LT-100
Development Document

Version: 1.0

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CONTENT

1. Introduction

LT-100 is a LoRaWAN compliant RF Tracker which includes Asia's first LoRaWAN certified module by Globalsat. It is designed for asset tracking, pet tracking, and personal monitoring of children and elderly. It has built-in Help button for help reports which allows immediate notification to the care giver/monitor. It is also equipped with a high capacity battery which allows up to 3 weeks (by 1 hour report interval) of usage without charging in best condition. LT-100 is fully compatible with LoRaWAN compliant gateways, making it the #1 choice for tracking application under the LoRaWAN network.

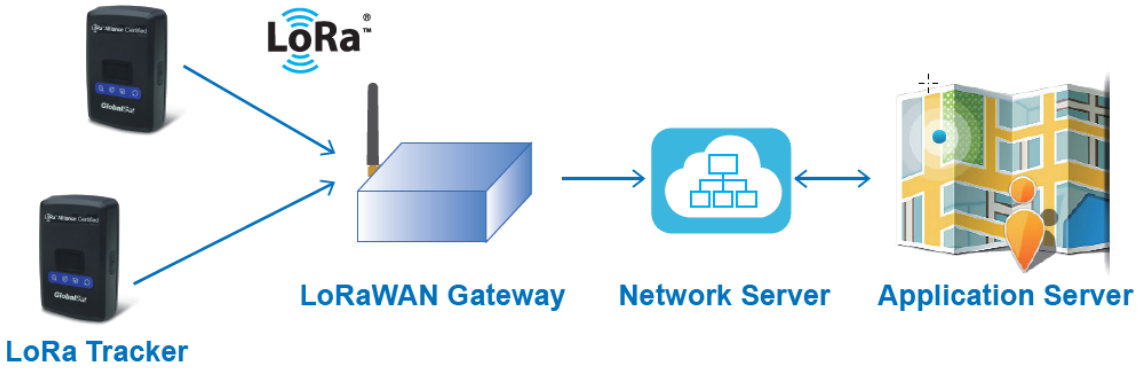
Features:

- **Configurable period report and motion report**
- **Power Low/Off alert (Vibration/buzzer)**
- **Support both OTAA and APB mode**
- **Help reports**

This document describes the communication protocol between LT-100 tracker and the LoRaWAN gateway, the built-in behavior modes of LT-100, and the function of each parameter.

2. Gateway Setup

LT-100 could send data via LoRa technology. Please refer to the following diagram.



Before starting communication LoRaWAN Gateway and LT-100 LoRa trackers, please refer to the LoRaWAN gateway's user manual to set the LoRa settings described on "4. LoRa settings" by GlobalSat-LT-100 Config Tool.

3. Protocol Summary

3.1 Report Messages Format

Report format of report messages:

GlobalSat Device Type	GPS Fix Status & Report Type	Battery Capacity	Latitude	Longitude
1 byte	1 byte	1 byte	4 bytes	4 bytes

GPS Fix Status & Report Type:

GPS Fix Status	Report Type
Bit6~Bit7	Bit0~Bit5

Parameters of Report Message	
Parameters	**Description**
GlobalSat Device Type	**Reserved**
GPS-fix Status	**00=not fix, 01=2D, 10=3D**
Report Type	**2=Periodic mode report** **4=Motion mode static report** **5=Motion mode moving report** **6=Motion mode static to moving report** **7=Motion mode moving to static report** **14=Help report** **15=Low battery alarm report** **17=Power on (temperature)** **19=Power off (low battery)** **20=Power off (temperature)**
Battery Capacity	**xxx** **unit: percent capacity**
Latitude	**xx.xxxxxx** **unit: degree**
Longitude	**xxx.xxxxxx** **unit: degree**

For example, our received payload is 00825b017d6b19073dc188.

GlobalSat Device Type:	**0x00 ＝＞ Reserved**
GPS-fix Status:	**0x82 ＝＞ 130 / 64 = 2 ＝＞ 3D Fixed**
Report Type:	**0x82 ＝＞ 130 % 64 = 2 ＝＞ Periodic mode report**
Battery Capacity:	**0x5b ＝＞ 91 %**
Latitude:	**0x017d6b19 ＝＞ 24,996,633 x 0.000001 = 24.996633˚**
Longitude:	**0x073dc188 ＝＞ 121,487,752 x 0.000001 = 121.487752˚**

3.2 Configuration Parameters

Most behaviors of LT-100 could be changed by Configuration Parameters. You could change the setting of configuration parameters by the following method. Connect LT-100 to personal computer via charging clip and USB cable and then set the configuration parameters by "GlobalSat-LT-100 Config Tool".

