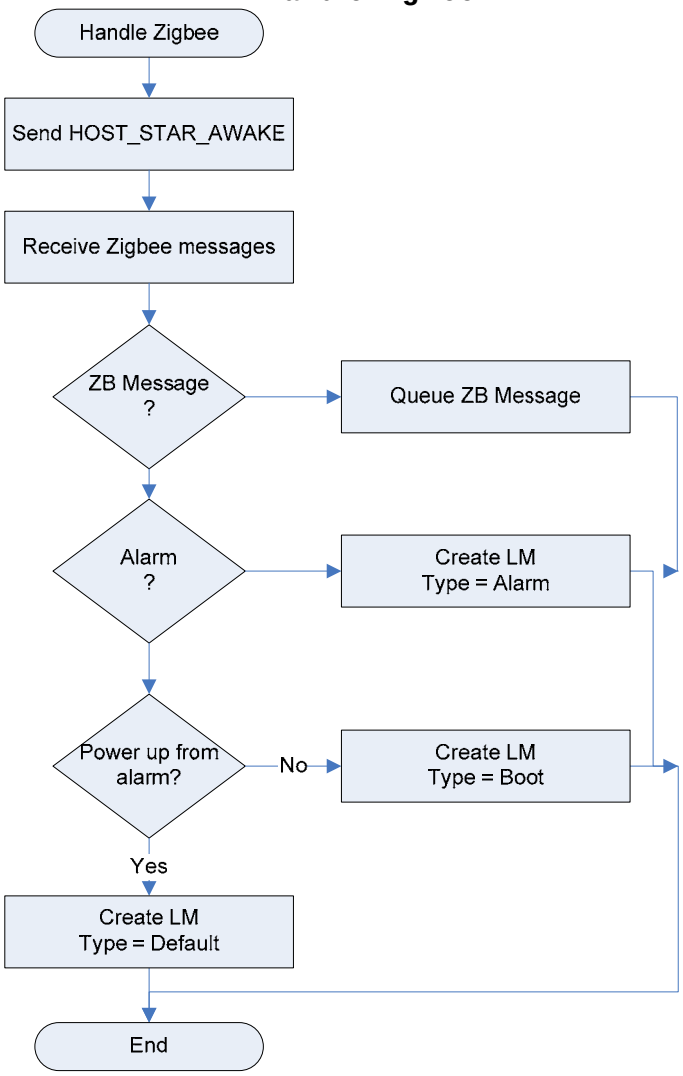
Message Rules



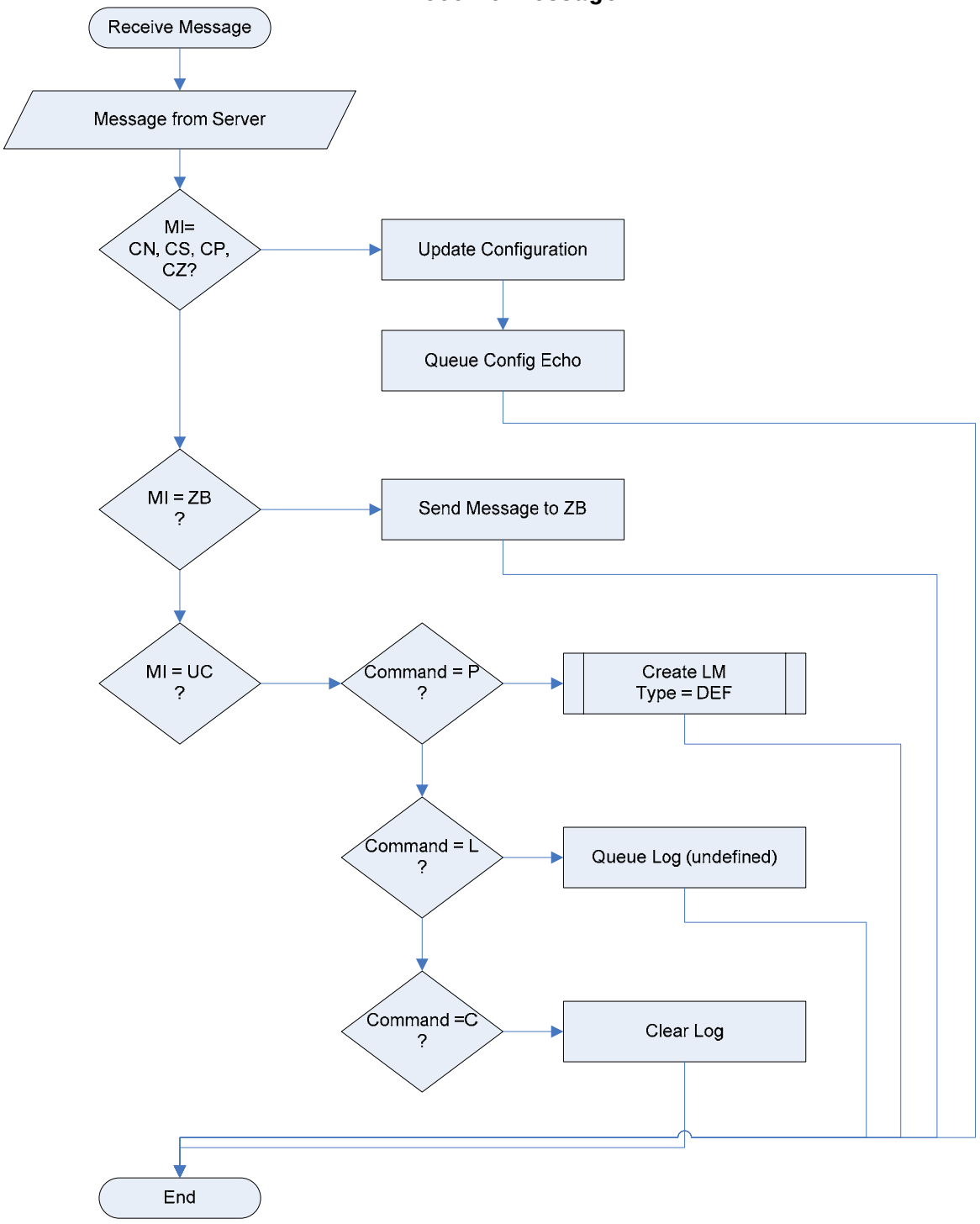
Handle GPS


Handle GPS
GPS Enable
Yes
GPS Mode
Tracking
Maintain GPS fixes and if enabled perform AssitNow once per day if the fix can not be maintained
Acquisition
Power up GPS
Hot Fix timeout length
= 0
> 0
Start hot fix timer
Wait for fix
Hot Fix Timeout
No
Found 3D Fix
No
Yes
Yes
Cold Fix locked out
Yes
Cold Fix timeout length
> 0
Start cold fix timer
AssistNow enabled
No
Run AssitNow during the cold fix timeout
Yes
Wait for fix
Found 3D Fix
No
Cold Fix Timeout
Yes
= 0
Power down GPS
Found 2D or 3D Fix
Yes
No
Store the fix coordinates
End

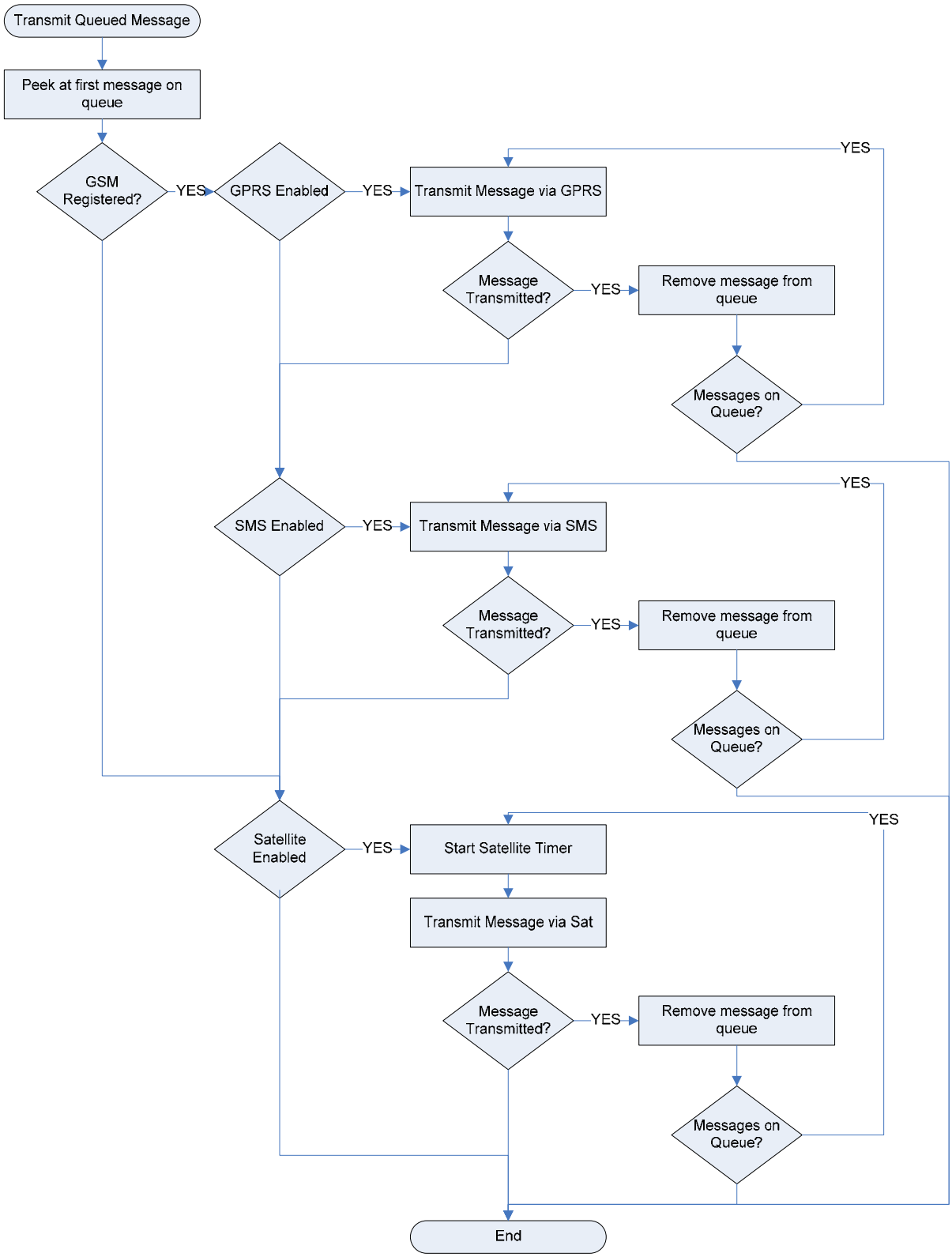
Handle ZigBee



Receive Message



Transmit Queued Messages



Over-the-Air Programming

The GT Lite firmware for both the main processor and low power controller are changeable wirelessly, with full code load capable through GPRS. The method shall includes an appropriate level of security. GT Lite authenticates OTA Upgrade messages first, then accesses a password protected repository to download code.

