

Preliminary



TrakLITE User Manual
May 1st, 2005

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Contact Information

WirelessWERX Inc.
100 Chaparral Court, Suite 260
Anaheim, CA 92808
U.S.A.

Phone: 714-685-9776
Fax: 714-685-9776

Web site: www.wirelesswerx.com

E-Mail: support@wirelesswerx.com

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1. Introduction

WirelessWERX has released the TrakLITE to meet the demand for an affordable asset management solution. Equipped with a GSM/GPRS modem, the TrakLITE utilizes one of the most adopted cellular network worldwide providing high data speeds at the lowest costs.

The TrakLITE is primarily intended for mounting on a mobile vehicle or cargo, and provides the means for remote positioning and communications on a global scale. The TrakLITE, when requested, can issue commands to a local system or cargo, receive and respond to requests for position and status, issue pre-programmed commands and status messages and log a combination of position, velocity, and status records for subsequent download to a Control Center.

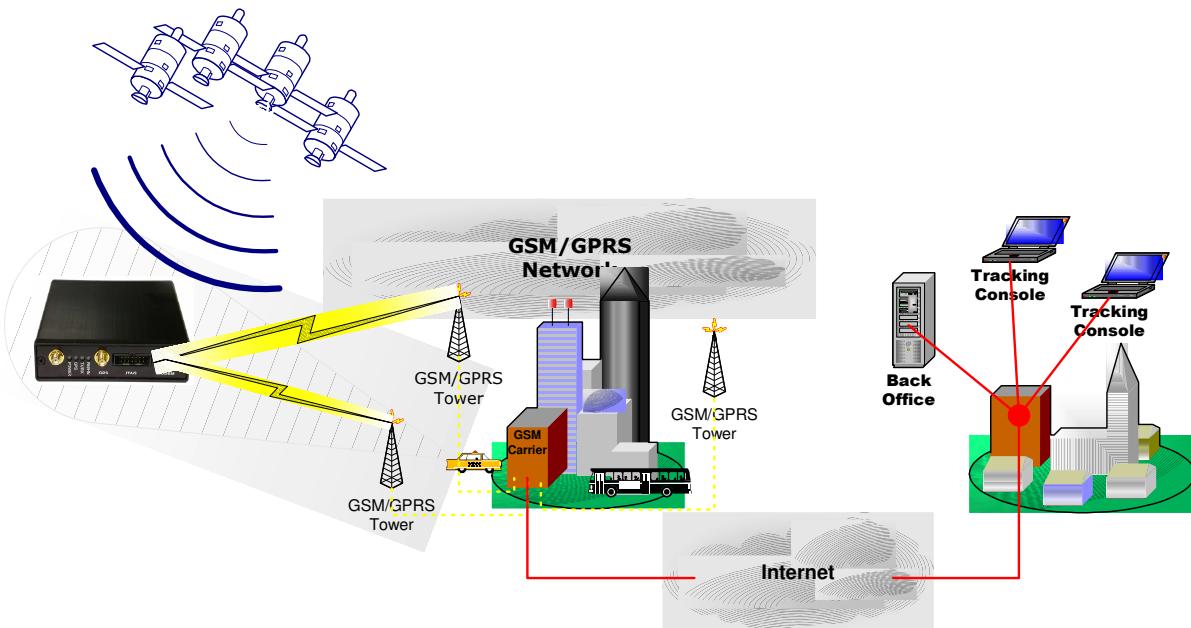


Figure 1: TrakLITE utilizing GPS Satellites and the GSM/GPRS Network

2. TrakLITE Hardware

Careful consideration was placed on the design of the TrakLITE to insure a small and affordable unit without limiting its features. This slimmed-down tracking unit measures only 5.45x4.17x1.12in (138.44x106x28.4mm) and weighs in at 9.6oz (272g), yet has our most extensive feature set to date.



Figure 2: TrakLITE size compared to a pair of reading glasses

2.1. Processor

The TrakLITE utilizes a 32-Bit RISC processor providing overall control and operational logic for the TrakLITE through the management of each of its interfacing modules.

2.2. Power Supply

A fused main power-in source is available with a recommended operating voltage range between 12 and 24 volts

2.3. RAM

The TrakLITE utilizes 32KB of RAM internal to its central processor.

