Laird™

Smart Technology. Delivered.

Device User Manual

LT-300

May 18, 2015

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1. Introduction

1.1 Scope

This document describes the general operation and features provided of the Laird LT-300 device. Laird LT-300 fleet tracking& management device is a completely stand-along product that contains: control circuitry, microcontroller, cellular modem, GPS receiver, cellular antenna, GPS antenna, accelerometer, discrete I/O, back-up battery, and firmware all assembled into a compact plastic enclosure. The LT-300 is GSM/CDMA based reliable solutions for vehicle tracking, asset monitoring, and fleet management markets.

1.2 Audience

This document is intended for Laird's customer or backend integrator whom used Laird's LT-300 as part of the solution.

1.3 Reference

The following document contains additional information which clarifies or further describes the Laird STEL Protocol used by LT-300 device:

Table 1-1: Reference Document

Number	Document	Version	Date
1	Laird Base64 STEL Protocol	2.0.10	April 22, 2015

1.4 Applicable Products

Table 1-2: Applicable Products

Product Number	Product Detail
63618	CDMA version
63616	2G GSM version
63622	3G GSM version
63624	Brazil 2G GSM version
SP 4202	Customer version
TBD	Other customer version

2. Quick Start

2.1 Connecting the LT-300

The device operates in 6 V-32 V range and protects against over-voltage surges. For 2- wire or virtual ignition detection, the LT-300 device will detect ignition using an internal algorithm.

2.2 Connector Pinouts

The LT-300 device has 2 micro-fit connectors, an 8- pin connector for power connection and I/Os, and a 12- pin connector gives extended I/O support. The LT-300 also has 2 LEDs; the blue LED indicates the status of cellular connection, while the green LED indicates the status of GPS fix.

Table 2-1: 8-Pin Connector Pin Number with Names

Pin Number	Name
1	Digital Output 1
2	Digital Output 2
3	Analog Input 1
4	Ground
5	Ignition
6	Serial Port RX
7	Serial Port TX
8	Power

Figure 2-1: 8-Pin Connector Pin-out

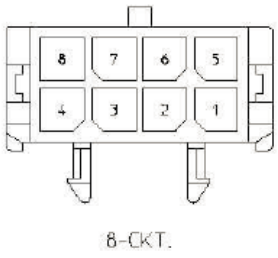
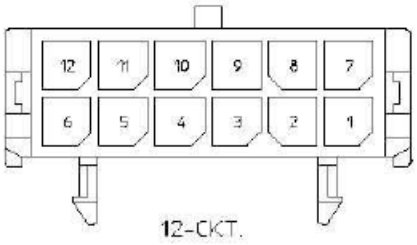


Table 2-2: 12-Pin Connector Pin Number with Names

Pin Number	Name
1	Analog Input 3
2	Ground
3	Digital Input 2
4	Digital Output 4
5	Ground
6	Mic
7	Analog Input 2
8	Digital Input 1
9	Digital Input 3
10	Digital Output 3
11	Speaker
12	Ground

Figure 2-2: 8-Pin Connector Pin-out

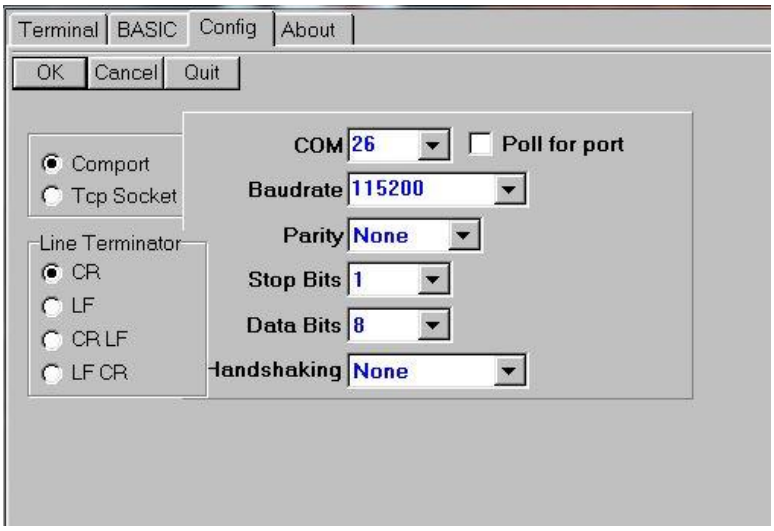


2.3 Serial Communication

The LT-300 allows serial communication for data passing through and debug purpose via a serial to USB connection.