ZigBee Mesh Network

At a configurable interval in hours starting at 0:00 GMT, the ZigBee Mesh Network will wake to transmit pending Event LM's to nodes with external communication (as indicated by the Connectivity Flag). The network will remain awake for a configurable time period to ensure every node has ample time to enumerate the network and transmit data. Nodes with an external network will take the data received via ZigBee and pack an LM by appending the last valid GPS fix. The message will then be placed in the queue for transmission on next transmission attempt.

DSP: Operations from the M100

ZB: Operations from the ZigBee module

1) DSP: Wake ZigBee module
2) DSP: Send connectivity flag status to ZigBee module
3) ZB: If connectivity flag = True
   a) ZB: Wait X seconds for all nodes to wake
   b) ZB: Declare node as Coordinator
   c) ZB: Enumerate network
   d) ZB: If no network is available
      i) ZB: Go to sleep
      ii) DSP: Return to previous function
   e) ZB: If network is available
      i) ZB: Listen for ZMT seconds for children to send messages
      ii) ZB: If ZigBee messages received
         (1) ZB: Pass messages to M100
         (2) ZB: Go to sleep
         (3) DSP: If GPS mode = Previous valid
            (a) DSP: Repack LM with last valid GPS fix
         (4) DSP: Place messages in queue with Message Identifier = LZ
         (5) DSP: Attempt transmit during next scheduled transmission or transmission of events
         (6) DSP: Return to previous function
      iii) ZB: If no ZigBee messages received
         (1) ZB: Go to sleep

(2) DSP: Return to previous function

4) ZB: If connectivity flag = False
   a) ZB: Declare node as router
   b) ZB: Join Available network
   c) ZB: If no network is available
      i) ZB: Go to sleep
      ii) DSP: Return to previous function
   d) ZB: If network is available
      i) DSP: If messages queued
         (1) DSP: Pass ZigBee module pending messages
         (2) ZB: Transmit messages to coordinator
         (3) ZB: If messages transmitted to coordinator success
            (a) DSP: Purge messages from queue
            (b) DSP: Return to previous function
            (c) ZB: Remain awake for remaining ZBT seconds
            (d) ZB: Go to sleep
      ii) DSP: If no messages queued
         (1) DSP: Return to previous function
         (2) ZB: Remain awake for ZBT seconds
         (3) ZB: Go to sleep

RFID Operation

GT Lite may also be equipped with active or passive RFID technology. Reads can be initiated by events or periodic timers. For more information about RFID options, please consult Section XXXXXXXXX.

Device to Server Message Description

Device to Server messages are originated at the device and transmitted to the server. All messages are transmitted by adding the message to the transmit queue and waiting for the next transmit attempt. Some messages, including events, are immediately transmitted by initiating transmission after the message is placed on the queue. The messages are defined here.

Logger Message

Logger messages are the standard method of communicating data to the IMB. They are created and sent either on a configurable reporting interval or immediately following an event.

Each Logger Message contains a "Record Data Type" that describes what caused the message to be created.

Following the Record Data Type, the logger message contains a date and time stamp, location information, and all sensor data available on the device.

Record Data Type

The Record Data Type communicates the type of Logger message sent and the reason for sending. Below is a table listing the most common Record Data Types.

Number	Record Data Type	Description
0	DEF	Scheduled location estimate and sensor read (no event)
1	OPTIC	Optical sensor event detected
2	SHOCK	Accelerometer sensor event detected
3	DOOR	Door open sensor event detected
5	BAT	Battery is depleted to the threshold
6	MOUNT	Mount sensor event detected
7	BOOT	Immediately follows soft/cold boot
8	ANT	GPS Antenna recently disconnected
9	MOTION	Motion event detected
10	ANA1	Analog 1 ZigBee sensor event detected
11	ANA2	Analog 2 ZigBee sensor event detected
12	ANA3	Analog 3 ZigBee sensor event detected
13	ANA4	Analog 4 ZigBee sensor event detected
18	EXPWR	External power sensor event detected
20	DIG2	Digital 2 ZigBee sensor event detected
21	DIG3	Digital 3 ZigBee sensor event detected
22	DIG4	Digital 4 ZigBee sensor event detected
23	DIG5	Digital 5 ZigBee sensor event detected

GPS Mode

The GPS mode provides additional information regarding the quality of the location estimate included in the logger record.

Parameter	Description
3D	3D location estimate. Accurate to within 10m.
2D	2D location estimate. Accurate to within 1.5km.
Previous Valid GPS	Providing latest valid location estimate

ZigBee Logger Message

The ZigBee Logger Message are messages that are originated in one device but transmitted to the server by another device through ZigBee mesh networking. The contents of a ZigBee Logger Message are the same as a standard logger message. The only difference is the Message Identifier, which designates that the Logger Message was passed through ZigBee mesh.

Network Configuration Message Echo

After receiving a Network Configuration Message over the air, the GT Lite immediately returns a Network Configuration Message Echo. This ensures that the device received the message and properly configured itself. It also allows the IMB to keep track of a device's configuration.

Sensor Configuration Message Echo

After receiving a Sensor Configuration Message over the air, the GT Lite immediately returns a Sensor Configuration Message Echo. This ensures that the device received the message and properly configured itself. It also allows the IMB to keep track of a device's configuration.

Power Configuration Message Echo

After receiving a Power Configuration Message over the air, the GT Lite immediately returns a Power Configuration Message Echo. This ensures that the device received the message and properly configured itself. It also allows the IMB to keep track of a device's configuration.

ZigBee Sensor Configuration Message Echo

After receiving a ZigBee Sensor Configuration Message over the air, the GT Lite immediately returns a ZigBee Sensor Configuration Message Echo. This ensures that the device received the message and properly configured itself. It also allows the IMB to keep track of a device's configuration.

ZigBee Network Notification Message

When a ZigBee sensor node is added or removed from a GT Lite's sensor network, the GT Lite alerts the server of the new configuration through a ZigBee Network Notification message. The payload of the ZigBee Network Notification Message contains the Senor Identification (SID) of all nodes in the sensor network and where each particular SID will appear in the GT Lite Logger Record. This allows the IMB to tag and, if necessary, apply transfer functions to the raw ZigBee data.

Inventory Message

The Inventory Message allows the GT Lite to keep a running inventory of data associated to the device. The data can be added to the device in a variety of ways including RFID and barcode. When the GT Lite receives the inventory information it can create one of two messages: New inventory or change inventory. The message command tells the server which type of message is being sent. The type of inventory data is conveyed to the IMB by the inventory datatype. This tells the IMB how to parse inventory records as they are received.

The inventory message consists of a standard logger message, followed by the type of inventory message (New or Change), tag datatype and tag data.

Tag Datatype

The tag datatype indicates the type of tag data being transmitted. Since each type of reader may contain data in addition to tag number, the tag datatype allows this data to be processed properly. The list of current tag datatypes is below.

Description
Wavetrend RFID tags – Tag ID only
Wavetrend RFID tags – All tag data
Barcode tags
EPC Gen2 – EPC only

Software Upgrade Notification Message

After a software upgrade for either low power controller or main processor, the device will return a message to confirm the upgrade is complete. The message contains the processor upgraded whether the upgrade was successful or failed, and the current software version.

Server to Device Message Description

Server to Device messages are sent from the server to the GT Lite. During standard operation, the GT Lite will only look for an incoming message after a successful transmission. For example, the GT Lite will only look for an incoming GPRS message after successfully sending a GPRS message.

While in "Always On" mode, the GSM receiver is left in an idle state. While in this mode, the GT Lite will always be able to receive an incoming SMS

Network Configuration Message

The network configuration message allows the user to configure the network parameters of the GT Lite. Below are the configurable parameters.

Parameter	Description
Server Mobile Number	The server number used for outgoing SMS messages
GPRS Address	TCP/IP server address for device to server GPRS messages
GPRS Port	TCP/IP port number for device to server GPRS messages
GPRS APN Name	APN server name for GPRS service provider

Sensor Configuration Message

The sensor configuration message allows the user to configure the sensor parameters and thresholds for the GT Lite. Below are the configurable parameters.

Parameter	Description
Optic Threshold	Threshold for optic events
Shock Threshold	Threshold for shock events
High Temp Threshold	High threshold for temperature events
Low Temp Threshold	Low threshold for temperature events
Battery Threshold	Low battery threshold
Analog 1-4 Low Threshold	Low Thresholds for ZigBee analog sensors 1-4
Analog 1-4 High Threshold	High Thresholds for ZigBee analog sensors 1-4
In Motion Debounce	Debounce time for in motion events
Stationary Debounce	Debounce time for stationary events
Door Enable	Door Sensor enable/disable
Mount Enable	Mount Sensor enable/disable
External Power Enable	External Power Sensor enable/disable
Motion Enable	Motion Sensor enable/disable
Digital 2-5 Enable	Enable/Disables for ZigBee digital sensors 2-5
Speed and Direction Enable	Speed and Direction enable /disable

Power Configuration Message

The power configuration message allows the user to configure power parameters and for the GT Lite. Below are the configurable parameters.

Parameter	Description
Stationary Transmit	Transmit interval used while the device is stationary
Powered Transmit	Transmit interval used while the device is powered
In Motion Transmit	Transmit interval used while the device is in motion
SMS Enable	SMS enable/disable
GPRS Enable	GPRS enable/disable
GPS Enable	GPS Receiver enable/disable
Sensor Suite Enable	Sensor suite enable/disable
GPS Hot Fix Timeout	Time allotted for GPS hot fix

GPS Cold Fix Timeout	Time allotted for GPS cold fix
GPS Cold Fix Lockout	Number of consecutive failed cold fix attempts before lockout
ZigBee Enable	ZigBee Enable / Disable
GSM Timeout	Time allotted for GSM registration
Assistance Mode	Mode for using Assisted GPS
Always On Mode Enable	Always on Mode enable/disable
GPS Mode	Mode for using GPS

ZigBee Sensor Configuration Message

The sensor configuration message allows the user to configure the sensor parameters and thresholds for the GT Lite. Below are the configurable parameters.