2.4. Flash Memory

The TrakLITE utilizes 256KB of flash memory internal to its central processor and up to 1Mb of external serial flash memory (divided into four memory modules). The serial flash memory modules allow for future memory expansion without introducing hardware redesign.

2.5. GSM Modem

The TrakLITE utilizes a GSM/GPRS modem operating in the 850/1900MHz region for the transmission of data. The interface to this modem is internal to the TrakLITE utilizing one of the central processor's built-in serial ports.

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2.6. GPS Receiver

The TrakLITE utilizes an ultra-low power consuming, fast-acquisition GPS receiver with short-circuit detection and protection capable of positioning accuracy to within a few feet.

2.7. Digital Input Interface

The TrakLITE supports the sensing of eight discreet inputs with an input signal range from 0 to 24 V (typical voltage range). Each input can be individually enabled or disabled and configured as active high or low with a desired amount of debounce.

Note: One of the eight inputs (input 1) is specifically designed for connection to the ignition circuit path of a vehicle.

2.8. Analog Input Interface

The TrakLITE supports the sensing of one analog input with an input signal range from 0 to 15 V when operating on a 12 V power source and 0 to 30 V when operating on a 24 V power source.

2.9. Digital Output Interface

The TrakLITE supports four discrete outputs for the purposes of controlling external peripherals. Each output is fused and capable of providing 1/2 Amp maximum per channel. However, if more than one output channel is utilized the sum total of all used output channels cannot exceed 1 Amp. With this consideration, we specify that each channel should be capable of driving 150mA each w/all channels utilized. Each output can be configured to startup in a desired state and be set high or low utilizing an over-the-air command.

One of the four outputs can be specifically designated to provide visual feedback to the customer in the case of certain emergency events such as medical or roadside assistance events. When an acknowledgeable event occurs, the LED output will turn on notifying the vehicle operator that an emergency message has been sent out. When the emergency message is received and acknowledged at a response center, a command is sent back to the TrakLITE that will "blink" the LED output for 30 seconds from an on state to off. The blinking LED on the emergency panel is the customer's assurance that the message was received and that help is on the way.

2.10. Peripheral Device Support

2.10.1. Bluetooth

The TrakLITE is available with an internal Class II Bluetooth module (Bluetooth v1.1 compliant). The TrakLITE's Bluetooth module's metal-can shielding and radio front-end filtering provides effective immunity to close proximity radio noise.

2.10.2. Serial Ports

The TrakLITE supports one 9-pin RS232 serial port for the purpose of interacting with and controlling peripheral devices. A second 4-pin RS232 serial interface consisting of data in/out and 2 flow-control lines is made available through the interface connector.

2.11. Data Logging

The TrakLITE supports three data-logging components utilizing its on-board serial flash storage devices.

2.11.1. Priority Event Log

Up to 512 priority events are stored in the priority event log when the TrakLITE cannot transmit data due to a lack of coverage via the principal communication medium. When the TrakLITE determines that the communication link has been re-established, all packets stored in the priority event log are sequentially transmitted at a maximum rate of five packets/second.

2.11.2. Standard Event Log

Up to 1024 position reports and non-priority events are stored in the standard event log when the TrakLITE cannot transmit data due to a lack of coverage via the principal communication medium. When the TrakLITE determines that the communication link has been re-established and the priority event log is empty, all packets stored in the standard event log are sequentially transmitted at a maximum rate of five packets/second.

2.11.3. Short-Range Radio Log

Up to 1024 position reports and events can be configured to be stored in the short-range radio log. Position reports and events stored in the short-range radio log will not be transmitted over the cellular communication link, but instead will be retained in memory until the unit returns to its hub for downloading either over the Bluetooth radio or one of the TrakLITE's two communication ports.

3. TrakLITE Firmware

The TrakLITE is an intelligent device under the control of a 32-bit RISC processor. This processor, interfaced to a variety of circuits including Flash, UART's, a modem, IO and a GPS receiver, can provide a wide range of features centered on the current GPS location generated by the GPS receiver.

3.1. Physical Events

Physical events trigger the sending of a message over the air when certain IO conditions are met. Each physical event can be flagged as a priority event as well as configured to assert from one to all outputs when activated.