For debug purpose, the user can use any terminal program to set up the communication with bellowing settings:

Figure 2-3: Terminal settings



Once the terminal is configured successfully, it will display the device debug prints. Communicate with the device using serial or STEL commands.

The serial command will be in lowercase only, while using the STEL in debug mode should include a "." (dot) in front of every command.

Example:

diag

.DIAG

3. Device General Operation

The LT-300 device's normal operation begins after installation at a qualified service center. Once installed in a vehicle the device is ready for operation as defined below:

- Send location and event reports using the STEL communication protocol. The STEL protocol is defined in the STEL interface document.

- Communication with the backend server via an IP message (UDP/TCP) or an SMS text message. These messages will only be accepted from approved addresses/phone numbers loaded into configuration file.

- The device expects an acknowledgement for every message it transmits to the server. If the acknowledgement is not received by the device then device will resend the same message after a predefined timeout period until it successfully receives an acknowledgement from the server.

- When cellular coverage is not available then the device will store reports/events internally. When the cellular coverage is available again, the device will send the saved reports/Events.

- For messages that have customer configurable variables (i.e. max speed) that are numbers, the device will store maximum and minimum values. The device will have the ability to check if the customer inputted variable fits within the maximum and minimum values and reject messages with outliers. If the variable is a text string (i.e. an IP address) the device will not be able to do any validation.

- In the cases where a variable is user configurable, the goal is to limit the device to two or three pre-defined values. For example, if the variable is stationary time (time vehicle is static prior to a park message being sent), the presets could be 30 minutes, 60 minutes and 120 minutes.

- The device will acknowledge every command it receives from the server.

- The device will respond to a request for location with a location report.

- The device will allow the server to update/change configurations.

- The device will send a daily Heartbeat location report. The heartbeat frequency will be once every 25 hours (by default) and will include latitude, longitude, date, time and device ID, the heartbeat frequency can be configurable by customers among a choice of presets.

- The device will send a Parking alert event when the vehicle has been stationary for more than one hour which will include the device location. The parking alert should be able to toggle on and off, and the "stationary time" prior to alert should be configurable among a choice of presets.

- The device will support Circular and Polygon Geofences.
    - The server administrator can add/modify/delete any Geofence
    - The device will check for Geofence events every 1 minute. The device will send a Geofence alert every time the vehicle transitions from inside to outside of the fence or vice versa.

- When the Ignition is Off:
    - When the Ignition is OFF the device shifts to low current draw / low power mode.
    - GPS is on all the time. To optimize the power in battery mode or low current draw mode, the GPS can be put in sleep mode in ignition off mode and periodically wake up to sync the almanac. With GPS on all the time, device supports location feedback within 20 seconds of wake up.
    - Support over the air updates.

- The server will acknowledge all the valid messages that are received from the device in the following syntax:

  ACK <sequence number>

  Sequence number the sequence number of the data received being acknowledge

3.1 Command Summary

The format and syntax of all commands and responses are identical whether they are sent or received using SMS or UDP.

The STEL protocol is used to communicate and interface with Laird cellular-GPS tracking and fleet management devices. The following rules apply to all remote commands:

1. All commands are in ASCII-text form and do not need a special termination character for the command string.
2. Commands to be issued in **UPPERCASE** only (commands given in lowercase will be ignored/no answer)
3. When commands are sent from the server to the device, the device will ACK/NACK received commands.
4. Valid commands will be acknowledged by server. An ACK message is received in the form: <ESN>,ACK,<command text>
5. Invalid commands will not be acknowledged. A negative Acknowledge is received in the form: <ESN>,NACK,<command text>
6. The general command (CMD) format is:
7. CMD<space><optional parameters separated by Comma>; (semicolon termination optional)
8. Commands can come via three modes: (Serial, SMS or Server). The ACK shall use the same communication mode (Serial, SMS, Server) as the original message.