Parameter	**Description**
Analog 5-X Low Threshold	Low Thresholds for ZigBee analog sensors 5-X
Analog 5-X High Threshold	High Thresholds for ZigBee analog sensors 5-X
Digital 6-X Enable	Enable/Disables for ZigBee digital sensors 6-X

ZigBee Sensor Network Message

To control which ZigBee sensors connect to the GT Lite, the server sends a ZigBee Sensor Network Message. Each ZigBee node has a unique identification number (EUID). The GT Lite only pairs with EUID's that are in its binding table. This message can add, delete, and clear the list of EUID's that is stored in the GT Lite.

The payload of the ZigBee Sensor Network Message contains a list of 64 bit EUID numbers for the GT Lite to add or delete from the binding table.

User Command Message

Commands sent to control the GT Lite are sent using the User Command Message. The Command data type defines the command. There is no payload data included in the User Command Message. Below is the list of current user command messages.

Parameter	**Description**
PING	Ping the GT Lite to create an LM and transmit
POLL LOG	Polls the GT Lite to transmit the log
CLEAR LOG	Clears the GT Lite's log

Software Upgrade Message

The Software Upgrade Message is a special SMS only message from the server to the device that initiates a code upgrade. Upon receipt, the device checks the authentication code. If correct, the device downloads the binary code from the ftp location indicated in the message.

Once the download is complete, the device upgrades the processor based on the received file extension.

Section 3: GT Lite Programming

Rename figures

Add section numbers for references

Add figure for locating J29

Add figure for programming and normal mode of J29

Rename figures

Add section numbers for references

Add figure for locating J5

Add figure for locating S1

3.1 Updating the Main Processor Software

The main processor contains two types of code: Low level firmware and application software. The firmware contains the operating system as well as GSM controls. This code transparent to the user and is rarely ever changed. The application software contains the device behavior and is visible to the user. This section defines updating the application software.

Programming over Serial

Programming the GT Lite over serial (RS232) is a direct connection to the main processor's serial bootloader. This method does not require any cellular connection, but it does require opening the GT Lite enclosure. Also, this is the only method to program a blank processor (no code) or a processor that has been recovered (see 3.3).

1. Remove the four case screws to open the GT Lite enclosure.
2. Locate J29 as shown in Figure XXXXXXXX below.

Figure XXXXXXXXX

3. Move the jumper to the programming side as shown in Figure XXXXXX below.

Figure XXXXXXXX

4. Connect the GT Lite debug cable to the external Conxall connector. Connect the serial (RS232) end of the debug cable to a PC.
5. Open a HyperTerminal connection to the COM port in which the GT Lite is connected.
6. Modify the connection properties to match Figure XXXXXX below.

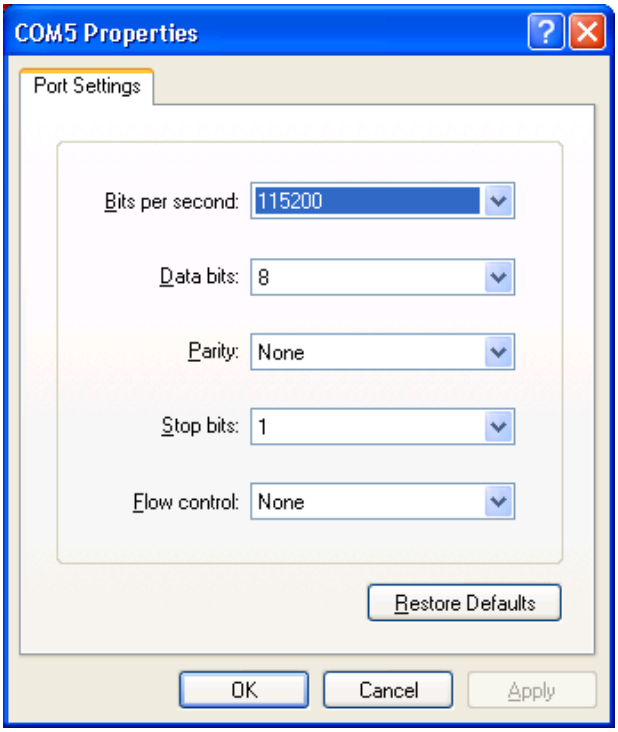


Figure XXXXXXXXX

7. Power on the GT Lite
8. Stop the application by typing the following command in HyperTerminal:

   AT+WOPEN=0 <enter>

9. Start the bootloader by typing the following command in HyperTerminal

   AT+WDWL <enter>

10. If the processor is in booloader mode, GT Lite should be printing a special character to the screen as shown in Figure XXXXX below.

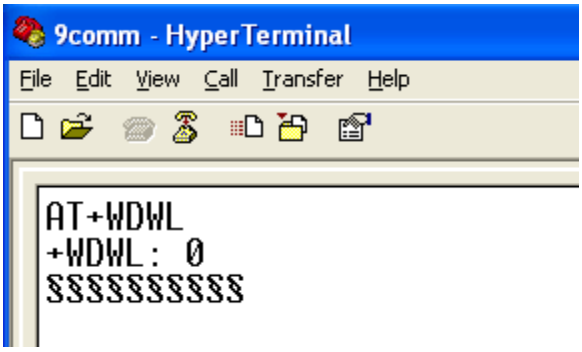


Figure XXXXXXXXX

11. Send the code by selecting Transfer → Send File…
12. Select the desired binary code file (.wpb.dwl) and use the following settings:

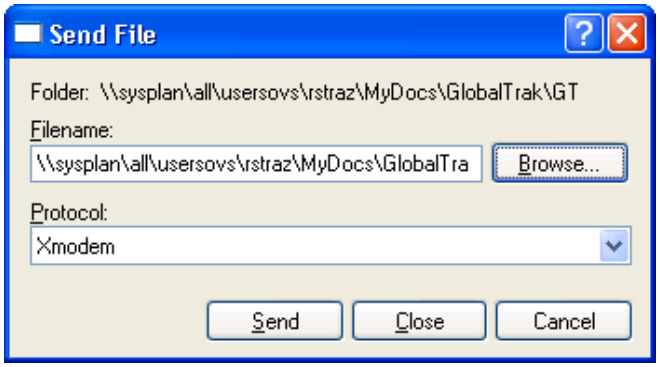


Figure XXXXXXXXX

13. Press Send to send the file
14. After transfer is complete, cycle power on the GT Lite
15. Clear the flash data by typing the following command:

    AT+WOPEN=3 <enter>

16. Start the application by typing the following command:

    AT+WOPEN=1 <enter>

17. Power off the GT Lite.
18. Move the jumper on J29 to the operating position as shown in Figure XXXXXXXX above.
19. Close the GT Lite enclosure by replacing the four case screws.

Programming over USB

Programming the main processor over USB allows the user to locally program the device without opening it. Only devices with software version 2.20 or higher are able to be programmed in this fashion.

Programming over USB uses a local command to initiate an Over-the-Air code download, so a GPRS connection is required. In areas with very weak or no GPRS, this method of loading code will fail.

1. Connect to GT Lite over USB and power on (see Section 4).
2. Wait until GT Lite is registered over GPRS. This is indicated by the following line (for more information, see Section 5):

   GPRS: GPRS has successfully connected!

3. Enter the following command into HyperTerminal replacing the marked parameters:

   AT+OTAU="[FTP Address and path]/[Filename],[Username],[Password]" <enter>

   [FTP Address and Path]: FTP address and path to folder in which GT Lite code is located.

[Filename]: Filename for main processor code. Must have the extension of .wpd.dwl.

[Username]: Username required to access FTP.

[Password]: Password required to access FTP.

4. Allow GT Lite to download code and update itself. GT Lite will reboot after download and update is complete.
5. Check GT Lite Software Version by entering the following command and make sure it matches (for more information, see Section 5):

   AT+PARAM="ALL" <enter>

6. Power off GT Lite.

Programming Over-the-Air

Over the air programming of the main processor allows the user to program the device without having any local access to it. Only devices with software version 2.20 or higher are able to be programmed in this fashion.

Over the air programming uses an SMS command to initiate an Over-the-Air code download, so a GPRS connection is required. In areas with very weak or no GPRS, this method of loading code will fail. Also, before proceeding with an over the air programming, ensure the device will remain on for the entire programming sequence.

For instructions on performing an over the air code upgrade, please consult the IMB O&M manual.

3.2 Updating Main Processor Firmware

Firmware Update Procedure

In the rare event that the main processor firmware requires an upgrade, below is the procedure to do so.

1. Download and install DWLWin from the Sierra Wireless if it is not already done.
2. Put your board in bootloader mode by jumpering J5 (shown below in Figure XXXXX) and putting J29 in Programming mode as shown in Figure XXXXXXX above.

Figure XXXXXXXX

3. Connect the GT Lite debug cable to the external Conxall connector. Connect the serial (RS232) end of the debug cable to a PC.
4. Power GT Lite on.
5. Open DWLWin and set it to the correct COM port and 115,200 baud.
6. Point the "Working Dir" at the .wpk firmware file, and check the .wpk checkbox.
7. Check "Open AT Application" under Erase.
8. Click Start in DWLWin, and then hold down switch S1 (shown in Figure XXXXX) on the board until the whole process is done. When prompted, select the chip as Q2687g. In all other dialog boxes, respond with NO.

Figure XXXXXXX

Firmware Versioning Information

Some changes in main processor firmware require modifications in the application software making only certain application software versions compatible with certain firmware versions. Below is the compatibility list.

FW Version	SW Version	Description
663b10	2.X	Original software. ATT compatible. FW and SW will become obsolete.
R72a00	3.X	Major upgrade. Adds slow idle capability. ATT compatible. Toolset will become obsolete.
R74a00	Unknown (may be 3.X)	Latest firmware for use with new toolset. No EOL plan set.

3.3 Programming the Low Power Controller

Programming over USB

Programming the low power controller over USB allows the user to locally program it. Only devices with main processor software version 2.20 or higher and low power controller version 2.20 or higher are able to be programmed in this fashion.

Programming over USB uses a local command to initiate an Over-the-Air code download, so a GPRS connection is required. In areas with very weak or no GPRS, this method of loading code will fail.

1. Connect to GT Lite over USB and power on (see Section 4).
2. Wait until GT Lite is registered over GPRS. This is indicated by the following line (for more information, see Section 5):

   GPRS: GPRS has successfully connected!

3. Enter the following command into HyperTerminal replacing the marked parameters:

   AT+OTAU="[FTP Address and path]/[Filename],[Username],[Password]" <enter>

   [FTP Address and Path]: FTP address and path to folder in which GT Lite code is located.