3.1.1. Digital Input Interface

The TrakLITE supports the sensing of eight digital inputs. The TrakLITE can be configured to generate a standard or priority event message when each digital input becomes active, inactive or both. The event message includes latitude, longitude, speed, direction, time, the state of its eight inputs, running odometer value and the event source and reason.

3.1.2. Analog Input Interface

The TrakLITE supports the sensing of one analog input. The TrakLITE can be configured to generate an event message when the analog input falls within one or more specified ranges of values. The event message includes latitude, longitude, speed, direction, time, the state of its eight inputs, running odometer value and the event source and reason.

3.2. Logical Events

Logical events trigger the sending of a message over the air when certain conditions are met. Most events are based on rules using a combination of the GPS position and one other factor such as time or speed. Each logical event can be flagged as a priority event as well as configured to assert from one to all outputs when activated.

3.2.1. Timed Reporting

The TrakLITE can be configured (either locally, utilizing a serial cable or over-the-air) to report its last known location on a user-defined interval in seconds. This location status includes latitude, longitude, speed, direction, time and the state of its eight inputs. The reporting interval can set to a range from 0 (no report) to 65535 seconds.

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3.2.2. Smart Timed Reporting

The TrakLITE can be configured (either locally utilizing a serial cable or over-the-air) to report its last known location on a user-defined interval in seconds. This location status includes latitude, longitude, speed, direction, time and the state of its eight inputs. The reporting interval can be set to a range from 0 (no report) to 65535 seconds.

Smart timed reporting has an additional qualification before transmitting the report. If the unit has not physically displaced by the user-defined number of meters since the last transmitted report, the current report will not be transmitted. This distance parameter is included in the configuration step. The smart timed reporting feature is important for customer's interested in reducing transmission costs; if the vehicle has not moved since the last report, do not transmit the same location report.

3.2.3. Schedule Reporting

The TrakLITE can be configured (over-the-air) to transmit location status messages on a 7-day/24-hour scheduled basis. The configuration command consists of a GPS start date and a 168-bit pattern (each bit represents one hour in the 7-day period). This location status includes latitude, longitude, speed, direction, time, the state of its eight inputs, running odometer value and the event source and reason.

3.2.4. Speeding

The TrakLITE can be configured (either locally utilizing a serial cable or over-the-air) with an excess speed threshold and time filter. When the unit exceeds the speed threshold for the configured time filter, an event message is transmitted indicating this occurrence. When the transponder crosses back below the speed threshold for the configured time filter, another event message is transmitted indicating this occurrence as well as a third message indicating the maximum velocity reached during the period when the transponder was above the speed threshold. The event message includes latitude, longitude, speed, direction, time, the state of its eight inputs, running odometer value and the event source and reason.

3.2.5. Excessive Idle Time

The TrakLITE can be configured (over-the-air) with excessive idle time thresholds. When the TrakLITE does not move more than the specified number of meters in the specified number of seconds with the ignition on, an event message is transmitted that the unit has exceeded its allowable idle time. The event message includes latitude, longitude, speed, direction, time, the state of its eight inputs, running odometer value and the event source and reason.

3.2.6. Error Detection

The TrakLITE will transmit an error message if an internal error is detected. Examples of internal errors may include an abnormal reset of the unit or a corruption at a specific memory address. The error message will include the type of error detected and any additional data that may be available to help rectify any issues.

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3.2.7. Address Registration

The TrakLITE supports dynamic IPs. Each time the TrakLITE establishes a data connection, its assigned IP address is compared to its last address. If its IP address has changed, the TrakLITE will transmit its unique ID and new IP Address.

3.3. Geofencing

Geofencing events trigger the sending of a message over-the-air when pre-defined boundaries loaded in the TrakLITE's flash memory are either entered and or exited. Individual geofences loaded on a TrakLITE can be flagged as a "no-fly" boundary as well as configured to assert from one to all outputs when entered and or exited.

3.3.1. Zones

Zones are irregular regions defined by a series of line segments enclosing an area. Each zone can have up to 252 deflection points for creating the line segments defining this irregular area. The TrakLITE can store up to 128 zones. If the transponder enters or exits a zone, a message is transmitted indicating what zone was entered or exited as well as the latitude, longitude, speed, direction, time, the state of its eight inputs, and running odometer value.