Table 3-1: Command Summary

Number	Command	Comment
1	DIAG*	Retrieve Diagnostic
2	SDIAG SMS	Diagnostic Info over SMS
3	SHOWALL*	Retrieve current settings
4	SET	Modify configuration variables that are part of second configuration set which resides on EEPROM
5	CFENCEADD	Add a circular geo- fence
6	PFENCEADD	Add a polygon geo-fence
7	FENCEDEL	Delete geo-fence

8	FENCEDELALL	Delete all geo-fences
9	FENCELSTALL*	List all geo-fences
10	BUZZWARN	Trigger Relay Driver
11	STARTERDIS	Disable the engine starter is toggled ON
12	STARTERENA	Disables the engine starter is toggled OFF
13	REPOENA	Repo mode is toggled ON
14	REPODIS	Repo mode is toggled OFF
15	LOCATE	Returns the current location of a device
16	ACK	ACK with a parameter that has sequence number of previous message.
17	UPDATE	OTA firmware update to a new version
18	GETIOSTATUS*	Returns the current status of IO
19	EMERGENCYENA	Enables Emergency Starter Override.
20	CARALARMENA	Sets INP3 to detect car alarms
21	CARALARMDIS	Resets INP3 to normal behavior
22	MODO	Set the Odometer
23	PRINT	Print the data on the UART interface

DIAG

To retrieve the current device status (Software Version, Bootloader Version, Hardware version, ICCID, IMEI , APN, GSM signal Strength, network registration information, Car battery voltage, Ignition voltage, Backup battery voltage, firmware version, ESN, Engine immobilization state, Logged packets information, latest location information):

Sample DIAG response is as shown below.

DIAG\r\n

ESN:<ESN number>, SW:<version>,HW:<version>,BL:<version> \r\n

IMEI:<number>, ISDN:<number>, APN:<string>\r\n

CSIG:<number>, CREG:<status> , IP:<ip address>\r\n

ASrv: <Server IP, port>\r\n

IOStatus:<io status>, Vbat:<vehicle voltage>, Vign:<ignition voltage>, Vana:<analog input 1 voltage>\r\n

Vana2:<analog input 2 voltage>, Vana3:<analog input 3 voltage>, Vintbat:<internal battery voltage>,Temp<board temperature>,Vintbat chgrg:<internal battery charging state>,PM:<>\r\n

Afix:<status>, dop:<number>, lat:<float>, long:<float>\r\n

Uptime:<number>, Repo:<repomode>, LatePayment:<mode>, StarterDis:<status>, FPkts:<Number Buffered packets>, SPkts:<Number of sent packets>\r\n

The complex message carries the following information.

Device related info:

ESN: Device unique serial number. This is used to identify and to address a device.

SW: Device Software Version currently installed

HW: Device Hardware Version

BL: Device Boot-Loader Version Number

Asrv: Server IP address, port number

IOSTATUS: Status of the GPIO's represented in 2 digit hexadecimal value. Each bit represents the state of a specific I/O as follows

Bit8 = <IGN STATE>
Bit7 = <INP1>
Bit6 = <INP2>
Bit5 = <INP3>
Bit4 = <OUT1>
Bit3 = <OUT2>
Bit2 = <OUT3>
Bit1 = <OUT4>
If bit value is 0 = Low
If bit value is 1 = High

Vbat*:* Supply Voltage (Car Battery)

Vana: Supply Voltage of Main Processor

Vign: State of Ignition Signal on Ignition (Pin7 on the connector): 0 Volt is OFF; 12 Volt is ON

Uptime: number of seconds from last device reboots

FPkts: Number of Packets in flash waiting to be sent

SPkts: Number of sent packets

IPaddr: Device's IP address

ASrv: Destination Server IP address and port

Repo: Repo Mode status. 1 if Repo mode is enabled, 0 if the Repo mode is disabled

LatePayment: Late payment mode. 0 if late payment is enabled and 0 if it is disabled

StarterDis: Starter disabled status. It is reported as 2-digit hexadecimal string. It is a bitwise field.

