ABT110 Tracker Protocol

LTE-Cat1 / EGPRS

R1.04

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0. Revision History

Revision	Date	Author	Description of Change
1.01	2025-07-04	Sherlock	Initial
1.02	2026-01-13	Sherlock	1. Added 1 “RTO request position” event state of Regular Report Event in **+RPT** message. 2. Added 10: “Request Realtime Positioning” in **AT@RTO** command. 3. Added mode 2: Button only support power on and only trigger SOS alarm after power on in <*Button Working Mode*> in **AT@GCS** command. 4. Added 2 “SOS button alarm” event state of Regular Report Event in **+RPT** message.
1.03	2026-01-31	Sherlock	1. Added 14: Distance in <*I/O*> of **AT@BSS** command. 2. Added **AT@EDS** command to support extern al distance alarm. 3. Added “42: External Distance Alarm Event” in <*Event Type*> of **+RPT** message. 4. Added <*Connection Life*> in **AT@SIS** command. 5. Added AT@SSI command to support second server information.
1.04	2026-06-15	Sherlock	1.Adjust <*Enter Jamming Duration*> parameter range from 60 to 360 seconds in **AT@JAM** command. 2. Added <*RSRP (LTE)*>, <*RSRQ (LTE)*>, <*RSSI (LTE)*> parameters in **AT@JAM** command. 3. Added <*MINCH (GSM)*>, <*SINR (GSM)*>, <*RSSI (GSM)*> parameters in **AT@JAM** command.

TERMS AND ABBREVIATIONS

TERMS

IN THIS DOCUMENT, UNLESS SPECIFIED, "TERMINAL", "DEVICE", "EQUIPMENT" ALL REFER TO THE TERMINAL DEVICE DESIGNED BY BTTECH.

ABBREVIATIONS

ACK	Acknowledgement
AGPS	Assisted Global Position System
APN	Access Point Name
ASCII	American National Standard Code for Information Interchange
BER	Bit Error Rate
BLE	Bluetooth Low Energy
CPU	Central Processing Unit
GPRS	General Packet Radio Service
GPS	Global Position System
GSM	Global System for Mobile Communication
HDOP	Horizontal Dilution of Precision
HTTP	Hyper Text Transfer Protocol
ICCID	Integrated Circuit Card Identity
IMEI	International Mobile Equipment Identity
IMSI	International Mobile Subscriber Identity
IoT	Internet of Things
IP	Internet Protocol
LAC	Location Area Code
LTE	Long Term Evolution
MCC	Mobile Country Code
MCU	Micro Controller Unit
MNC	Mobile Network Code
MQTT	Message Queuing Telemetry Transport
NTP	Network Time Protocol
PLMN	Public Land Mobile Network
RSSI	Received Signal Strength Indicator
SIM	Subscriber Identity Module
SMS	Short Message Service
SN	Serial Number
TCP	Transmission Control Protocol
UDP	User Datagram Protocol
UTC	Coordinated Universal Time
WAN	Wide Area Network
VG	Virtual Ignition
VGN	Virtual Ignition On
VGF	Virtual Ignition Off