   [Filename]: Filename for low power controller code. Must have the extension of .ebl.

   [Username]: Username required to access FTP.

   [Password]: Password required to access FTP.

4. Allow GT Lite to download code and update the low power controller. GT Lite will reboot after the low power controller is updated.
5. Power off GT Lite.

Programming Over-the-Air

Over the air programming of the low power controller allows the user to program the device without having any local access to it. Only devices with main processor software version 2.20 or higher and low power controller version 2.20 or higher are able to be programmed in this fashion.

Over the air programming uses an SMS command to initiate an Over-the-Air code download, so a GPRS connection is required. In areas with very weak or no GPRS, this method of loading code will fail. Also, before proceeding with an over the air programming, ensure the device will remain on for the entire programming sequence.

For instructions on performing an over the air code upgrade, please consult the IMB O&M manual.

3.4 Recovering the GT Lite

There is a small chance that main processor programming can fail in such a way that the device becomes unusable until recovered.

1. Download and install DWLWin from the Sierra Wireless if it is not already done.
2. Put your board in bootloader mode by jumpering J5 (shown above in Figure XXXXX) and putting J29 in Programming mode as shown in Figure XXXXXXX above.
3. Connect the GT Lite debug cable to the external Conxall connector. Connect the serial (RS232) end of the debug cable to a PC.
4. Power GT Lite on.
5. Open DWLWin and set it to the correct COM port and 115,200 baud.
6. Uncheck all files under Working Dir.
7. Check "Open AT Application" and "Objects" under Erase.
8. Select "Wireless CPU Type as Q2686/Q2687.
9. Click Start in DWLWin, and then hold down switch S1 (shown in Figure XXXX) on the board until the whole process is done.

Section 4: Connecting GT Lite to a PC Host

Rename figures

Add section numbers for references

4.1 Install GT Lite USB Drivers

The first step in connecting a GT Lite device to a PC Host is to install and configure the GT Lite USB drivers. This step must be completed once for each GT Lite device connected to a PC. Once the driver is installed for a GT Lite device, that device can be reconnected to the PC without needing to reinstall the driver.

Install USB Driver

1. Connect GT Lite to a USB port with the GT Lite diagnostic cable.
2. Power on the GT Lite
3. Windows should recognize the new device
4. In the found new hardware wizard, select Install From a Specific Location and click Next
5. Select the location of Wavecom drivers and click OK.

Configure USB Driver

6. When installation is complete, open the Device Manager
7. Expand the Modems heading
8. Right click Wavecom USB Modem and click Properties
9. Open the Advanced tab and click Advanced Port Settings…
10. Set the Com Port Number that is not "In Use". This should be the same com port number for all GT Lite devices. After the first GT Lite is set up, Windows will warn that the COM port is "In Use". This is not a problem.
11. The other settings should look like the following:

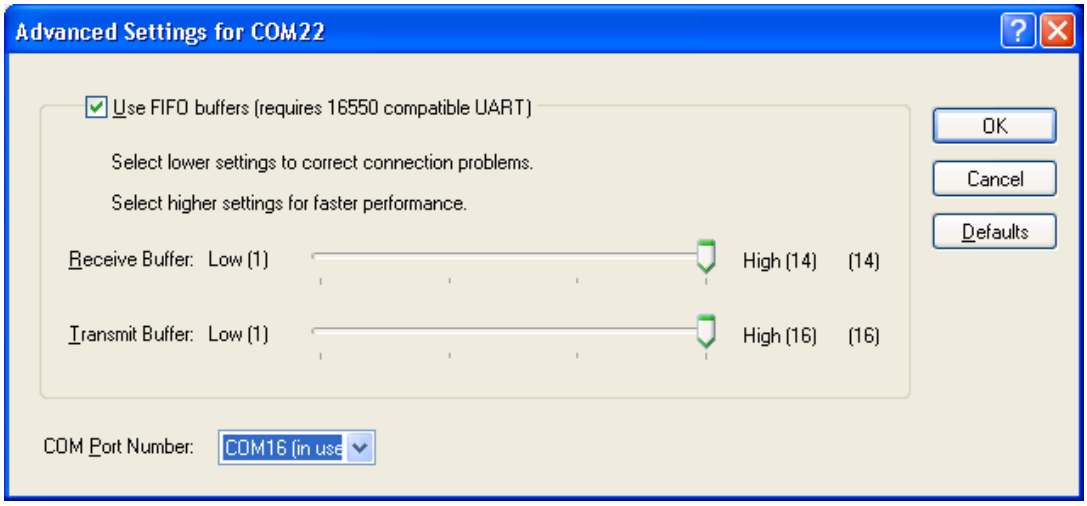


Figure XXXXXX

12. Click OK to accept the settings
13. Click OK on the Properties window
14. Power off GT Lite

4.2 Create HyperTerminal Connection

The next step to connecting a GT Lite to a PC is to create and save a HyperTerminal connection. HyperTerminal is free software that allows a PC to monitor serial data, such as the diagnostic data coming from GT Lite. This step only needs to be completed once per computer.

15. Power on GT Lite.
16. Open a new HyperTerminal connection.
17. Name the connection 'GT_Lite_Connection' and click OK.
18. Select the COM port number used in step 10 above.
19. Set the COM port properties using the settings shown below and press 'OK'.

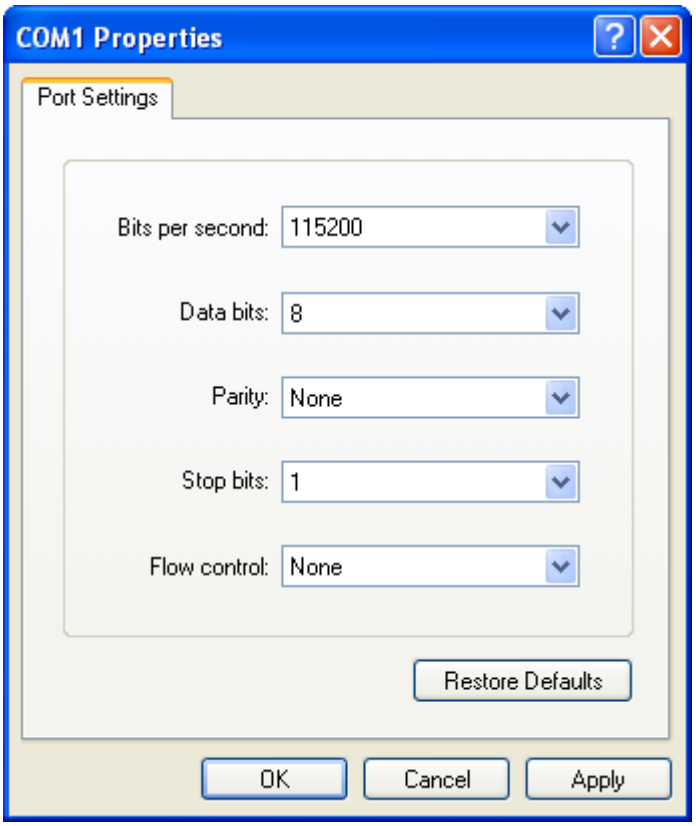


Figure XXXXXX

20. Save the connection to a known location such as the desktop.
21. Close HyperTerminal.
22. Power off GT Lite.

4.3 Connect GT Lite to HyperTerminal

After installing drivers and creating a HyperTerminal connection, it is possible to connect GT Lite to a host PC. The steps below outline the method for establishing a host connection over USB. However, it is also important to understand what makes these steps necessary.

When GT Lite is powered off, in a sleep mode, or in the process of rebooting, the connection over USB is internally disconnected. When this happens the PC will likely play the 'disconnect USB' notification sound. When the GT Lite powers up (from off state, sleep, or coming out of reboot), it reestablishes the USB connection. At the time when the USB connection is established, it is essential for HyperTerminal to be disconnected from USB COM port. Only after the USB connection is established can the COM port be successfully opened by clicking the 'Call' button in HyperTerminal.

Due to the nature of USB drivers and HyperTerminal there are also times when this procedure is followed correctly and the connection looks to be established, but no text is displayed in the terminal window. In this case it is necessary to disconnect the COM port connection in HyperTerminal and reboot the device.

23. Open the GT Lite HyperTerminal Connection.
24. When HyperTerminal warns that the COM port cannot be opened, click OK.
25. Power off GT Lite if it is on.
26. Ensure HyperTerminal is disconnected from the COM port.
27. Power on GT Lite.
28. Wait for the USB device to connect. This usually takes about 5 seconds. Windows will play the USB connect notification sound when it is done.
29. Click the 'Call' button on HyperTerminal.
30. If HyperTerminal is unable to connect to the COM port, go back to step 25.
31. Type a character and press enter to ensure the connection is correctly made.
32. If the character is not echo'd back in the HyperTerminal session, click the Disconnect button in HyperTerminal and go back to step 3.
33. GT Lite is now connected to HyperTerminal and commands can be issued. If characters stop echoing to the terminal or the device disconnects from USB, go back to step 25.

Section 5: Monitoring and Configuration

Add GPS Acquisition.

Add SMS attempt, transmit and fail.

Add GPRS fail.

Add GPS success.

Add low power controller fail.

Add OTA download.

Add SMS receive.

Add GPRS receive.

Add sleep.

Add section numbers for references

Add expected response for VLM and CLM.

Add section numbers for references

5.1 Monitoring the GT Lite

The GT Lite USB interface can be used for monitoring an diagnostics of GT Lite functions. This includes troubleshooting as well as operational diagnostics (will the GT Lite work in an operational scenario). This section describes how to interpret GT Lite diagnostic information. It is broken down into three parts: Overview, Diagnostic information by Function and Function by Diagnostic information. The first is an overview that describes how the diagnostic information is sorted and the basic theory. The second section is diagnostic output sorted by the GT Lite function (GSM registration, message creation, etc.). The second section is diagnostic output sorted by the actual output.

Diagnostic Overview

The diagnostic output from GT Lite is a serial data stream. For most functions occurring inside of GT Lite there are diagnostic print statements that output to HyperTerminal. Each line of diagnostic output follows the following format:

SUBSYSTEM: (Function) Output

The SUBSYSTEM is a system in which the diagnostic information refers to. Under Subsystem below, there is a list of each subsystem and a description.

The (Function) is a lower level descriptor that defines where in the code the diagnostic print occurs. This piece does not occur on every print statement and can be ignored by the user.

The Output is the diagnostic print statement. This is the description that tells the user what is going on inside of the unit.

Subsystem

NV:

NV statements deal with accessing and writing to Non-Volatile (NV) memory. This is where configuration data and messages are stored. These statements are generally of no concern to the user.