3.3.2. Waypoints (Reference Points)

Waypoints are circular areas defined by a point and radius. The TrakLITE can store up to 2048 waypoints. If the unit enters or exits a waypoint, a message is transmitted indicating what waypoint was entered or exited as well as the latitude, longitude, speed, direction, time, the state of its eight inputs, and running odometer value.

3.4. Commands

The TrakLITE is designed to respond to various query and set commands sent to it over GSM/GPRS cellular network.

3.4.1. Position Query

Upon receiving this query, the TrakLITE will return the last valid GPS position, speed, direction, time and input state.

3.4.2. Odometer Set/Query

This command is sent to the TrakLITE to configure or query the units running odometer value. Upon receiving this query command, the TrakLITE will return its latitude, longitude, speed, direction, time, the state of its eight inputs and running odometer value.

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3.4.3. IO Query

Upon receiving this query command, the TrakLITE will return the last updated state of its 8 inputs and 6 outputs (active/inactive). For any given input, the active state is relative to that inputs configuration. For instance, if an input is configured to be active-low (H-L), then 0 volts at the input translates into that input being "active". If the input is configured to be active high (L-H), then 12/24 volts at the input translates into that input being "active".

3.4.4. Analog Voltage Level Query

This command is sent to TrakLITE to query the main power, backup power and analog input(s) voltage levels.

3.4.5. Set A Single Output

This command is sent to the TrakLITE to set one individual output either high or low.

3.4.6. Text Message

This command used for sending Text Messages to a TrakLITE equipped with either a PDA or MDT for exchanging messages with an operator using the Client Console.

3.4.7. Alarm Acknowledge

This command is sent to the TrakLITE to terminate the sending of an emergency event (panic, roadside, medical). When the alarm acknowledge is received, no further emergency messages for the current event are transmitted.

3.4.8. Passenger Count Set/Query

This command is sent to TrakLITE units equipped with a passenger counter to configure or query the running passenger count values. Upon receiving this query command, the TrakLITE will return its running passenger counts the last valid latitude, longitude, speed, direction, time, running odometer value, the state of the IRMA sensors and the state of its eight inputs.

3.4.9. Timed Reporting Configuration

This command is sent to the TrakLITE to configure or query the reporting interval for the Timed Reporting feature of the firmware.

3.4.10. Smart Timed Reporting Configuration

This command is sent to the TrakLITE to configure or query the reporting interval and distance parameter for the Smart Timed Reporting feature of the firmware.

3.4.11. Scheduled Reporting Configuration

This command is sent to the TrakLITE to configure or query the schedule for the Scheduled Reporting feature of the firmware.

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3.4.12. Excess Speed Configuration

This command is sent to the TrakLITE to configure or query the maximum speed and time threshold of the excess speed feature of the firmware.

3.4.13. Excess Idle Configuration

This command is sent to the TrakLITE to configure or query the maximum idle time and allowed displacement of the excessive idle feature of the firmware.

3.4.14. GPS Filter Configuration

This command is sent to the TrakLITE to configure or query the GPS filtering parameters of the firmware.

3.4.15. Power Level Critical Configuration

This command is sent to the TrakLITE to configure or query the minimum power level before cutting off use of main power and depending on backup power only.

3.4.16. Firmware Version Query

This command is sent to the TrakLITE to query its firmware version number as well as its hardware configuration.

3.4.17. Upload New Firmware

This command is sent to the TrakLITE to initiate the uploading of new firmware over the cellular network.

3.4.18. Input Enable Configuration

This command is sent to the TrakLITE to configure or query which of its eight inputs are enabled and/or disabled.

3.4.19. Event Enable Configuration

This command is sent to the TrakLITE to configure or query which of its events are enabled and/or disabled.

3.4.20. Priority Event Configuration

This command is sent to the TrakLITE to configure or query which of its events are priority events.

3.4.21. Cellular Message Configuration

This command is sent to the TrakLITE to configure or query which of its enabled events are to transmit an event message via its cellular modem.

3.4.22. Short-Range Radio Message Configuration

This command is sent to the TrakLITE to configure or query which of its enabled events are to save a message for later transmission via its optional Bluetooth radio.