Configure Parameters					
		Code words	Parameters	Type	Description
Main	Device	O0	Enable/disable power key	1/0	1=enable power key 0=disable power key Default=1
		O4	Power on operating mode	u8	2=Periodic 4=Motion Default=2
		O7	Firmware Version	char(28)	Read only
		O8	Enable/Disable Battery low LED light	1/0	1=enable LED 0=disable LED Default=1
		O9	Enable/disable GPS/ LoRa LED function	1/0	1=enable LED 0=disable LED Default=1
		J8	Enable/disable LT-100 to automatically power on when power capacity is charged to the capacity of J1	1/0	0=disable 1=enable Default=1 **Note: If J8 is set to 0, please wait for 10 seconds after connecting LT-100 to power and then turn on device.**
	Other	Gt	G-sensor sensitivity	u8	5=high, 10=medium, 25=low Default=10

		O1	Interval for triggering motion sensor	u16, in seconds	1 ~ 100 Default=5
GPS	GPS	C0	GPS always on	1/0	0=disable 1=enable Default=0
		C1	The time to get GPS-fix if LT-100 got GPS-fix over 1 hour ago	u16, in seconds	60 ~ 600 Default=120
		C2	The time to get GPS-fix if LT-100 got GPS-fix within 1 hour	u16, in seconds	10 ~ 120 Default=30
		C3	GPS fix time before sending the first report	u16, in seconds	0 ~ 600 If "C3"=0, disable first report message. Default=30
		C4	Time for getting GPS fix between pressing Help button and sending out the Help report	u16, in seconds	>=1 Default=15
		C8	Maximum GPS off time	u16, in seconds	0 ~ 65535 Default=10800

Communication	LoRa	D0	LoRaWAN device address	char(8)	Read only. Use LM-130 default LoRaMac last 8 digit as the DevAddr.
		D5	LoRaWAN ADR	1/0	0=disable 1=enable Default=1
		D8	LoRa module firmware version	char(20)	Read only
		D9	LoRaWAN DevEUI	char(16)	Read only

Communication					
	Acknowledgement	A1	Wait confirmation from gateway after sending message to gateway	1/0	0=disable 1=enable Default=0
		A3	Wait confirmation from server for Help report	1/0	0=disable 1=enable Default=1
		A6	Number of re-sending reports without getting ACK from gateway	u8	Range:1~8 Default=2
Tracking	Period	P0	Report interval of period report	u32, in seconds	>=10 Default=60
	Motion	R0	Report interval in static state	u32, in seconds	>=10 Default=3,600
		R1	Report interval in moving state	u32, in seconds	>=10 Default=30
		RH	GPS always on in moving state	1/0	0=disable 1=enable Default=1

4. LoRa Setting

4.1 LoRa Setting

In order to activate the communication between gateway and device, the LoRa parameter is necessary to set at the beginning. Please make sure the LoRaWAN settings (such as NwkSKey, AppSkKey, AppEui, AppKey) in LT-100 matched with the settings in network server. For detail settings, please refer to "LT-100 Basic Parameter Settings.pdf".
Few LoRaWAN parameters are included as the table below.

Code word	Parameters	Value	Description
D0	LoRaWAN device address	char(8)	Read only. Use LM-130 default LoRaMac last 8 digit as the DevAddr.
D5	LoRaWAN ADR	1/0	0=disable 1=enable Default=1
D8	LoRa module firmware version	char(20)	Read only
D9	LoRaWAN DevEUI	char(16)	Read only