AT:

AT statements deal with very low level AT commands on the main processor. These can be ignored by the user.

APPLICATION:

APPLICATION is a broad category that deals with many basic functions of the device. These include communication between processors and systems and device configuration.

GPS:

GPS statements deal with the GPS module. This includes assistance data processing and GPS configuration.

PROTOCOL:

PROTOCOL statements deal with the Over-the-Air protocol on GT Lite. These statements usually refer to message packing and creation.

SMS:

SMS statements deal with the Short Message Service (SMS) subsystem. These are transmit and receive attempts over SMS.

TCP:

TCP statements deal with the TPC/IP over GPRS subsystem. These are transmit and receive attempts over GPRS as well as gathering of assistance data.

OTA:

OTA statements deal with over the air upgrade processes. This is both downloading code and performing the upgrade.

POWER:

POWER statements deal with power control of the device. This includes sleep and shutdown of modules to keep power output low.

Common GT Lite Functions

Low Power Controller Communication

There are many statements that deal with communication with the low power controller. Most of these are defined in the Common Diagnostic Output section below. The most common line is below:

APPLICATION: (messageCallback) ZIGBEE_STAR_AWAKE

This line indicates to the user that communication with the low power controller is successfully operating.

Message Creation

When messages are created, GT Lite outputs the entire contents of the message. However the first line printed indicating a message has been created is below. It indicates a message has been created and the type of message. The recordDataType definition is in section 2.2.

PROTOCOL: (LoggerMessage_Create) Enter. recordDataType=7

After the creation statement, the following is displayed, which shows the contents of the message.

Note: GPS information (including speed and direction) is updated after the GPS fix is received.

PROTOCOL: ################ LoggerMessage_Create ################
PROTOCOL: Record Data Type: 7
PROTOCOL: GPS Mode: Providing Last Valid Location Estimate
PROTOCOL: Timestamp: 299785758 sec: 3469 days, 17 hrs, 49 min, 18 sec

```
PROTOCOL: Latitude:   8388607
PROTOCOL: Longitude:        8388607
PROTOCOL: Optic sensor:     1
PROTOCOL: Accelerometer:    0
PROTOCOL: Temperature:      466
PROTOCOL: Battery:    37
PROTOCOL: Analog sensor 1:  0
PROTOCOL: Analog sensor 2:  0
PROTOCOL: Analog sensor 3:  0
PROTOCOL: Analog sensor 4:  0
PROTOCOL: Speed:      0
PROTOCOL: Direction:  0
PROTOCOL: External Analog 1:        0
PROTOCOL: External Analog 2:        0
PROTOCOL: Door State:       Open
PROTOCOL: Mount State:      removed
PROTOCOL: External Power:   Yes
PROTOCOL: In Motion: Yes
PROTOCOL: Digital 2:  0
PROTOCOL: Digital 3:  0
PROTOCOL: Digital 4:  0
PROTOCOL: Digital 5:  0
```

GSM Registration

When GPRS successfully registers on a network, the following statement is displayed:

GPRS: GPRS has successfully connected!

There are other statements that show incremental successes of registering, but the statement above indicates all steps have been completed and the connection was successfully established.

GPS Assistance Data

During aquisistion of GPS assistance data, there is a lot of diagnostic information printed to the screen. The initial statement that indicates assistance aquisision has started is:

GPS: (HotFixTimer) SendingAssistNow request.

The final statement that indicates assistance has been completed and successfully loaded onto the GPS module is:

GPS: ASSISTNOW_TRANSFER_COMPLETE

GPS Acquisition

GPRS Transmit

After each successful GPRS transmission the following is printed:

PROTOCOL: (LoggerMessage_TcpTransferCallback) TCP Successful.

This indicates a single message has been transmitted over GPRS. For each message in the queue that is successfully transmitted, it will be printed. Once the queue is empty and no more messages are left to transmit, the following is printed:

PROTOCOL: (LoggerMessage_CheckQueue) Queue is empty.

SMS Transmit

After each successful SMS transmission the following is printed:

PROTOCOL: (LoggerMessage_SmsTransferCallback) SMS Successful

This indicates a single message has been transmitted over SMS. For each message in the queue that is successfully transmitted, it will be printed. Once the queue is empty and no more messages are left to transmit, the following is printed:

PROTOCOL: (LoggerMessage_CheckQueue) Queue is empty.

Sleep (Slow Idle)

When the device is finished with a cycle and goes to sleep, the following statement will be printed, indicating how long the device will sleep.

POWER: Next cycle in 157 seconds.

If the device is configured appropriately to enter slow idle (instead of alarm mode), the following statement will be printed to indicate entering of slow idle.

POWER: Now entering Slow Idle (and cycle). 157 seconds

Sleep (Alarm Mode)

When the device is finished with a cycle and goes to sleep, the following statement will be printed, indicating how long the device will sleep.

POWER: Next cycle in 1621 seconds.

If the device is configured appropriately to enter alarm mode (instead of slow idle), the following statement will be printed to indicate that the device will enter slow idle for 30 seconds before going into alarm mode.

POWER: Now entering Slow Idle (and sleep). 30 seconds

Common Diagnostic Output

APPLICATION: IMEI:

This statement is followed by the device IMEI. The IMEI is the device ID of the GSM module. We use the last 11 digits of the IMEI with an L in front to create the GT Lite ID number.

APPLICATION: Firmware Version:

The statement is followed by the device firmware version. This is the low level firmware on the main processor. The firmware version is required to know what version of application code to load on the main processor.

APPLICATION: (batteryVoltageCallback) millivolts=4101, mAh = 3772

The battery callback displays the current battery voltage in millivolts and capacity remaining in mAh remaining.

APPLICATION: (messageCallback) ZIGBEE_STAR_AWAKE

This statement indicates proper communication with the low processor controller. Every time the main processor interrupts the low power controller, the low power controller reponds with the ZIGBEE_STAR_AWAKE message. If this message is received by the main processor, the debug statement above will be printed.

APPLICATION: (messageCallback) ZIGBEE_RESET_INFO

After a reset or boot, the low power controller tells the main processor the reason for reset. The statement following ZIGBEE_RESET_INFO states the reason for reset.

APPLICATION: (messageCallback) ZIGBEE_STAR_SENSOR_DATA

This statement indicates the main processor has received sensor data from the low power controller. Following this statement, there will be debug information that describes the sensors and data received.

APPLICATION: (messageCallback) sensorId=6, sensorValue=454

This statement describes data from one sensor that is received by the main processor. There are typically at least 5 of these messages together to describe all of the sensor data on the low power controller. The sensor ID describes what sensor is reporting and the data is a digital value from the sensor. Please consult section XXXXXXX on wireless sensors.

APPLICATION: (messageCallback) ZIGBEE_STAR_SENSOR_EVENT_DATA

This statement indicates that the main processor has received event data from the low power controller. If this is received, at least one sensor has gone into an event condition.

APPLICATION: (messageCallback) ZIGBEE_STAR_END

This statement indicates the end of low power controller communication. It is sent by the low power controller to say that it has no further information to send.

PROTOCOL: (LoggerMessage_Create) Enter. recordDataType=0

This statement indicates that a message has been created and the record data type of the message. For more information about record data types, please consult section 2.2.

PROTOCOL: (LoggerMessage_CreateTempMessage) Device message created successfully!

This statement indicates that a message has been successfully placed on the temp queue. All messages on the temp queue require a GPS update once a fix is received.

PROTOCOL: (LoggerMessage_CreateDeviceMessage) Device message created successfully!

This statement indicates that a message has been successfully placed on the transmit queue. Generally messages move from the temp queue to the transmit queue upon being updated with a GPS fix.

GPRS: CREG reports:

This statement indicates that GT Lite is searching to register on a GSM network. It will be displayed once per second until registered or the GSM timeout is reached.

GPRS: GPRS has successfully connected!

This statement indicates that GT Lite has successfully registered on a GSM network.

GPS: Powering on the GPS

This statement indicates the beginning of GPS acquisition. At this statement the GPS module is powered on.

GPS: (GetGpsFix) Started hot fix timer.

This statement indicates that the hot fix timer for GPS acquisition has started.

GPS: (HotFixTimer) Hot fix timer expired.

This statement indicates that the hot fix timer for GPS acquisition has expired.

GPS: (HotFixTimer) Started cold fix timer.

This statement indicates that the cold fix timer for GPS acquisition has started.

GPS: (HotFixTimer) SendingAssistNow request.

This statement indicates the beginning of a GPS assistance request. Many statements concerning low level assistance processing will follow.

TCP: Got WIP_CEV_READ

This statement indicates a read over TCP/IP. This is typically seen during assistance download, OTA code download, or receipt of GPRS configuration message.

TCP: PEER_CLOSE received

This statement indicates that a transfer over TCP/IP has completed.

GPS: ASSISTNOW_TRANSFER_COMPLETE

This statement indicates that assistance data has been successfully been downloaded to the GPS module.

GPS: (ColdFixTimer) Cold fix timer expired

This statement indicates that the cold fix timer for GPS acquisition has expired and GPS acquisition has failed to get a 3D fix.

GPS: (ColdFixTimer) Valid fix not obtained

This statement indicates that no valid fix, 2D or 3D has been received in the time allotted for GPS acquisition. In this case the last valid fix will be provided.

PROTOCOL: (TempMessage_CheckQueue) Updating a LoggerMessage GPS.

This statement indicates that a message on the temp queue is being updated with new GPS data. Following this, the message will be placed on the transmit queue.

PROTOCOL: (TempMessage_CheckQueue) Placing updated LM on DeviceMessage Queue.

This statement indicates that a message with updated GPS information is being moved from the temp queue to the transmit queue.

PROTOCOL: (LoggerMessage_SendMessage) Sending message via GPRS

This statement indicates that a transmit is being attempted via GPRS. This means that the device had previously registered on the GSM network and only the transmit is left.

PROTOCOL: (LoggerMessage_TcpTransferCallback) TCP Successful.

This statement indicates that a GPRS transmit attempt was successful and a server ACK has been received by the device.

5.2 Configuring the GT Lite

Configurable Parameters

Below is a table of all the configurable parameters and a description of what they do. The local name is the name of the parameter when configuring locally at the device. The Remote Name is the name of the parameter when remotely configuring. If a remote name is not present, then the parameter can only be configured locally; if the local name is not present, the parameter can only be configured remotely.