1. Data Stream Format

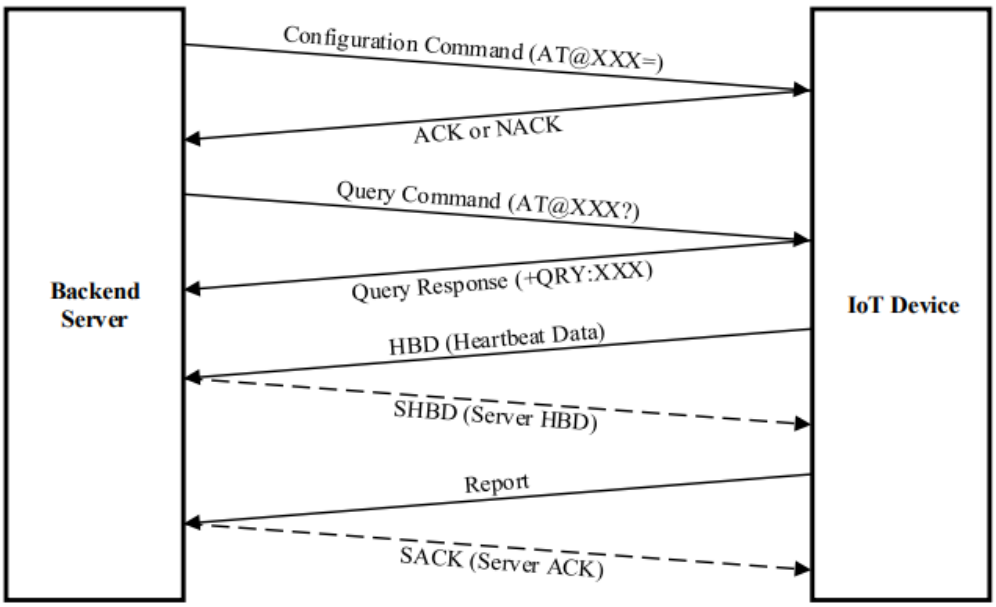
Data stream includes upstream and downstream.

Upstream refers to the data stream transmitted from the terminal device to the backend server via cellular network, which includes the response to the downlink command and some unsolicited messages.

Downstream refers to the data stream transmitted from the backend server to the terminal device via cellular network, which includes the commands to configure or operate the terminal and the response to the uplink message.

Upstream and downstream include the following types of frames:

Direction	Frame Encoding	Frame Type	Frame Usage
Downstream	Printable ASCII	Configuration Command	The backend server configures the parameters of the terminal.
		Query Command	The backend server queries the current parameters of the terminal.
		+SACK	Server Acknowledgement. The backend server send +SACK response to the terminal when it receives an +RST message from terminal.
		+SHBD	The backend server responds to the terminal **+SHBD** frame when it receives **+HBD** frame
Upstream	Printable ASCII	+QRY	The backend server sends a '**Query Command**' frame to the terminal, and the terminal responds with the current parameters.
		+HBD	Heartbeat Data. In order to maintain connectivity with the backend server, the terminal periodically sends a **+HBD** frame to the server.
		+ACK	Acknowledgement. When the terminal receives a **Configuration Command** from backend server/data cable/SMS/bluetooth, It responds with a **+ACK** frame indicating that a legitimate command has been received.
		+NACK	No Acknowledgement. When the backend server sends an illegal '**Configuration Command**' frame to the terminal, and the terminal responds with a **+NACK** frame indicating that an illegal command has been received.
	Hexadecimal Code	+RPT	A message that the terminal actively reports to the backend server.



The backend server issues commands to the terminal to not only configure and query its parameters, but also control it to perform certain actions. And the terminal sends heartbeat packets and unsolicited reports to the backend server appropriately.

All the upstream and downstream frames end with character "#" (i.e. 23H). In the frame of printable ASCII format, the character "," is used to separate the adjacent parameter characters. In the frame of the hexadecimal code format, there is no separator between the parameters. Please refer to the detailed descriptions of each frame format below.

2. Command Structure

2.1. Configuration Command

2.1.1. Network

2.1.1.1. SIS (Server Information Settings)

The command **AT@SIS** is used to configure backend server parameters, such as IP, Port.

➢ **AT@SIS=**

Example: **AT@SIS=at,0,1,255.255.255.255,12345,,,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@SIS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Report Mode	1	0 - 3	0
4	Buffer Mode	1	0 - 2	1
5	Main Server IP / Domain Name	<=60		
6	Main Server Port	<=5	0 – 65535	
7	Reserved	0		
8	Reserved	0		
9	SACK Enable	1	0 - 1	0
10	Heartbeat Interval	<=3	0|2 – 360 (min)	0
11	PDP Enable	1	0 - 1	0
12	TLS Enable	1	0 - 1	0
13	TLS Verification Mode	1	0 - 2	0
14	Connection Life	<=3	5 – 300 (sec)	5
15	Serial Number	4	0000 – FFFF	
16	Tail	1	#	#

✧ <Report Mode>: This parameter defines the method of communication between the backend server and the device.