Here is the how the bitwise definition of this status:

Bit0 (lsb): Starter-disable Flag. 1- If Starter is disabled, 0- if Starter is enabled
Bit 1: Emergency enable override status. 1- Emergency enabled is activated, 0 – Emergency enable is deactivated
Bit 2: Manual Starter Override status. 1- MSO is activated, 0- MSO is deactivated
Bit 7-3: Override hours count. Number of hours override (either MSO or emergency) remaining

Modem related info:

IMEI: IMEI number of the modem

ISDN: Phone number of the activated CDMA modem

IP: IP address of the cell modem

ICCID: (integrated circuit card identifier). Sim Card Serial number printed on Sim Card. For CDMA this is not reported.

APN: (Access Point Name). Provider specific name of an internet service access point for GPRS

CSIG: Signal strength (0-31) converted into a dBm value. Range: (-113 dBm (0) to -53 dBm (31)). Invalid if signal strength is 85.

CGREG: GPRS registration status (Internet). Not applicable to CDMA.

Registration State Values:

0= not registered, modem is not looking for a network
1= registered to home-network; provider's home-network
2= not registered, modem is currently trying to find a network to logon to
3= registration denied; Sim Card is not allowed to register on this network
4= unknown
5= registered at foreign network (roaming)

CREG: GSM Registration Status. GSM registration status will use the same codes as above.

GPS Receiver related info:

Afix: Fix type

dop: Dilution of Precision

Value: 1=ideal, 2=excellent, 3-5=good, 6-10=moderate, 10-20=fair, >20=poor. GPS DOP will depend on current satellite positions and number of satellites.

A larger value indicates the higher inaccuracy of a location calculation. Ideal value is 1.

Reset Commands

RESET

Reboot the device

RESET G

Restart the GPS receiver

RESET E

Factory reset, all the configurations (like SET parameter configuration, Geo-Fence configurations) and Odometer counters are stored in device non-volatile memory called EEPROM. Upon receiving the "RESET E" command the device erase all non-volatile configurations

Note: It is recommended to reset the unit using "RESET" command after performing a "RESET E".

RESET C

Restart the cellular modem

RESET H

Clear all the logged/stored event messages

SET

The system has a set of configurable parameters that are defined in Table 8- SET Configuration Parameters. The device is shipped with factory default set of parameters as shown in the SET configuration table. These configurations can be changed using SET command. “RESET E” command will restore all set configuration parameters to factory default values.

Command:

SET Parameter=<value>

Example:

Use the following command to set APN, which is Access Point Name to m2m.tmobile.com

SET APN=m2m.t-mobile.com

It is possible to set multiple parameters in one command string, but the total string must not exceed 126 characters.

Command:

SET parameter1=value1, parameter2=value2……..parameter-n=value-n;

Examples:

SET PMN=10,PMF=60;

SET IPD=’xxx.xxx.xxx.xxx’,PMF=20,PMN=10,IPU=’xxx.xxx.xxx.xxx’;

Parameters are separated by “,” (comma) and the whole string is terminated by a “;”(semicolon), parameters have string for the value will start and terminate by single colon.

LOCATE

The following command will return the current location of a device as a comma-separated variable ASCII string.

Command:

LOCATE [SMS [number]]

Channel: response channel via SMS

Number: phone number the response is send to

If no parameter/channel is given, then the module uses the configurable default method (DDC). Also, there are configurable default values for the default SMS phone.