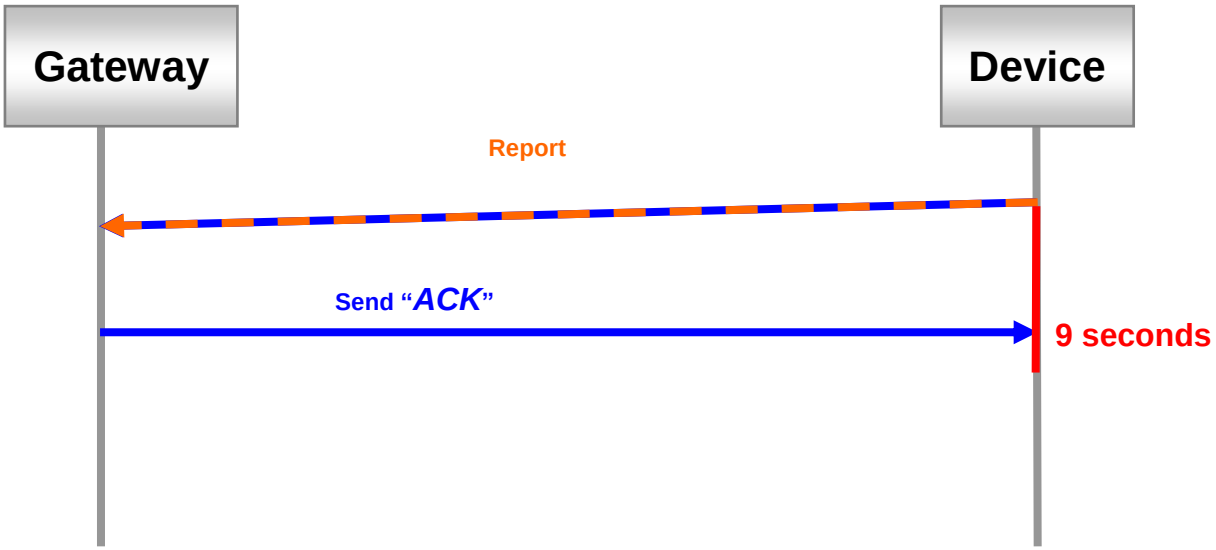
4.2 Acknowledgement

Acknowledgement is the acknowledge receipt used to confirm if gateway receive the report from device.
The following parameters must be set to enable/disable acknowledgement.

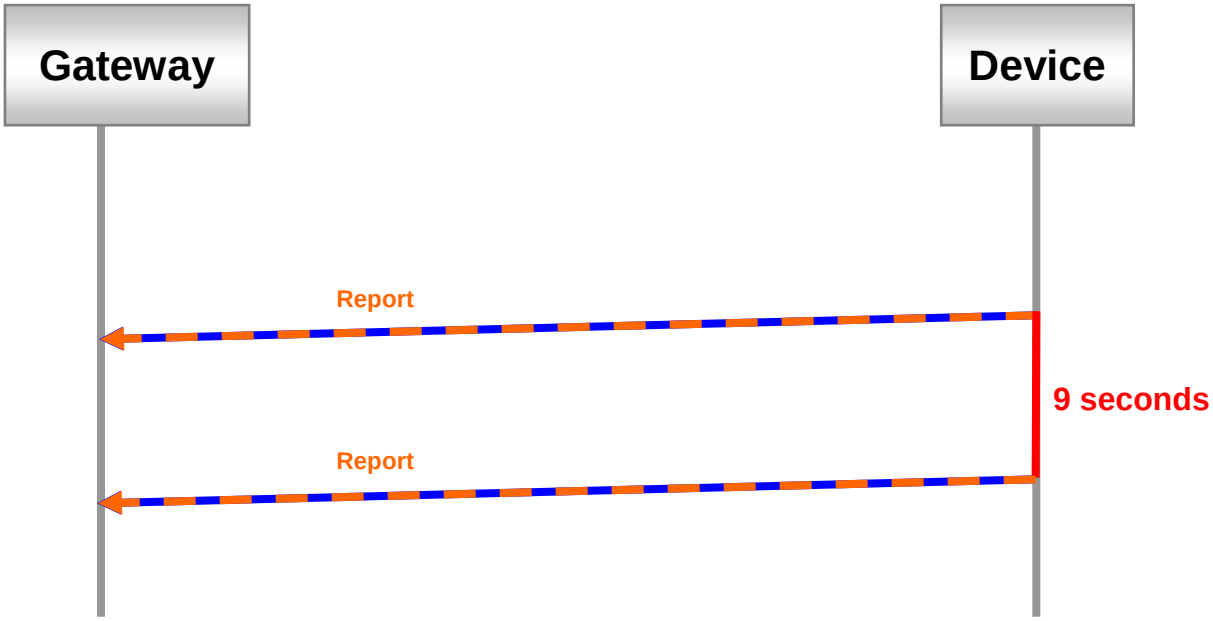
Code word	Parameters	Value	Description
A1	Wait confirmation from gateway after sending message to gateway	1/0	Default=1
A3	Wait confirmation from server for Help report	1/0	Default=1
A6	Number of re-sending reports without getting ACK from gateway	u8	Range:1~8 Default=2