Local Name	Remote Name	Description
SERVPORT	Server Port	Port number for GPRS communication
SERVADDR	Server IP Address	Server TCP/IP address for GPRS communication
SMSNUM	Server Mobile Number	Server phone number for SMS communication
LOWBAT	Low Battery Threshold	Threshold for low battery alerts Local: mAh Remote: mAh / 10
STATTRANS	Transmission Interval	Stationary transmission interval Local: Seconds Remote: Minutes
STDTRANS	Motion Reporting	In Motion transmission interval Local: Seconds Remote: Minutes
POWTRANS	Powered Transmission Interval	Powered transmission interval Local: Seconds Remote: Minutes
GSMSND	GSM Send Timeout	Timeout for GSM registration Local: Seconds Remote: Seconds * 10
GPRSENABLE	GPRS Receiver Enable	Enable parameter for GPRS 1 (enable), 0 (disable)
SMSENABLE	SMS Enable	Enable parameter for SMS 1 (enable), 0 (disable)
GPSENABLE		Enable parameter for GPS 1 (enable), 0 (disable)
HOTFIX	GPS Hot Fix	Timeout for GPS Hotfix Seconds
COLDFIX	GPS Cold Fix	Timeout for GPS Coldfix Local: Seconds Remote: Seconds * 10

LOCKOUT	GPS Cold Fix Lockout	Lockout for consecutive failed coldfix attempts Number of attempts
ASSISTMODE	Assistance Mode	Assistance mode select 0 = Assistance Off 1 = On hot fix 2 = On cold fix 3 = Use AssistNow Offline. *Not implemented*
GPSMODE	GPS Mode	GPS mode select 0 = GPS Off 1 = Acquisition mode 2 = Tracking mode
ZIGMESH		ZigBee mesh timeout Seconds
ASSTLAT		Default assistance latitude Decimal
ASSTLONG		Default assistance longitude Decimal
FREQBAND		Default frequency band EU = European US = US
OPTIC	Optic Threshold	Threshold for optic events Digital steps (0 – 1023)
SHOCK	Shock Threshold	Threshold for shock events Local: milli-g's Remote: milli-g's / 10
TEMPHIGH	High Temp Threshold	Threshold for high temperature events Threshold = (°C – 50)/0.1693
TEMPLOW	Low Temp Threshold	Threshold for low temperature events Threshold = (°C – 50)/0.1693
DOOR	Door Enable	Door Sensor Enable 1 (enable), 0 (disable)
MOUNT	Mount Enable	Mount Sensor Enable 1 (enable), 0 (disable)
MOTION	Motion Enable	Motion Sensor Enable 1 (enable), 0 (disable)
	Server Name	Server APN name for GPRS
	Ext Power Enable	External Power Enable 1 (enable), 0 (disable)

	Speed/Direction Enable	Speed and Direction Enable 1 (enable), 0 (disable)
	Sensor Suite Enable	Sensor suite enable 1 (enable), 0 (disable)
	ZigBee Enable	ZigBee wireless enable 1 (enable), 0 (disable)
	Always On Mode	Always on mode 1 (enable), 0 (disable)
	Low Ana1 Threshold	ZigBee wireless analog sensor 1 low threshold Digital value (0 – 1023)
	High Ana1 Threshold	ZigBee wireless analog sensor 1 high threshold Digital value (0 – 1023)
	Low Ana2 Threshold	ZigBee wireless analog sensor 2 low threshold Digital value (0 – 1023)
	High Ana2 Threshold	ZigBee wireless analog sensor 2 high threshold Digital value (0 – 1023)
	Low Ana3 Threshold	ZigBee wireless analog sensor 3 low threshold Digital value (0 – 1023)
	High Ana3 Threshold	ZigBee wireless analog sensor 3 high threshold Digital value (0 – 1023)
	Low Ana4 Threshold	ZigBee wireless analog sensor 4 low threshold Digital value (0 – 1023)
	High Ana4 Threshold	ZigBee wireless analog sensor 4 high threshold Digital value (0 – 1023)
	Low Ana5 Threshold	ZigBee wireless analog sensor 5 low threshold Digital value (0 – 1023)
	High Ana5 Threshold	ZigBee wireless analog sensor 5 high threshold Digital value (0 – 1023)
	Low Ana6 Threshold	ZigBee wireless analog sensor 6 low threshold Digital value (0 – 1023)
	High Ana6 Threshold	ZigBee wireless analog sensor 6 high threshold Digital value (0 – 1023)
	Low Ana7 Threshold	ZigBee wireless analog sensor 7 low threshold Digital value (0 – 1023)

	High Ana7 Threshold	ZigBee wireless analog sensor 7 high threshold Digital value (0 – 1023)
	Low Ana8 Threshold	ZigBee wireless analog sensor 8 low threshold Digital value (0 – 1023)
	High Ana8 Threshold	ZigBee wireless analog sensor 8 high threshold Digital value (0 – 1023)
	Digital 2 Enable	ZigBee wireless digital sensor 1 enable 1 (enable), 0 (disable)
	Digital 3 Enable	ZigBee wireless digital sensor 2 enable 1 (enable), 0 (disable)
	Digital 4 Enable	ZigBee wireless digital sensor 3 enable 1 (enable), 0 (disable)
	Digital 5 Enable	ZigBee wireless digital sensor 4 enable 1 (enable), 0 (disable)

Local Configuration and Commands

Status Commands

View Parameters

View the current parameters stored on the GT Lite. This lists all basic parameters as well as the current software version.

Command:

AT+PARAM=”ALL”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SERVPORT=5900
+SYSSTAT: SERVADDR=65.202.226.90
+SYSSTAT: SMSNUM=41080101
+SYSSTAT: LOWBAT=5
+SYSSTAT: STATTRANS=310
+SYSSTAT: STDTRANS=1800
+SYSSTAT: POWTRANS=3600
+SYSSTAT: GSMSND=60
+SYSSTAT: GPRSENABLE=1
+SYSSTAT: SMSENABLE=1
+SYSSTAT: GPSENABLE=1
+SYSSTAT: HOTFIX=10
+SYSSTAT: COLDFIX=120
+SYSSTAT: LOCKOUT=0

```
+SYSSTAT: ASSISTMODE=2
+SYSSTAT: GPSMODE=1
+SYSSTAT: ZIGMESH=300
+SYSSTAT: Software Version=3.00
+SYSSTAT: ASSTLAT=34.100000
+SYSSTAT: ASSTLONG=-84.000000
+SYSSTAT: FREQBAND=US
+SYSSTAT: OPTIC=0
+SYSSTAT: SHOCK=3000
+SYSSTAT: TEMPHIGH=0
+SYSSTAT: TEMPLOW=0
+SYSSTAT: DOOR=1
+SYSSTAT: MOUNT=1
+SYSSTAT: MOTION=1
```

A description of each parameter value is described above in Configurable Parameters.

View GSM Signal Strength

View the current signal strength for the GSM network.

Command:

```
AT+CSQ
```

Expected Response:

```
+CSQ: <rssi>,<ber>

OK
```

<rssi>:	Received Signal Strenth	
	0	-113 dBm or less
	1	-111 dBm
	2 to 30	-109 to -53 dBm
	31	-51 dBm
<ber>:	Bit Error Rate	
	0…7	Valid BER
	99	Unknown or Undetectable

View Logger Messages

View the current queue of logger messages on the device.

Command:

```
AT+VLM
```

Expected Response:

```
XXXXXXXXXXXXXXXXX
```

Clear Logger Messages

Clear the current queue of logger messages on the device.

Command:

AT+CLM

Expected Response:

XXXXXXXXXXXXX

Power Commands

View Stationary Transmit Interval

View the current transmit interval used while the device is stationary or while motion sensor is turned off.

Command:

AT+PARAM=”STATTRANS”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: STATTRANS=<stat>
OK

<stat>: Transmit interval in seconds

Set Stationary Transmit Interval

Set a new transmit interval used while the device is stationary or while motion sensor is turned off.

Command:

AT+PARAM=”STATTRANS”,”<stat>”

<stat>: Transmit interval in seconds

Expected Response:

OK

View Powered Transmit Interval

View the current transmit interval used while external power is applied to the device.

Command:

AT+PARAM=”POWTRANS”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: POWTRANS=<pow>
OK

<pow>: Transmit interval in seconds

Set Powered Transmit Interval

Set a new transmit interval used while the device is powered.

Command:

AT+PARAM=”POWTRANS”,”<pow>”

<pow>: Transmit interval in seconds

Expected Response:

OK

View In Motion Transmit Interval

View the current transmit interval used while the device is in motion and the motion sensor is turned on.

Command:

AT+PARAM=”STDTRANS”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: STDTRANS=<std>
OK

<std>: Transmit interval in seconds

Set In Motion Transmit Interval

Set a new transmit interval used while the device is in motion and the motion sensor is turned on.

Command:

AT+PARAM=”STDTRANS”,”<std>”

<std>: Transmit interval in seconds

Expected Response:

OK

Network Commands

View Server Port Number

View the current port number used for GPRS communications.

Command:

AT+PARAM=”SERVPORT”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SERVPORT=<port>
OK

<port>: Server port number

Set Server Port Number

Set a new port number used for GPRS communications.

Command:

AT+PARAM="SERVPORT","<port>"

<port>: Server port number

Expected Response:

OK

View Server Address

View the current TCP/IP server address used for GPRS communications.

Command:

AT+PARAM="SERVADDR"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SERVADDR=<addr>
OK

<addr>: Server address

Set Server Address

Set a new TCP/IP server address used for GPRS communications.

Command:

AT+PARAM="SERVADDR","<addr>"

<addr>: Server port number

Expected Response:

OK

View SMS Number

View the current port server SMS phone number used for SMS communications.

Command:

AT+PARAM="SMSNUM"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SMSNUM=<sms>
OK

<sms>: Server SMS phone number

Set SMS Number

Set a new port server SMS phone number used for SMS communications.

Command:

AT+PARAM="SMSNUM","<sms>"

<sms>: Server SMS phone number

Expected Response:

OK

View GSM Registration Timeout

View the current timeout used to register on the GSM network.

Command:

AT+PARAM="GSMSND"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: GSMSND=<gsm>
OK

<gsm>: GSM registration timeout in seconds

Set GSM Registration Timeout

Set a new timeout used to register on the GSM network.

Command:

AT+PARAM="GSMSND","<gsm>"

<gsm>: GSM registration timeout in seconds

Expected Response:

OK

View GPRS Enable Parameter

View the current status of the GPRS Enable parameter.

Command:

AT+PARAM=”GPRSENABLE”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: GPRSENABLE=<gprs>
OK

<gprs>: GPRS enable status.
0 = Disabled
1 = Enabled

Set GPRS Enable Parameter

Set a new value for the GPRS Enable parameter.