- 0: Stop mode.
- 1: TCP mode.

The device will send data to the backend server by TCP protocol. Receiving protocol commands via TCP is supported if the EGPRS/LTE network allows it.

- 2: UDP mode.
  The device will send data to the backend server by UDP protocol. Receiving protocol commands via UDP is supported if the EGPRS/LTE network allows it.
- 3: MQTT mode.
  MQTT (Message Queuing Telemetry Transport) is a lightweight, publish subscribe based messaging protocol suitable for resource constrained devices and low bandwidth, high latency, or unstable network environments.

✧ <*Buffer Mode*>: The working mode of the buffer report function. If the buffer report function is enabled and the device goes into areas without EGPRS/LTE network coverage or without receiving **+SACK** message from server, the device will save all the reports locally. If the device goes back to areas with EGPRS/LTE network coverage, it will then send all the buffered reports through EGPRS/LTE.

- 0: Disable buffer function
- 1: Low priority - Enable the buffer report function: In this mode, the device will send the buffered messages after sending real time messages.
- 2: High priority - Enable the buffer report function: In this mode, the device will send the real time messages after sending buffered messages.

✧ <*Main Server IP / Domain Name*>: The IP address or the domain name of the primary server.

✧ <*Main Server Port*>: The port of the primary server.

✧ <*SACK Enable*>: This parameter defines whether the backend server should respond to the terminal with **+SACK** message when it receives a message from the terminal.

- 0: The backend server doesn't reply with **+SACK** message when receiving a message from the terminal.
- 1: The backend server replies with **+SACK** message when receiving a message from the terminal.

✧ <*Heartbeat Interval*>: The interval for sending heartbeat messages (**+HBD**) when report mode is TCP long-connection mode or UDP mode. If it is set to 0, no heartbeat message will be sent.

✧ <*PDP Enable*>: This parameter defines whether send "PDP Alarm Event" of **+RPT** message when the terminal socket connects to server.

- 0: Disable PDP alarm event report.
- 1: Enable PDP alarm event report.

✧ <*TLS Enable*>: The working mode of TLS.

- 0: Disable.
- 1: Enable.

✧ <*TLS Verification Mode*>: It expresses the certificate verification way for the terminal.

- 0: Don't verify the certificates, no certificates need to be built into the terminal.
- 1: Only server certification, CA file needs to be built into the terminal.
- 2: Server and client certifications, CA file, Client certificate, client key file needs to be built into the terminal.

✧ <*Connection Life*>: A numeral to indicate the time to maintain TCP connection for receiving commands from the main server. If there is no data transmission within the time specified by <*Connection Life*>, the TCP connection will be closed. The unit is second.

2.1.1.2. SSI (Second Server Information Settings)

The command **AT@SSI** is used to configure second backend server parameters, such as IP, Port.

➢ **AT@SSI=**

Example: **AT@SSI=at,0,1,255.255.255.255,12345,,,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@SSI=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Report Mode	1	0 - 3	0
4	Buffer Mode	1	0 - 2	1
5	Second Server IP / Domain Name	<=60		
6	Second Server Port	<=5	0 – 65535	
7	Reserved	0		
8	Reserved	0		
9	SACK Enable	1	0 - 1	0
10	Heartbeat Interval	<=3	0|2 – 360 (min)	0
11	Reserved	0		
12	TLS Enable	1	0 - 1	0
13	TLS Verification Mode	1	0 - 2	0
14	Reserved	0		
15	Reserved	0		
16	Serial Number	4	0000 – FFFF	
17	Tail	1	#	#

✧ <Report Mode>: This parameter defines the method of communication between the backend server and the device.

- 0: Stop mode.
- 1: TCP mode.
  The device will send data to the backend server by TCP protocol. Receiving protocol commands via TCP is supported if the EGPRS/LTE network allows it.
- 2: UDP mode.
  The device will send data to the backend server by UDP protocol. Receiving protocol commands via UDP is supported if the EGPRS/LTE network allows it.
- 3: MQTT mode.

MQTT (Message Queuing Telemetry Transport) is a lightweight, publish subscribe based messaging protocol suitable for resource constrained devices and low bandwidth, high latency, or unstable network environments.