3.4.23. Assert Output 1, 2, 3 & 4 Configuration

These commands are sent to the TrakLITE to configure or query which of its enabled events are to assert output 1, 2, 3 and/or 4.

4. TrakLITE Configuration

The TrakLITE is shipped pre-tested and configured with factory defaults, but will most likely require additional configuration before being installed. The configuration of the TrakLITE is achieved using ConfigLITE, a Windows 2000/Windows XP application designed and developed by WirelessWERX, Inc.

ConfigLITE interfaces with the TrakLITE via COM 1 using a null-modem cable. The configuration process begins by launching the ConfigLITE application and then powering on the TrakLITE. ConfigLITE will read and display the current configuration of the TrakLITE when powered on, enabling modifications to be made from there.

4.1. Modem Configuration Tab

The 'Modem Configuration' tab is used for configuring the TrakLITE's modem, the GSM/GPRS and SIM card connection parameters and the destination of data transmitted over the GSM/GPRS network.

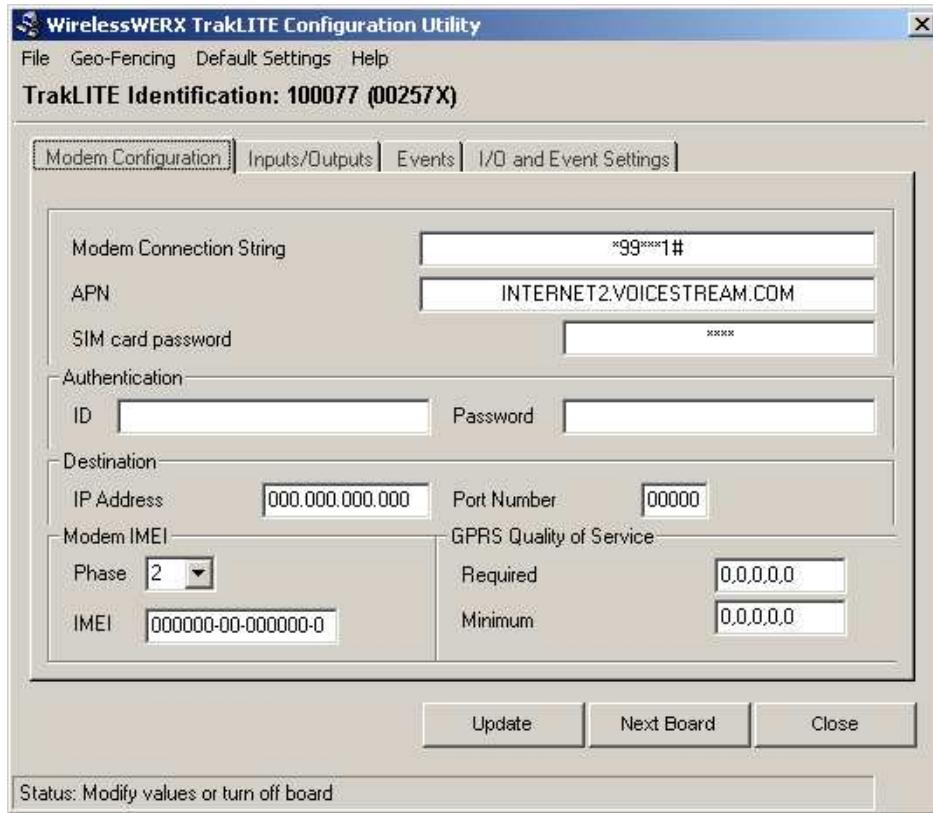


Figure 3: ConfigLITE Modem Configuration Tab

4.2. Inputs/Outputs Tab

The 'Inputs/Outputs' tab is used for configuring the TrakLITE's eight inputs and 4 outputs.