Command:

AT+PARAM=”GPRSENABLE”,”<gprs>”

<gprs>: GPRS enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

View SMS Enable Parameter

View the current status of the SMS Enable parameter.

Command:

AT+PARAM=”SMSENABLE”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SMSENABLE=<sms>
OK

<sms>: SMS enable status.
0 = Disabled
1 = Enabled

Set SMS Enable Parameter

Set a new value for the SMS Enable parameter.

Command:

AT+PARAM=”SMSENABLE”,”<sms>”

<sms>: SMS enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

View GSM Frequency Band Default

View the default frequency band used for GSM.

Command:

AT+PARAM="FREQBAND"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: FREQBAND=<freq>
OK

<freq>: Frequency band.
EU = European frequency band (900 and 1800)
US = US frequency band (850 and 1900)

Set GSM Frequency Band Default

Set the default frequency band used for GSM.

Command:

AT+PARAM="FREQBAND","<freq>"

<freq>: Frequency band.
EU = European frequency band (900 and 1800)
US = US frequency band (850 and 1900)

Expected Response:

OK

View GSM Frequency Band

View the current frequency band used for GSM.

Command:

AT+WMBS?

Expected Response:

+WMBS: <Band>,<ResetFlag>

OK

<Band>: band frequency configuration
0 mono-band mode 850 MHz
1 mono-band mode 900 extended MHz (900E)
2 mono-band mode 1800 MHz

3 mono-band mode 1900 MHz
4 dual-band mode 850/1900 MHz
5 dual-band mode 900E (extended) / 1800 MHz
6 dual-band mode 900E (extended) / 1900 MHz

<ResetFlag> 0 Band was not modified since the last boot.
1 Band has been modified since the last boot. Reboot required for change to take effect.

Set GSM Frequency Band

Set the current frequency band used for GSM.

Command:

AT+WMBS=<Band>

<Band>: band frequency configuration
0 mono-band mode 850 MHz
1 mono-band mode 900 extended MHz (900E)
2 mono-band mode 1800 MHz
3 mono-band mode 1900 MHz
4 dual-band mode 850/1900 MHz
5 dual-band mode 900E (extended) / 1800 MHz
6 dual-band mode 900E (extended) / 1900 MHz

Expected Response:

OK

GPS Commands

View GPS Enable Parameter

View the current status of the GPS Enable parameter.

Command:

AT+PARAM="GPSENABLE"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: GPSENABLE=<gps>
OK

<gps>: GPS enable status.
0 = Disabled
1 = Enabled

Set GPS Enable Parameter

Set a new value for the GPS Enable parameter.

Command:

AT+PARAM=”GPSENABLE”,”<gps>”

<gps>: GPS enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

View GPS Hotfix Timeout

View the GPS Hotfix timeout.

Command:

AT+PARAM=”HOTFIX”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: HOTFIX=<hot>
OK

<hot>: Hotfix timeout in seconds

Set GPS Hotfix Timeout

Set a new timeout GPS Hotfix timeout.

Command:

AT+PARAM=”HOTFIX”,”<hot>”

<hot>: Hotfix timeout in seconds

Expected Response:

OK

View GPS Coldfix Timeout

View the GPS Coldfix timeout used after the Hotfix timer expires.

Command:

AT+PARAM=”COLDFIX”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: COLDFIX=<cold>
OK

<cold>: Coldfix timeout in seconds

Set GPS Coldfix Timeout

Set a new GPS Coldfix timeout used after the Hotfix timer expires.

Command:

AT+PARAM="COLDFIX","<cold>"

<cold>: Coldfix timeout in seconds

Expected Response:

OK

View GPS Coldfix Lockout

View the number of consecutive failed GPS coldfix attempts before skipping the coldfix attempt.

Command:

AT+PARAM="LOCKOUT"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: LOCKOUT=<lock>
OK

<lock>: Coldfix lockout in number of attempts
0 = never lockout

Set GPS Coldfix Lockout

Set the number of consecutive failed GPS coldfix attempts before skipping the coldfix attempt.

Command:

AT+PARAM="LOCKOUT","<lock>"

<lock>: Coldfix lockout in number of attempts
0 = never lockout

Expected Response:

OK

View GPS Assistance Mode

View the mode in which GT Lite uses and gathers assistance data for GPS.

Command:

AT+PARAM="ASSISTMODE"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.

+SYSSTAT: ASSISTMODE=<astmode>
OK

<astmode>: GPS Assistance Mode
0 = Assistance Off
1 = Gather assistance data before hotfix timeout starts
2 = Gather assistance data after hotfix timeout expires
3 = Use AssistNow Offline. *Note: Currently not implemented*

Set GPS Assistance Mode

Set the mode in which GT Lite uses and gathers assistance data for GPS.

Command:

AT+PARAM="ASSISTMODE","<astmode>"

<astmode>: GPS Assistance Mode
0 = Assistance Off
1 = Gather assistance data before hotfix timeout starts
2 = Gather assistance data after hotfix timeout expires
3 = Use AssistNow Offline. *Note: Currently not implemented*

Expected Response:

OK

View GPS Mode

View the mode in which GT Lite uses GPS.

Command:

AT+PARAM="GPSMODE"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: GPSMODE=<gpsmode>
OK

<gpsmode>: GPS Mode
0 = GPS Off
1 = GPS Acquisition mode
2 = GPS Tracking mode

Set GPS Mode

Set the mode in which GT Lite uses GPS.

Command:

AT+PARAM="GPSMODE","<astmode>"

<gpsmode>: GPS Mode

0 = GPS Off
1 = GPS Acquisition mode
2 = GPS Tracking mode

Expected Response:

OK

View Default Assistance Latitude

View the default latitude used for assistance data. This is only used if no GPS fix has been received by the device.

Command:

AT+PARAM="ASSTLAT"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: ASSTLAT=<asstlat>
OK

<asstlat>: Default latitude for assistance data in decimal form

Set Default Assistance Latitude

Set the default latitude used for assistance data. This is only used if no GPS fix has been received by the device.

Command:

AT+PARAM="ASSTLAT","<asstlat>"

<asstlat>: Default latitude for assistance data in decimal form

Expected Response:

OK

View Default Assistance Longitude

View the default longitude used for assistance data. This is only used if no GPS fix has been received by the device.

Command:

AT+PARAM="ASSTLONG"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: ASSTLONG=<asstlon>
OK

<asstlon>: Default longitude for assistance data in decimal form

Set Default Assistance Longitude

Set the default longitude used for assistance data. This is only used if no GPS fix has been received by the device.

Command:

AT+PARAM=”ASSTLAT”,”<asstlon>”

<asstlon>: Default longitude for assistance data in decimal form

Expected Response:

OK

Sensor Commands

View Low Battery Threshold

View the threshold set for Low Battery events.

Command:

AT+PARAM=”LOWBAT”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: LOWBAT=<bat>
OK

<bat>: Low battery threshold in mAh. 0 – 3800

Set Low Battery Threshold

Set a new threshold set for Low Battery events.

Command:

AT+PARAM=”LOWBAT”,”<bat>”

<bat>: Low battery threshold in mAh. 0 – 3800

Expected Response:

OK

View Optic Threshold

View the threshold set for optic events.

Command:

AT+PARAM=”OPTIC”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: OPTIC=<optic>
OK

<optic>: Optic threshold in digital steps. 0 – 1023

Set Optic Threshold

Set a new threshold set for optic events.

Command:

AT+PARAM="OPTIC","<optic>"

<optic>: Optic threshold in digital steps. 0 – 1023

Expected Response:

OK

View Shock Threshold

View the threshold set for shock events.

Command:

AT+PARAM="SHOCK"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: SHOCK=<shock>
OK

<shock>: Shock threshold in milli g's. 0 – 18000

Set Shock Threshold

Set a new threshold set for shock events.

Command:

AT+PARAM="SHOCK","<shock>"

<shock>: Shock threshold in milli g's. 0 – 18000

Expected Response:

OK

View Low Temperature Threshold

View the threshold set for low temperature events.

Command:

AT+PARAM=”TEMPLOW”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: TEMPLOW=<templow>
OK

<templow>: Low temperature threshold
°C = <templow>*0.1693 - 50

Set Low Temperature Threshold

Set a new threshold set for low temperature events.

Command:

AT+PARAM=”TEMPLOW”,”<templow>”

<templow>: Low temperature threshold
<templow> = (°C – 50)/0.1693

Expected Response:

OK

View High Temperature Threshold

View the threshold set for high temperature events.

Command:

AT+PARAM=”TEMPHIGH”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: TEMPHIGH=<temphigh>
OK

<temphigh>: High temperature threshold
°C = <temphigh>*0.1693 - 50

Set High Temperature Threshold

Set a new threshold set for high temperature events.

Command:

AT+PARAM=”TEMPHIGH”,”<temphigh>”

<temphigh>: High temperature threshold
<temphigh> = (°C – 50)/0.1693

Expected Response:

OK

View Door Enable Parameter

View the current status of the Door Enable parameter.

Command:

AT+PARAM="DOOR"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: DOOR=<door>
OK

<door>: Door enable status.
0 = Disabled
1 = Enabled

Set GPS Enable Parameter

Set a new value for the Door Enable parameter.

Command:

AT+PARAM="DOOR","<door>"

<door>: DOOR enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

View Mount Enable Parameter

View the current status of the Mount Enable parameter.

Command:

AT+PARAM="MOUNT"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: MOUNT=<mount>
OK

<mount>: Mount enable status.
0 = Disabled
1 = Enabled

Set Mount Enable Parameter

Set a new value for the Mount Enable parameter.

Command:

AT+PARAM=”MOUNT”,”<mount>”

<mount>: Mount enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

View Motion Enable Parameter

View the current status of the Motion Enable parameter.

Command:

AT+PARAM=”MOTION”

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: MOTION=<mot>
OK

<mot>: Motion enable status.
0 = Disabled
1 = Enabled

Set Motion Enable Parameter

Set a new value for the Motion Enable parameter.

Command:

AT+PARAM=”MOTION”,”<mot>”

<mot>: Motion enable status.
0 = Disabled
1 = Enabled

Expected Response:

OK

ZigBee Commands

Add ZigBee EUID

Add a single EUID to the ZigBee binding table. EUID’s are 64 bit addresses assigned to each ZigBee node. The GT Lite will only talk to nodes with EUID’s in its binding table.