- <*Buffer Mode*>: The working mode of the buffer report function. If the buffer report function is enabled and the device goes into areas without EGPRS/LTE network coverage or without receiving +SACK message from server, the device will save all the reports locally. If the device goes back to areas with EGPRS/LTE network coverage, it will then send all the buffered reports through EGPRS/LTE.
  - 0: Disable buffer function.
  - 1: Low priority - Enable the buffer report function: In this mode, the device will send the buffered messages after sending real time messages.
  - 2: High priority - Enable the buffer report function: In this mode, the device will send the real time messages after sending buffered messages.
- <*Second Server IP / Domain Name*>: The IP address or the domain name of the second server.
- <*Second Server Port*>: The port of the second server.
- <*SACK Enable*>: This parameter defines whether the backend server should respond to the terminal with +SACK message when it receives a message from the terminal.
  - 0: The backend server doesn't reply with +SACK message when receiving a message from the terminal.
  - 1: The backend server replies with +SACK message when receiving a message from the terminal.
- <*Heartbeat Interval*>: The interval for sending heartbeat messages (**+HBD**) when report mode is TCP long-connection mode or UDP mode. If it is set to 0, no heartbeat message will be sent.
- <*TLS Enable*>: The working mode of TLS.
  - 0: Disable.
  - 1: Enable.
- <*TLS Verification Mode*>: It expresses the certificate verification way for the terminal.
  - 0: Don't verify the certificates, no certificates need to be built into the terminal.
  - 1: Only server certification, CA file needs to be built into the terminal.
  - 2: Server and client certifications, CA file, Client certificate, client key file needs to be built into the terminal.

2.1.1.3. NIS (Network Information Setting)

The command **AT@NIS** is used to configure network information parameter.

- **AT@NIS=**

Example: **AT@NIS=at,apn,username,123456,,,,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@NIS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at

3	APN	<=42		
4	APN User Name	<=32	NULL	
5	APN Password	<=32	NULL	
6	Reserved	0		
7	Reserved	0		
8	Reserved	0		
9	Network Scan Mode	1	0 - 2	0
10	Search No Signal Cover	<=4	0|10 – 1440 (min)	0
10	Serial Number	4	0000 – FFFF	
11	Tail	1	#	#

- <*APN*>: Access point name (APN).
- <*APN User Name*>: The GPRS APN user name. If the parameter field is empty, the current value for this parameter will be cleared.
- <*APN Password*>: The GPRS APN password. If the parameter field is empty, the current value for this parameter will be cleared.
- <*Network Scan Mode*>: Configure RAT(s) to be Searched.
  - 0: Automatic (Cat1->GSM).
  - 1: Cat1 only.
  - 2: GSM only.
- <*Search No Signal Cover*>: It expresses the allowed time of search network, when no LTE and GSM coverage. In general, under no LTE and GSM coverage, the unit search network timeout is 260 seconds, the unit still have not register network success in search network twice in a row, the unit will can't allow search network in the time of <Search No Signal Cover>.

2.1.1.4. MQT (MQTT Information Setting)

The command **AT@MQT** is used to configure MQTT information parameter.

- **AT@MQT=**

Example: **AT@MQT=at,apn,username,123456,,,,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@MQT=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Server Index	1	0 - 1	0
4	Reserved	0		
5	Client ID	<64	NULL	

6	User Name	<64	NULL	
7	Password	<64	NULL	
8	Subscribe Topic	<80	NULL	
9	Subscribe QOS	1	0 - 2	
10	Publish Topic	<80	NULL	
11	Publish QOS	1	0 - 2	
12	Keep Alive	<=4	0 - 3600	120
13	Serial Number	4	0000 – FFFF	
14	Tail	1	#	#