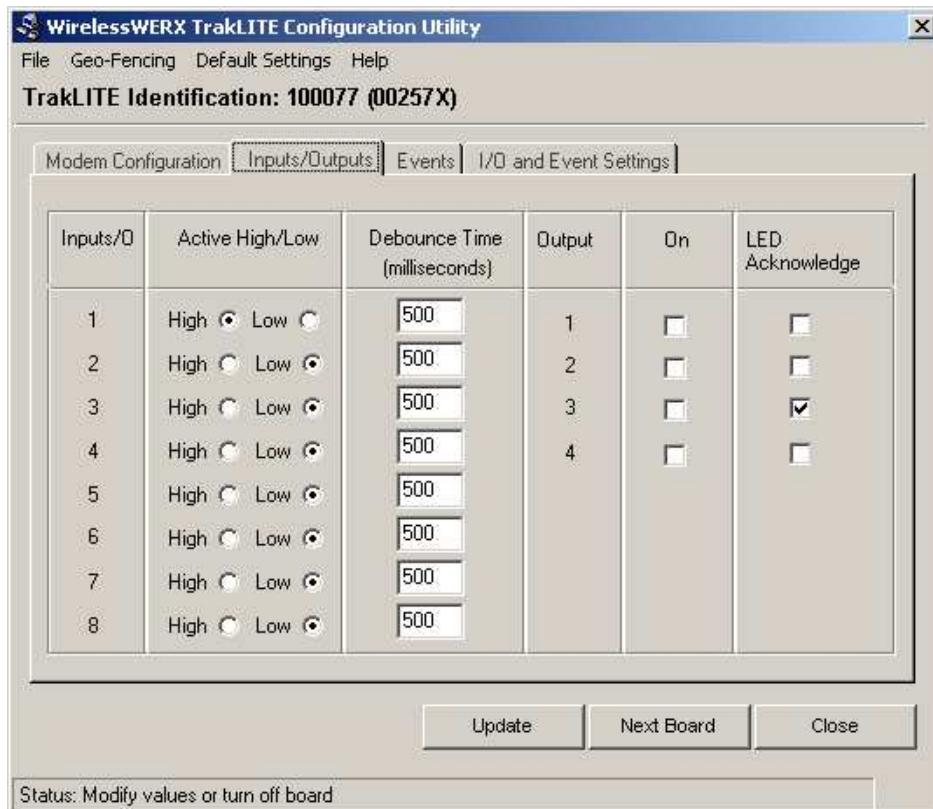


Figure 4: ConfigLITE Inputs/Outputs Tab

4.3. Events Tab

The 'Events' tab is used for configuring the most common TrakLITE events as well as enabling any desired GPS filtering.

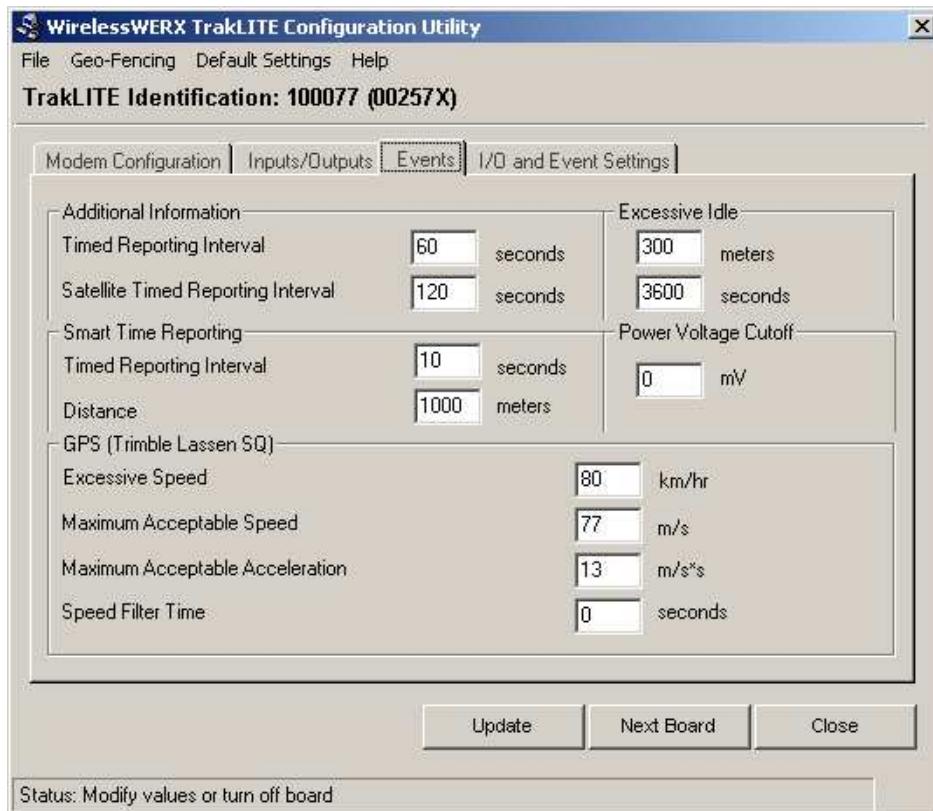


Figure 5: ConfigLITE Events Tab

4.4. IO and Event Settings Tab

The 'IO and Event Settings' tab is used for enabling the TrakLITE inputs and events, setting priority inputs and events, automatically asserting outputs and enabling cellular messages.