Example:

“LOCATE” send LOCATE event to UDP or SMS based on DDC configuration

“LOCATE SMS” will send LOCATE event via SMS to a default phone number specified in (PHN)

“LOCATE SMS, 2345556789” Will send SMS to phone number 2345556789

3.2 Periodic Report

The LT-300 device can be configured reporting in a time based interval for vehicle ignition on or off. The content of periodic message can be configured by STEL settings.

Example:

SET PMF=6 (set the periodic message during ignition OFF state to every 60 seconds)

SET PMN=3 (set periodic message during ignition ON state to every 30 seconds)

3.3 Event Report

The LT-300 device can be configured to send reports triggered by events in addition to the periodic report. The individual event reporting can be enabled or disabled by STEL settings. Please reference the Laird STEL Protocol Specification for each event type and enable.

Example:

SET EES=PNAIG

Default EES=PNVAESIGX

4. Device Features

4.1 Geo-Fence

The LT-300 device will support up to 5 circular fences and 5 polygonal fences, Circular fences are represented with radius and center location. Polygonal fences are represented with vertices. The maximum vertex supported by LT-300 is 10. Entering or leaving a user geo-fence causes an event or alert that can be transmitted. Whenever device enters or leaves a “Geo-fence”, the device reports GEOFENCE_ENTRY or GEOFENCE_EXIT, depending on which direction the fence is crossed.

The device also supports one additional circular fence called “System Fence” that is used for Towing events. System fence will be set automatically when the vehicle is in parking state and disabled after the vehicle’s ignition has been detected.

Add Circular Fences

Command: CFENCEADD <ID>,<Delay>,<EVENTS>,<CENTER>,<RADIUS>

ID: Fence Identifier (0 to 65535)

DELEAY: Time (in seconds) that a vehicle has to be inside or outside of a fence for an event to be triggered

EVENTS: Send events on entry and/or exit from fence

1 - Event on entry

2 - Event on exit

3 – Event on both entry and exit

CENTER: fence center position Latitude and longitude in degree (float)

RADIUS: Radius of circular geo-fence in 10meters units

Example:

To add a circular fence at 42.34676,-83.94323 and 1Km radius

CFENCEADD 1001,5,3,42.34676,-83.94323,100

Add Polygon Fence

Command: PFENCEADD <ID>,<DELAY>,<EVENTS>,<NUM_VERTICES>,<Vertex1>,<Vertex2>, ….<VertexN>,

Required fields are:

ID: Fence Identifier (0 to 65535). Note that circular fence id and polygon fence id should not be the same

DELEAY: Time (in seconds) that a vehicle has to be inside or outside of a fence for an event to be triggered

EVENTS: Send events on entry and/or exit from fence

1 - Event on entry

2 - Event on exit

3 – Event on both entry and exit

NUM_VERTICES: Number of vertices of the polygon. A minimum of 3 and a maximum of 10 vertices are supported.

VERTEX n: Location of vertex n of polygon. Vertex is a combination of <LAT,LONG> and it the location of vertex n

Example:

To add a polygon fence of 4 vertices

PFENCEADD 1002,5,3,4,42.95466,-83.69831,42.95743,-83.55927,42.87546,-83.56579,42.87345,-83.65334

Delete a User Fence

Command: FENCEDEL <id>

ID: Fence Identified as given with CFENCEADD or PFENCEADD

Delete all user fences

Command: FENCEDELALL

List all user fences

Command: FENCELSTALL

Send all the user fences to the Data server via UDP. Sample response on the UDP data server is as shown below.