- <*Server Index*>: It indicates support MQTT server map index.
  - 0: Main Server.
  - 1: Second Server.
- <*Client ID*>: Each client connected to the server has a unique client identifier (Client ID). Both the client and the server must use the Client ID to identify the state associated with the MQTT session between them. The Client ID can contain only uppercase letters, lowercase letters and numeric characters.
- <*User Name*>: Client username, used for MQTT server authorization.
- <*Password*>: Client password, used for MQTT server authorization.
- <*Subscribe Topic*>: The client subscribes topic name.
- <*Subscribe QOS*>: the quality of service of subscribe topic.
- <*Publish Topic*>: The client publishes topic name.
- <*Publish QOS*>: the quality of service of publish topic.
- <*keep Alive*>: It is used to set keep alive mechanism for MQTT, Range: 0 - 3600; Default value: 120; Unit: seconds. This parameter defines the maximum interval time for receiving messages from the client. Within 1.5 times the set time, if the server does not receive a message from the client, it is assumed that the client has sent a DISCONNECT message, and therefore the server will disconnect the client connection.

2.1.1.5. TCR (TLS Certificate Remote Download)

The command **AT@TCR** is used to configure TLS certificate remote download parameter.

- **AT@TCR=**

Example: **AT@TCR=at,0,0,abcd,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@TCR=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at

3	Server Type	1	0 - 2	
4	Server Protocol Type	1	0	
5	Certificate File Type	1	0 - 2	
6	Download URL	<=80	legal URL Address	
7	Serial Number	4	0000 – FFFF	
8	Tail	1	#	#

✧ <*Server Type*>: The type of server using TLS.
- 0: Main Server.
- 1: Second Server.
- 2: MQTT server.

✧ <*Server Protocol Type*>: The type of communication protocol using for obtain data from the server.
- 0: HTTP.

✧ <*Certificate File Type*>: It expresses the type of certificate file to download from the server.
- 0: CA certificate.
- 1: Client certificate.
- 2: Client Key.

✧ <*Download URL*>: The URL to download the certificate.

2.1.1.6. TCL (TLS Certificate Local Download)

The command **AT@TCL** is used to configure TLS certificate local download parameter.

➢ **AT@TCL=**

Example: **AT@TCL=1,0,13,2,ABCDEFGH,1234,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@TCL=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0 | 1	
4	Server Type	1	0 - 2	
5	Certificate File Type	1	0 - 2	
6	Total Package	<=3	1 - 255	
7	Current Package ID	<=3	1 - 255	
8	Certificate Data	<=768	HEX	
9	CRC16	4	0000 – FFFF	

10	Serial Number	4	0000 – FFFF	
11	Tail	1	#	#

✧ <*Mode*>: The working mode of local certificate file.
- 0: Delete file.
- 1: Write file.

✧ <*Server Type*>: The type of server using TLS.
- 0: Main Server.
- 1: Second Server.
- 2: MQTT server.

✧ <*Certificate File Type*>: It expresses the type of certificate file to download from local
- 0: CA certificate.
- 1: Client certificate.
- 2: Client Key.

✧ <*Total Package*>: Need total package of write certificate data.

✧ <*Current Package ID*>: the current package ID of write certificate data.

✧ <*Certificate Data*>: certificate data written to file.

✧ <*CRC16*>: CRC verification current transfer data whether is correct.

2.1.2. General

2.1.2.1. GMT (Greenwich Mean Time Setting)

The command **AT@GMT** is used to configure time zone.

➢ **AT@GMT=**

Example: **AT@GMT=at,0,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@GMT=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Time Zone Direction	1	0|1	
4	Time Zone	<=2	0 - 12	
5	Serial Number	4	0000 – FFFF	
6	Tail	1	#	#

✧ <*Time Zone Direction*>*: This indicates east time zone or the west time zone.*
- 0: East time zone.
- 1: West time zone.

✧ <*Time Zone*>: UTC offset in hours.