Command:

AT+ZIGADD=”[EUID]”

Replace [EUID] with a valid 16 character ZigBee EUID

Expected Response:

EM250: (AtHandlerAddToBindTable) Enter.
APPLICATION: (em250HandlerQueue) Enter.
APPLICATION: (em250StarStart) Enter
APPLICATION: (messageCallback) Enter. commandId=57, payloadLength=0
APPLICATION: (messageCallback) ZIGBEE_STAR_AWAKE
APPLICATION: (em250FormatEncoderDecoderSend) Enter.

Remove a single ZigBee EUID

Remove a single EUID to the ZigBee binding table. Once command is entered, GT Lite will no longer communicate the removed EUID.

Command:

AT+ZIGREM="[EUID]"

Replace [EUID] with a valid 16 character ZigBee EUID

Expected Response:

EM250: (AtHandlerRemoveFromBindTable) Enter.
APPLICATION: (em250HandlerQueue) Enter.
APPLICATION: (em250StarStart) Enter
APPLICATION: (messageCallback) Enter. commandId=57, payloadLength=0
APPLICATION: (messageCallback) ZIGBEE_STAR_AWAKE
APPLICATION: (em250FormatEncoderDecoderSend) Enter.

Remove all ZigBee EUIDS

Removes all stored EUID's from the ZigBee binding table. Once command is entered, GT Lite will no longer communicate any wireless devices.

Command:

AT+ZIGREMALL

Expected Response:

EM250: (AtHandlerRemoveAllFromBindTable) Enter.
APPLICATION: (em250HandlerQueue) Enter.
APPLICATION: (em250StarStart) Enter
APPLICATION: (messageCallback) Enter. commandId=57, payloadLength=0
APPLICATION: (messageCallback) ZIGBEE_STAR_AWAKE
APPLICATION: (em250FormatEncoderDecoderSend) Enter.

View ZigBee Mesh Timeout

View the ZigBee mesh timeout.

Command:

AT+PARAM="ZIGMESH"

Expected Response:

APPLICATION: (SYSSTAT_ParamCommandHandler) Enter.
+SYSSTAT: ZIGMESH=<mesh>
OK

<mesh>: ZigBee mesh timeout in seconds

Set ZigBee Mesh Timeout

Set a new ZigBee mesh timeout.

Command:

AT+PARAM="ZIGMESH","<mesh>"

<mesh>: ZigBee mesh timeout in seconds

Expected Response:

OK

Programming Commands

Main Processor Upgrade

Upgrade the main processor by downloading a binary image from an FTP site and loading new code.

Command:

AT+OTAU="[FTP Address and path]/[Filename],[Username],[Password]"

[FTP Address and Path]: FTP address and path to folder in which GT Lite code is located.
[Filename]: Filename for main processor code. Must have the extension of .wpd.dwl.
[Username]: Username required to access FTP.
[Password]: Password required to access FTP.

Expected Response:

OK

Low Power Controller Upgrade

Upgrade the low processor controller by downloading a binary image from an FTP site and loading new code.

Command:

AT+OTAU="[FTP Address and path]/[Filename],[Username],[Password]"

[FTP Address and Path]: FTP address and path to folder in which GT Lite code is located.
[Filename]: Filename for main processor code. Must have the extension of .ebl.
[Username]: Username required to access FTP.

[Password]: Password required to access FTP.

Expected Response:

OK

Remote Configuration

Most configuration parameters listed above can also be modified and configured remotely with the IMB. A document is uploaded to the IMB which sends a message to GT Lite and updates the configuration. The IMB parameter names and descriptions are listed in the configurable parameters table. For more information on sending over the air configuration messages, please consult the IMB Operation and Maintenance manual.

Section 6: Operations and Installation

More info on using GT Lite

Add other installations methods

6.1 Using the GT Lite

Using the GT Lite in a stand-alone application is extremely simple, consisting of only 4 steps.

1. Power on GT Lite in an open area with a clear view to the sky.
2. Ensure the device is powered on by looking at the GSM and Activity indicators.
3. Wait 5 minutes to allow the GT Lite to locate itself.
4. Install the GT Lite in the desired location.

There are many mounting brackets and options for the GT Lite. Some of the more common options are detailed in 6.2.

6.2 Installation Types

Dry Goods Container Bracket

Note: Use of Dry Goods Container Bracket requires GT Lite internal door sensor.

Dry goods container bracket allows the GT Lite to be quickly and securely mounted to a container door with almost no chance of error. By design, this configuration monitors door position along with the standard GT Lite sensors. The steps below pick up after steps 1-4 in section 2.

1. Install GT Lite to the Dry Goods Container Bracket using 4 #8 screws. (this step is likely to be already completed)
2. Install the GT Lite bracket on the left door (as facing the container doors from the outside) allowing the notched section to fit over a rib in the door. See figure 5.

Figure 5

3. Install the magnet bracket on the right door, again allowing the notched section to fit over a rib in the door. See figure 6.

Figure 6

4. Close container doors.

Reefer Container Bracket

TBD

In Cargo Installation

TBD

Magnetic Mount Bracket

TBD

Section 7: GT Lite Care and Maintenance

Add Handling GT Lite

Maintenance other than charging??

7.1 Handling GT Lite

7.2 GT Lite Maintenance

Charging the GT Lite

GT Lite contains internal charging circuitry that allows it to self monitor charging. The only requirement is a 7V – 18V DC power source. This source can be 12V automotive power or any DC power supply that fits the above criteria. The steps below define charging with the included power supply, but they mostly apply to charging via any method.

1. Select proper plug adapter from the included kit.
2. Plug the power supply into any 100V – 240V AC socket.
3. Connect the charger to the GT Lite external interface connector.
4. Ensure the charging LED lights solid red.
5. Wait approximately 4 hours for charging to complete.
6. When the charging LED turns off, disconnect GT Lite from the charger.

Note: Charging can be done while device is on or off with very little effect on charge time. If charging while on, temperature readings will be elevated due to charging.

Section 8: Standards and Certifications

Add electrical standards

Add all certifications

8.1 Standards

Electromagnetic Compatibility

The relevant electromagnetic compatibility requirements for the intended product use are detailed below.

Note: All requirements in this section are expected to be met by the GT Lite product, based on component ratings and product design, but have not necessarily been fully tested.

The GT Lite conforms to appropriate sections of the International Telecommunications Union (ITU) European Telecommunications Standards Institute (ETSI) Harmonized Standards.. Specific requirements are defined in the sections below.

Radiated Emissions

The GT Lite complies with the test methodology and test levels defined in EN 300 832 and CISPR 25.

Conducted Emissions

The GT Lite complies with the test methodology and test levels defined in EN 300 832 for conducted emissions.

Radiated Immunity

The GT Lite complies with the test methodology and test levels defined in EN 300 832 for radiated immunity.

Conducted Immunity

The GT Lite complies with the test methodology and test levels defined in EN 300 832 for conducted immunity.

Electrostatic Discharge

The external connectors on the GT Lite complies with the test methodology and test levels defined in EN 300 832.

Environmental Limits

Note: All requirements in this section are expected to be met by the GT Lite product version, based on component ratings and product design, but have not necessarily been fully tested.

The GT Lite conforms to appropriate sections of the International Electrotechnical Commission and the SAE J1455 Joint SAE/TMC Recommended Environmental Practices for Electronic Equipment Design (Heavy-Duty Trucks). Specific requirements are defined in the sections below.

Operating Temperature

The GT Lite operates from -40 °C to +85 °C.

Operational Shock

The GT Lite while operating withstands half sine acceleration of 30 g (300 m/s2) shock, 18 ms duration in accordance with IEC 68-2-27 Ea.

Operational Vibration

The GT Lite while operating withstands 3 g (30 m/s2) vibration for 10 frequency sweeps from 25 to 500 Hz, as tested according to IEC 68-2-6 (test Fc).

8.2 Certifications

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radi-ate radio frequency energy and, if not in-stalled and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

-Reorient or relocate the receiving antenna.

-Increase the separation between the equipment and receiver.

-Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

-Consult the dealer or an experienced radio/ TV technician for help.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Section 9: Troubleshooting

Add troubleshooting for:

Programming

Diagnostic setup

Configuration

Installation

Maintenance

9.1 Diagnostic Setup Troubleshooting

9.2 Programming Troubleshooting

9.3 Configuration Troubleshooting

9.4 Installation and Operational Troubleshooting

Symptom	Possible Cause	Solution
No GSM communication	SIM card not installed or installed improperly	Check SIM card installation
	SIM card not provisioned	Contact GlobalTrak to ensure SIM card is properly provisioned
	Configuration disables GSM communication	Check the Configuration file for errors and reload a correct file
	GT Lite set to wrong GSM frequency bands	-Allow GT Lite to receive a GPS fix, then wait for next transmit attempt -Allow GT Lite to transmit 6 times.
	No GSM signal available	Test network strength with quad-band phone. If no network available, move installation where a stronger signal is available
	The GT Lite is damaged or otherwise faulty	Replace the GT Lite
GPS fix receive failed on installed device	GPS Cold Fix never received prior to installation	Remove GT Lite and place in area with clear line of sight to the sky

9.5 Maintenance Troubleshooting

Section 10: Safety

Add safety stuff

Section 11: Manufacturer Information

Add Manufacturer Information

Section 12: Wireless Devices

Add overview

Add pairing

Add Operations

Add Supported devices

Add Troubleshooting

12.1 Overview

12.2 Pairing

12.3 Operations and Installation

12.4 Supported Devices

12.5 Wireless Devices Troubleshooting

Section 13: Orbcomm Satellite Option

Add overview

Add detailed description

Add Operations

Add Troubleshooting

13.1 Overview

13.2 Detailed Description

13.3 Operations and Installation

13.4 Troubleshooting

Section 14: Iridium Satellite Option

Add overview

Add detailed description

Add Operations

Add Troubleshooting

14.1 Overview

14.2 Detailed Description

14.3 Operations and Installation

14.4 Troubleshooting

Section 15: Wavecom Active RFID Option

Add overview

Add detailed description

Add Operations

Add Supported Tags

Add Troubleshooting

15.1 Overview

15.2 Detailed Description

15.3 Operations and Installation

15.4 Supported Tags

15.5 Troubleshooting

Section 16: SAVI Active RFID Option

Add overview

Add detailed description

Add Operations

Add Troubleshooting

16.1 Overview

16.2 Detailed Description

16.3 Operations and Installation

16.4 Troubleshooting

Section 17: ThingMagic Passive RFID Option

Add overview

Add detailed description

Add Operations

Add Supported Tags

Add Troubleshooting

17.1 Overview

17.2 Detailed Description

17.3 Operations and Installation

17.4 Supported Tags

17.5 Troubleshooting