ALLFENCES <number of Fences> <Page number>\r\n

[1,<ID>,<TYPE>,<DELAY>,<EVENTS>,<CENTER>,<RADIUS>\r\n

[2,<ID>,<TYPE>,<DELAY>,<EVENTS>,<CENTER>,<RADIUS>\r\n

[3,<ID>,<TYPE>,<DELAY>,<EVENTS>,<CENTER>,<RADIUS>\r\n

[4,<ID>,<TYPE>,<DELAY>,<EVENTS>,<CENTER>,<RADIUS>\r\n

[5,<ID>,<TYPE>,<DELAY>,<EVENTS>,<CENTER>,<RADIUS>\r\n

ALLFENCES <number of Fences> <Page number>\r\n

[6,<ID>,<TYPE>,<DELAY>,<EVENTS>,<NUM_VERTEX>,<VERTEX_1>,..<VERTEX_N>\r\n

[7,<ID>,<TYPE>,<DELAY>,<EVENTS>,<NUM_VERTEX>,<VERTEX_1>,..<VERTEX_N>\r\n

[8,<ID>,<TYPE>,<DELAY>,<EVENTS>,<NUM_VERTEX>,<VERTEX_1>,..<VERTEX_N>\r\n

[9,<ID>,<TYPE>,<DELAY>,<EVENTS>,<NUM_VERTEX>,<VERTEX_1>,..<VERTEX_N>\r\n

[10,<ID>,<TYPE>,<DELAY>,<EVENTS>,<NUM_VERTEX>,<VERTEX_1>,..<VERTEX_N>\r\n

A Center or a Vertex is a location represented as combination of Latitude and Longitude separated by a comma “,”

Table 4-1: User Fences Specification

Field	Size and Units	Min	Max	Description
ID	2bytes	1	65535	Unique ID to the device representing fence ID
TYPE	1byte	1	2	Fence type 1 – Circular 2 - Polygon
DELAY	1 byte, seconds	1	240	Fence Event Entry/Exit delay in seconds
EVENTS	1 byte	1	3	Fence event type 1 – Fence Enter 2 – Fence Exit 3- Both Fence Exit and Fence Enter
Center	Position (lat,long)	N/A	N/A	Center position (Latitude and longitude) of the Circular fence
Radius	Word, units 10m	1	10000	Radius of the Circular Fence
Num_Vertex	1byte,	3	10	Number of vertices of the polygon Example 10 vertices. Minimum 3 Vertices and Maximum 10
Vertex X	Position (lat,long)	N/A	N/A	Latitude and Longitude of Vertex X

4.2 Cellular

4.2.1 SMS

The device is able to send SMS message to both server query and SMS query.

Command:

SDIAGQ SMS [<phone number>]

To retrieve minimal diagnostic information over SMS. Below is the response sample.

<ESN>,SDIAG,<software version>,<APN name>,<active data server IP>,<active data server UDP port>,<Vehicle Battery Voltage>,<CGREG>,<Number of Flash Packets stored>,<Device Uptime in

seconds>,<Cell modem uptime from last modem reset>,<Number of Cell modem resets>, <IPAddress>, <IO status>, GPS status(Valid/Invalid), Afix, DOP, Lat, Long

LOCATE SMS [number]

To retrieve locate information over SMS.

Note: the LCOATE response is sending in binary format, the response needs to be decoded to get the information.

4.3 General Purpose Input/ Output

The device has 4 digital outputs, 3 analog inputs, and 3 digital inputs. The bellowing command will check the IO status of all the digital and analog inputs. It also reports the current state of the digital outputs.

Command:

GETIOSTATUS

Response: <ESN>,IOSTATUS,<IOSTATUS>,<ADC1>,<ADC2>,<ADC3>

4.3.1 Relay/Starter Enable and Disable

The device will support the disabling of the vehicle engine starter for recovery purposes and also provide the capability to over-ride the disabled starter. The device will respond to a request to disable the vehicle by sending an acknowledgment to the request and sending the GPS position report at the time the request is received.

- Following the acknowledgement and reporting to the Disable request then check if the conditions for disable the starter are present. Conditions for disable are:
  - Ignition is OFF
  - Vehicle is in stationary
  - Cell Coverage presents
  - Valid GPS fix
- When the conditions are present send a GPS location report and disable the engine starter.
- The disabled starter can also be Enabled by toggling the ignition key ON/OFF for a predefined period.

STARTERDIS Disable the engine starter

STARTERENA Re-enable the engine starter

4.3.2 Emergency Starter Override

The following command will override the starter disable feature for 24 hours.