2.1.2.2. GCS (Global Configuration Setting)

The command **AT@GCS** is used to configure device parameter,

- **AT@GCS=**

Example: **AT@GCS=at,19C,,0,,,,FF,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@GCS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	New Password	2 - 19	'0' - '9', 'a' - 'z', 'A' - 'Z'	
4	Data Mask	<=8	(HEX)	
5	Event Data Mask	<=8	(HEX)	
6	LED Mode	1	0|1	0
7	Low Battery Threshold	<=2	5 – 30 (%)	10
8	Reserved	0		
9	GNSS Working Mode	1	0|1|3|4	1
10	GNSS Info Mask	<=4	0000 - FFFF	FF
11	AGPS Mode	1	0|1	0
12	ODO Enable	1	0|1	0
13	ODO Initial Mileage	<=9	0.0 – 4294967.0 (Km)	0.0
14	Hour Meter Enable	1	0|1	0
15	Initial Hour Meter Count	11	00000:00:00 - 99999:59:59	00000:00:00
16	Power Saving Mode	1	0 – 1	0
17	Reserved	0		
18	Power On Mode	1	0|1	0
19	Button Working Mode	1	0 – 2	0
20	Serial Number	4	0000 – FFFF	
21	Tail Character	1	#	#

- <*New Password*>: It is used to set up a new password.
- <*Data Mask*>: Component mask of the **+RPT/-RPT** message.

Mask Bit	**Item**

Bit 31	Reserved
…	…
Bit 19	BLE Information Mask
Bit 18	Reserved
…	…
Bit 9	Reserved
Bit 8	Event Data Mask
Bit 7	Upgrade information Mask
Bit 6	Reserved
Bit 5	Neighboring Cell Information
Bit 4	Cell Information Mask
Bit 3	GNSS Information Mask
Bit 2	Battery Information Mask
Bit 1	Network Type
Bit 0	Multi-Packet, this bit doesn't support configuration, when the length of message more than 256 Bytes, this bit will be enabled.

✧ <*Event Data Mask*>: Component sub mask of the **<***Data Mask*>.

Mask Bit	**Item**
Bit 31	Reserved
…	…
Bit 20	Rear Light Lux Mask
Bit 19	Front Light Lux Mask
Bit 18	Build-in Temperature Mask
Bit 17	Reserved
Bit 16	RF433 Info Mask
Bit 15	Reserved
Bit 14	TLS Certificate Download Mask
Bit 13	Reserved
…	…
Bit 10	Hour Meter Count Mask

Bit 9	Reserved
Bit 8	Reserved
Bit 7	GEO Status Mask
Bit 6	Reserved
Bit 5	Mileage Info Mask
Bit 4	Reserved
Bit 3	Reserved
Bit 2	Ignition & Motion State Mask
Bit 1	Reserved
Bit 0	Reserved

- <*LED Mode*>: This parameter is used to configures the LEDs' working mode:
  - 0: All LEDs does not work after 6 minutes.
  - 1: All LEDs always work.
- <*Low Battery Threshold*>: when battery voltage is lower than <*Low Battery Threshold*>, the device will send the low battery voltage alarm event to backend server.
- <GNSS Working Mode>: This parameter configures the GNSS working mode
  - 0: Disable GNSS Fixing.
  - 1: GPS Only.
  - 3: GPS, GLONASS and GALILEO.
  - 4: GPS, BEIDOU and GALILEO.
- <*GNSS Info Mask*>: This parameter configures the GNSS information mask of **+RPT** message.

Mask Bit	Item
Bit 15	Reserved
…	…
Bit 8	GNSS Satellites Number
Bit 7	UTC Time
Bit 6	Longitude
Bit 5	Latitude
Bit 4	Altitude
Bit 3	Azimuth
Bit 2	Speed
Bit 1	HDOP
Bit 0	GNSS Fixing Type

- <*AGPS Mode*>: AGPS helps increase the possibility to fix GNSS position and reduces the time

to fix GNSS position. When AGPS is enabled, it will consume some data.

- 0: Disable the AGPS function.
- 1: Enable the AGPS function.

✧ <*ODO Enable*>: Enable/disable the ODO-graph function to calculate the total mileage.

- 0: Disable the odometer. The mileage will not be included in the position related messages.
- 1: Enable the ODO-graph function to calculate the total mileage by GNSS. The current mileage will be included in the position related message.

✧ <*ODO Initial Mileage*>: The initial value for calculating the total mileage.

✧ <*Hour Meter Enable*>: Enable/disable the hour meter count function. When the hour meter count function is enabled, the hour meter count will be calculated when the device detects the vehicle ignition is on.