4.2.1 Receive Acknowledgement from Gateway

Receive ACK from gateway within 9 seconds:



Not receive ACK from gateway within 9 seconds:



5. Tracking

5.1 Periodic Mode

Periodic mode is for setting an interval for LT-100 to regularly report its location according to the interval. You could set LT-100 to be periodic mode by setting parameter O4=2 via configuration tool. When it reaches the report time, LT-100 will turn on GPS and report the location and concerning information to LoRAWAN gateway.
The parameter of periodic mode:

Code word	Parameter	Value	Description
P0	Report interval	u32, in seconds	>= 10 Default=60

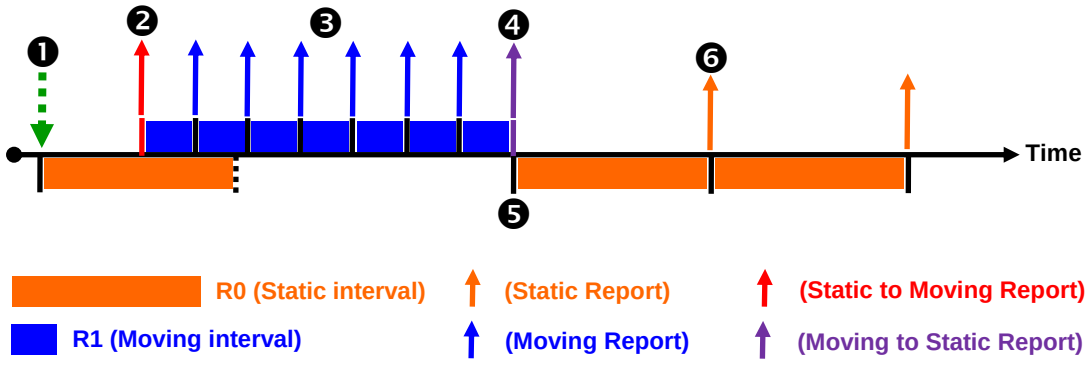
The report type of periodic report is '2'.
Example:
The periodic report 00825e017d6c24073dbbe9

Note:
If P0 is below 30 seconds, please enable C0 to make sure LT-100 could get GPS fix.

5.2 Motion Mode

Motion mode is an economic report mode. Under motion mode, LT-100 will report its location with high frequency when LT-100 detects motion (moving state). When LT-100 is static, it will report its location with low frequency (static state). It can save the report-transmission fee. Between the moving state and static state, there is a validation state for LT-100 not to jump to static state as soon as it does not detect motion.

There are 2 report frequency of motion mode, one is when LT-100 detects motion, and the other is when LT-100 is static. The behavior is as following:



❶	Receive command and then enter motion static mode.
❷	When LT-100 detects motion, it will enter motion moving mode and send “static to moving” report.
❸	Motion Moving Report.
❹	When LT-100 is static, it will send “moving to static” report and then return to the motion static mode.
❺	Re-start timer for motion static interval.
❻	Motion Static Report.

You could define the content of report and the report interval of motion mode. You could set LT-100 to be motion mode by setting parameter O4=4 via configuration tool.

The parameters of motion mode:

Code word	Parameters	Value	Description
R0	Report interval in static state	u32, in seconds	>= 10 Default=3600

R1	Report interval in moving state	u32, in seconds	>= 10 Default=30
RH	GPS always on in moving state	1/0	1=enable 0=disable Default=1

The report type of motion static report is '4'.
The report type of motion moving report is '5'.
The report type of static to moving report is '6'.
The report type of moving to static report is '7'.

Example:
The static to moving report 00865e017d6c24073dbbe9
The static report 00845e017d6c24073dbbe9

6. Help

When Help button is long pressed, LT-100 will try to get GPS fix according to the parameter C4 setting and then send help reports continuously to LoRaWAN gateway till it get server acknowledgement (A3=1). If A3 is set 0, LT-100 will send one report.

Code word	Parameters	Value	Description
C4	Time for getting GPS fix between pressing Help button and sending out the Help report	u16, in seconds	>=1 Default=15
A3	Wait confirmation from server for Help report	1/0	0=disable 1=enable Default=1

The report type of help report is '14'.

Example:
The help report 008e5d017d6a67073dc1e3