Command:

ENERGENCYENA

4.3.3 Manual Starter Override

The device will support a manual override of the starter-disable feature by performing a pre-defined number of ignition cycles (Ignition On ->Ignition Off ->Ignition On). Manual override will have following features:

- MSO feature will be enabled whenever the vehicle is in starter-disabled state.
- There will be a manual override counter to track and determine the number of times this feature gets used.
    - The counter will decrement with each MSO usage.
    - When the counter reaches 0, manual override will be disabled.
- In order to initiate an ignition On/Off cycle, the ignition needs to be off for 15 seconds.
- Manual override require the following key sequence to re-enable the starter:
    - When the counter is 2: 5 Ignition cycles within 5 seconds
    - When the counter is 1: 7 Ignition cycles
- The manual override counter can also be reset using configuration parameter.
- “EMERGENCYENA” command will override MSO feature.

4.3.4 Buzzer/ Audible Warning

For late payment warning in BHPH application, device will trigger to indicate a late payment warning under bellowing condition:

- Ignition cycle will trigger event
- Output signal to external noisemaker
- Signal will be periodic:
    - On for 1 second
    - Off foe 1 second
    - It will be activated for BWP period

Command:

BUZZWARN <0/1>

0- Disable
1- Enable

4.3.5 Print

The bellowing command will print the data on the UART interface.

Command:

PRINT <data>

The data will be sent to the device and sent/print on the UART interface.

4.4 Accelerometer

The accelerometer is able to detect motion during ignition on and off states, and the device is able to provide raw accelerometer data at regular intervals.

4.4.1 Towing Detection

The device will detect and report if the vehicle is being towed as defined below:

- Vehicle motion is detected via accelerometer.
- Vehicle theft/towing detection will be enabled when the ignition is turned OFF.
- Towing event is generated if there is a change in position that is more than a predefined limit during ignition OFF.

4.5 Battery Mode

The device is equipped with a 550 mAh internal battery, and will have the ability to report voltage of internal battery. The battery mode will be able to handle device disconnection and low battery events.

- If the device is disconnected from the vehicle or power is abruptly disconnected then a disconnected event will be generated and sent to the server. If no cellular signal is available, the device will repeat the sequence until the battery dies.
- Device will send an event to server when the vehicle battery drops below a specific threshold.

4.6 Voice Call

To use Fleet voice call features, the following pins need to connect the device:

1. Mic input to Mic P input
2. Speaker connection to Speaker P and Speaker N outputs
3. A generic push button input should be connected to digital input 3

Digital Input 3 can be configured for Voice call feature as push button input to answer/terminate call. To configure Digital input 3 for voice call, parameter AEE needs to be configured. The AEE parameter is a bitwise field that is used for configuring Analog and Digital inputs monitoring on LT-300 device.

AEE set parameter: It is a bit wise field and the description of each bit is as following:

Table 4-2: AEE Configuration Parameter

Bit Number	Input Pin	Configuration
Bit 0 (LSB)	Analog Input 1	Enable/Disable Analog input 1 change monitoring. 0 - disable,1 – enable
Bit 1	Analog Input 2	Enable/Disable Analog input 2 change monitoring. 0 – disable, 1 – enable
Bit 2	Analog Input 3	Enable/Disable Analog input 3 change monitoring. 0 – disable, 1 – enable
Bit 3	Unused	Unused
Bit 4	Digital Input 1	Enable/Disable Digital input 1 change monitoring. 0 – disable, 1 – enable
Bit 5	Digital Input 2	Enable/Disable Digital input 2 change monitoring. 0 – disable, 1 – enable
Bit 6	Digital Input 3	Enable/Disable Digital input 3 change monitoring. 0 – Digital input 3 acts as push button input for voice call,

		1 – Enable Digital input 3 change monitoring.
Bit 7 (MSB)	Unused	Unused

To configure Digital Input 3 as voice call push button input, set bit 6 of AEE to 0:

Example command:

SET AEE=24

4.6.1 Incoming Call

To receive incoming voice call, the device's digital input 3 should be connected to generic push button. Set bit 6 of AEE parameter to 0.