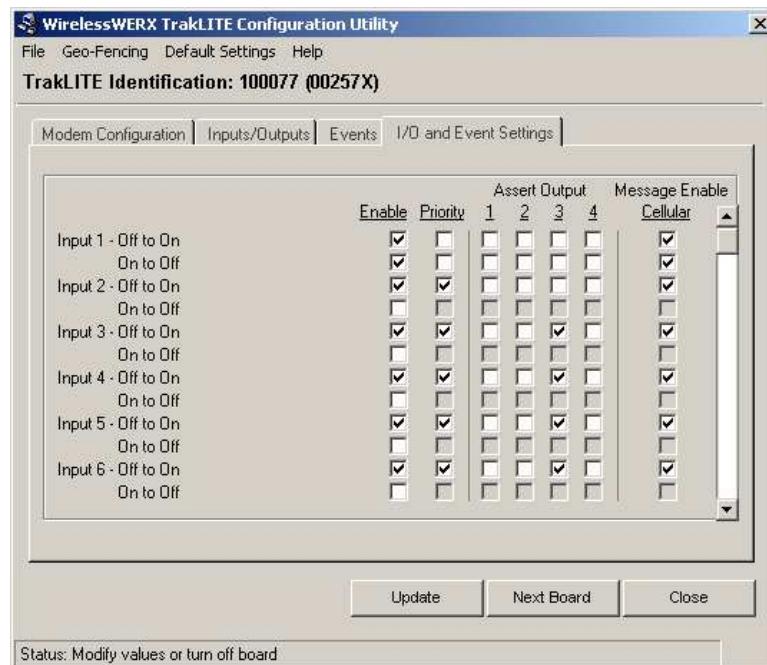


Figure 6: ConfigLITE - Sample of configuring TrakLITE inputs

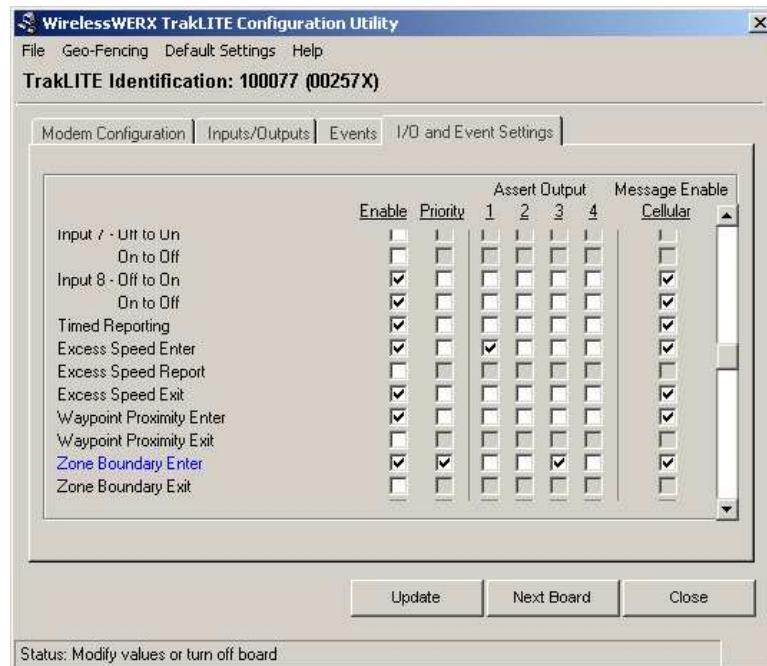


Figure 7: ConfigLITE - Sample of configuring TrakLITE events

5. TrakLITE Installation and Operation

The radio(s) contained in the TrakLITE meets all the applicable FCC requirements for RF Safety. While in operation, the FCC requires users and nearby persons to maintain a minimum separation distance of 20 cm (8 inches) or further from the TrakLITE. Any changes or modifications not expressly approved by WirelessWERX could void the authority to operate this equipment.