- 0: Disable the HMC function.
- 1: Enable the HMC function.

✧ <*Initial Hour Meter Count*>: The initial value of <*Hour Meter Count*> which range is 00000:00:00 – 99999:59:59. It is consisted of three parts that separated by ':', the first part is hour digits and the length of it is 5 bytes, the second part is 2 bytes minute digit, the last part is 2 bytes second digit. When the ignition is on, <*Hour Meter Count*> will be reported in regular reports and ignition events and calculated based on this value.

✧ <*Power Saving Mode*>: It is used to set up the different working mode to save the power consumption.

- 0: Normal Power Saving Mode: When the device detects ignition off and <*IGF Send Interval*> is less than 10 minutes, GPS chip will be always on. When <*IGF Send Interval*> is 10 minutes or more, the GPS chip will be on only when it is needed. The cellular module will be always on.
- 1: Low Power Saving Mode (G-sensor on): When the device detects ignition off and <*IGF Send Interval*> is less than 10 minutes, GPS module and cellular module will be always on. When <*IGF Send Interval*> is 10 minutes or more, the GPS chip will be on only when it is needed. The cellular module will be on when there is any message need to send to backend server, the unit can wake up by virtual ignition.

✧ <*Power On Mode*>: It is used to set up the working mode of power on, when the battery discharging 100% completely, insert the cable to charging.

- 0: Power on automatic.
- 1: Power on by press button.

✧ <*Button Working Mode*>: It is used to set up the working mode of button.

- 0: Button support power on and power off.
- 1: Button only support power on.
- 2: Button only support power on and only trigger SOS alarm after power on.

2.1.2.3. RRS (Regular Report Setting)

The command **AT@RRS** is used to configure regular GNSS report parameters. It can be set to report multiple GNSS in one message when ignition is on. However, it will only report one GNSS in each message when ignition is off.

➢ **AT@RRS=**

Example: **AT@RRS=at,1,0,30,3600,1000,1000,30,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@RRS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0|1|2	0
4	IGN GNSS Fixing Interval	<=4	0 – 3600 (sec)	0
5	IGN Send Interval	<=4	1 – 3600 (sec)	30
6	IGF Send Interval	<=5	0 – 86400 (sec)	3600
7	Discard No Fix	<=1	0|1	1
8	Reserved	0		
9	Corner Angle	<=3	0|5– 90	30
10	Reserved	0		
11	Reserved	0		
12	Reserved	0		
13	Reserved	0		
14	Long Standby Start Mode	1	1 - 2	1
15	Wake Up Init Time	4	HHMM	0800
16	Wake Up Ping Interval	<=2	1|2|3|4|6|8|12|24	24
17	Wake Up Positioning Interval	<=2	1|2|3|4|6|8|12|24	24
18	Wake Up Weekly Index	<=1	1 - 7	1
20	Daily Wake Up Time Index	<=1	0 - 6	0
21	Daily Wake Up Time	4	HHMM	
22	Serial Number	4	0000 – FFFF	
23	Tail Character	1	#	#

✧ <*Mode*>: The working mode of the regular GNSS report function.

- 0: Disable this function.
- 1: Fixed timing GNSS report (Continuous Mode). The report message is sent to the backend server periodically according to the <*Send Interval*> Parameter.
- 2. Long Standby Mode.

✧ <*IGN GNSS Fixing Interval*>: It is GNSS fixing internal when ignition is on. Its range is 0 – 3600s. If it is set to be 0, the device will update GNSS position according to the value of <*IGN Send*

Interval>. Please notice that <*IGN GNSS fixing Interval*> can not be more than < *IGN Send Interval*>.