The device will only allow receiving of voice calls from a list of pre-approved phone number. The approved phone numbers can be configured in parameter PHV. A maximum of three phone numbers can be added to the approved list of phone numbers. If there are more than one phone number to be specified in parameter PHV, then each phone number should be added to PHV using a "." (dot) as a phone number delimiter.

Example:

If the approved phone numbers are 1234567890, 4567778888 and 3334445555 then set the PHV value as:

SET PHV=1234567890.4567778888.3334445555

When an operator makes a voice call from one of the approved phone numbers to device, the device will check the incoming number. If the incoming number is among the approved phone numbers specified in PHV, then the voice call is allowed and phone rings will be heard on the connected speakers. If it's not among the approved list, then the device will reject the call. For calls from approved numbers, the driver can accept the call by pressing the voice call button that is connected to digital input 3. Upon finishing the call the user can terminate the call by pressing the voice call push button.

4.6.2 Outgoing Call

The device can make an outgoing voice call to a pre-configured number. The pre-configured number should be specified in parameter PHO. A voice call push button should be connected to digital input 3 of the device. The Bit 6 of the AEE parameter should be set to 0.

The user can initiate an outgoing voice call by pressing the voice call push button. Upon pressing the button the device will recognize this input and place a voice call to the configured number that is specified in parameter PHO. To terminate the call the user should press the voice call push button again.

4.6.3 Stealth Call

In this mode the device can make a voice call to a pre-configured number specified in parameter PHL, wherein the device Speaker is muted during the call. Since the speaker is muted the user will not be aware of the STEALTH call. A user intervention is not needed to setup this call. It can be triggered by the operator/server only. The stealth call can be initiated by sending a remote command: STEALTHCALL. The device will enter stealth mode upon receiving the command. The device will mute the speaker and trigger an outgoing voice call to the number specified by parameter PHL. The stealth call will remain active for a maximum period of 60 minutes. After 60 minutes the device will terminate the stealth call and exit from the STEALTH mode to a normal mode.

Command:

STEALTHCALL

Note:

1. During any voice call activity (Stealth or Incoming or outgoing calls), the data connection is not available. So, any events generated during the voice call will not be sent to the server and will be stored in the internal memory. Similarly any remote commands will not be received from the data server. All the events that got logged during the voice call will be uploaded/sent only after closing the voice call.
2. The parameter PHE can be used to set the volume level of the voice call. The PHE can be set from 0 to 14. By default this value is set to 12. Any change to the volume level, will be in effect only after a device reset or cell modem reset.

4.7 Over the Air Firmware Update

The LT-300 is able to update the device firmware over the air without physically access to the device.

Command:

SET IPU=<IP address of update server>

SET OTA=1

UPDATE <Firmware version>

Firmware Version	Firmware version that needs to be downloaded. This could be filename as well but that depends on the OTA update server implementation

On UPDATE command, device downloads the firmware from the specified server and boots up with the new firmware. In case the update process stops in between due to server going down while the update is in progress or due to unavailability of GPRS connection; devices will boot up with a factory programmed fail safe firmware.

Note: During the update stage, device will not be reachable by server command.

4.8 Device Diagnostics

4.8.1 LED Indication

The device has 2 LEDs for connection status indication. Green LED indicates the GPS status, and the Blue LED indicates the cellular status. Table-11 describes the blinking patterns for the two LEDs.

Table 4-3: LED Patterns

LED	SOLID	Blink Once Every 2 Seconds	Blink Thrice Every 2 Seconds	Both LED Blink in the Same Pace
GREEN (GPS)	Device has a valid GPS fix	GPS is trying to acquire a valid fix	NA	Device is in Bootloader mode, not able for communication
BLUE (Cell)	Device established cellular connection	Modem is trying to establish a connection with network	SIM card is not present	

5. Revision History

VERSION	CHANGES	DATE	NAME
0.1	Initial draft version	April 28, 2015	Ying Li
1.0	First released revision	May 18, 2015	Ying Li