Figure 8: TrakLITE Front Side



Figure 9: TrakLITE Back Side

5.1. Wiring Harness

The power, inputs, outputs and a second communications port of the TrakLITE is accessible via its 20-pin connector found on the front side of the unit.

Pin No.	Name	Color	Description
1	PWR	RED	Power (12 or 24 volts)
2	GND	BLACK	Ground
3	OUT 1	BLUE	Output 1
4	OUT 2	YELLOW	Output 2
5	OUT 3	GREEN	Output 3
6	OUT 4	BROWN	Output 4
7	IN 1	WHITE/BLACK	Input 1 (Ignition)
8	IN 2	WHITE/BLUE	Input 2
9	IN 3	WHITE/YELLOW	Input 3
10	IN 4	WHITE/GREEN	Input 4
11	IN 5	WHITE/BROWN	Input 5
12	IN 6	WHITE/GREY	Input 6
13	IN 7	WHITE/PURPLE	Input 7

Pin No.	Name	Color	Description
14	IN 8	WHITE/ORANGE	Input 8
15	COM2RTS	GREY	COM2 Ready To Send
16	COM2CTS	WHITE	COM2 CTS
17	COM2TX	PURPLE	COM2 Transmit
18	COM2RX	ORANGE	COM2 Receive
19	An-In	WHITE/RED	Analog Input
20	B/U Batt	GREEN/YELLOW	Backup Battery

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5.2. Communications Port 1 (COM 1)

The communications port #1 (COM 1) is a 9-pin RS232 serial port found on the front side of the unit. COM 1 is intended to be used for the interaction with and controlling of peripheral devices.

5.3. Cellular Antenna

Connect the GSM cellular antenna to the female SMA connector labeled MODEM found on the backside of the unit.

5.3.1. Recommended Cellular Antenna

Manufacturer: Radiall/Larsen
Part Number: MMC/P3ESMA
Description: 3" Magnetic Mount/Whip
Antenna Gain: 3 dB
Frequency: 825-896/850-1990Mhz

5.4. GPS Antenna

Connect the GPS antenna to the female SMA connector labeled GPS found on the backside of the unit.

5.4.1. Recommended GPS Antenna

Manufacturer: Laipac
Part Number: P1-SMA 3V
Description: Magnetic Mount
Antenna Gain: 4 dBic
Frequency: 1575.42 ± 3 Mhz

5.5. Bluetooth Antenna

Connect the Bluetooth antenna to the reverse polarity SMA connector labeled BT found on the backside of the unit.

5.5.1. Required Bluetooth Antenna

Manufacturer: Radiall/Larsen
Part Number: MS3E2400SMA
Description: 2" Magnetic Mount/Whip
Antenna Gain: 3 dB
Frequency: 2.4-2.5 GHz

Note: A Bluetooth antenna of the same type with a lower gain is also permissible

5.6. JTAG (Programming Port)

The JTAG programming port is used for the initial programming of the TrakLITE firmware. All subsequent firmware updates can be achieved either using COM 1, the Bluetooth radio or over the cellular network.

5.7. LED Indicators

The TrakLITE utilizes four LED's found on the backside of the unit to give a visual indication of the state of its power, and its GPS and cellular connections.

5.7.1. Power LED

- Off: TrakLITE is powered off
- Solid Red: TrakLITE is powered on

5.7.2. GPS LED

- Fast Green Blink: Acquiring a GPS fix
- Slow Green Blink (once a second): A GPS Fix has been acquired

5.7.3. TX/RX (Transmit/Receive) LED

- Single Red Blink: Cellular transmission sent
- Single Green Blink: Cellular transmission received

5.7.4. RM/HM (Roam/Home) LED

A **RED** light sequences indicates that the TrakLITE is roaming while a **GREEN** sequence indicates that the unit is on its home cellular network.

- Fast Blink: Attempting cellular network registration
- Slow Blink (once a second): Registered on cellular network, data connection not established
- Solid: Data connection established