- <*IGN Send Interval*>: It is GNSS report internal when ignition is on. The value range is 1 – 3600s. It can be maximum 15 times higher than <IGN GNSS Fixing Interval>. When it is times of the <IGN GNSS Fixing Interval>, device will send the GNSS report with multiple GNSS positions.
- <*IGF Report Interval*>: The time interval for fixing and sending the position information when ignition is off. Its value range is 0 – 86400s.
- <*Turning Angle*>: It is the parameter to set up the turning angle GNSS report. 0 means "Disable the turning of angle". If the parameter is set to be higher than 0, the device will keep comparing the heading between the two latest GNSS fixing. If the difference is same or more than the set value, It will generate a GNSS of the turning possible and sent it within the regular GNSS report.
- <*Discard No Fix*>: It is used to set up the device whether the GNSS report need to be sent. when GNSS fixing is failed.
  - 0: Enable report.
  - 1: Disable report.
- <*Long Standby Start Mode*>: The mode indicates the way to calculate the wakes up time.
  - 1: Wake up Init Time defines unit first wake-up according to parameter <*Wake Up Init Time*> (UTC time). If current UTC time is 10:00, and <*Wake Up Init Time*> configured to 09:00, means device first wake up will be next day at 09:00 UTC time.
    * Wake up Ping Interval parameter defines the interval at which the server will receive short message (No GNSS position, only ping).
    * Wake up Positioning Interval parameter defines the sending of +RPT reports to the server.

    Notice:
    * If 'Wake up Ping Interval' is equal to 'Wake Up Positioning Interval' - the unit will report according to the 'Wake Up Positioning Interval' parameter, +RPT message.

    * If 'Wake up Ping Interval' is less than the 'Wake Up Positioning Interval', it means the unit will wake up and send a ping to the server according to the 'Wake Up Ping Interval'(No GNSS position, only ping), but the position will be sent according to the 'Wake Up Positioning Interval', +RPT message.

  - 2: The device will wake up according to the <*Wake Up weekly Index*> and <*Daily Wake Up Time*> setting and ignore the parameters <*Wake Up Init Time*>, <*Wake Up Interval*>, but it is still controlled by <*Week weekly Index*>.
- <*Wake Up Init Time*>: The start time for the device's initial wake up. The value range of "HH" is "00" – "23". The value range of "MM" is "00" – "59".
- <*Wake Up Ping Interval*>: A numeral to determine the wakes up times within one day. '24' means "Wake up and PING to server once a day".
- <*Wake Up Positioning Interval*>: A numeral to determine the wakes up times within one day. '24' means "Wake up and positioning once a day".
- <*Wake Up Weekly Index*>: A numeral to determine the wakes up with which day in weekly.

Please refer to the following define.

- 1: Monday
- 2: Tuesday.
- 3: Wednesday
- 4: Thursday.
- 5: Friday
- 6: Saturday.
- 7: Sunday

✧ <*Daily Wake Up Time Index*>: A numeral to determine the number of wakes up times in daily.

✧ <*Daily Wake Up Time*>: A numeral to determine the wakes up time in daily.

2.1.2.4. RTO (Real Time Operation)

The command AT@RTO is used to retrieve information from the device or control the device, when it executes certain actions.

➢ **AT@RTO=**

Example: **AT@RTO=at,1,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@RTO=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Sub Command	<=1	1 – 11 | 18	
4	Reserved (Optional)	0		
5	Reserved (Optional)	0		
6	Serial Number	4	0000 – FFFF	
7	Tail	1	#	#

✧ <Sub Command>: A hex value to indicate the sub command to be executed.

- 1: **Read Parameter**. Get the all configurations of the device via the message **+ALL**.
- 2: **Reboot The Device**.
- 3: **Power Off The Device.**
- 4: **Reset All Parameters to factory settings and clear all buffered messages.**
- 5: **Query Network Information**. Get APN, ICCID, RSSI, Cell-ID and IP via the message **+QNI**.
- 6: **Query Version**. Get the version information of the device via the message **+VER**.
- 7: **Reserved.**
- 8: **Request All Messages.** It is used to request the device to generate all types of messages and send to backend server for integration.
- 9: **Delete Buffer Message**, it will delete current all buffer messages.
- 10: **Request Realtime Positioning**, when unit got positioning, it will generate "RTO request position" event state of Regular Report Event in **+RPT** message.
- 11: **Query Satellite Information**. When the device receives the command **AT@RTO** to

get the GPS, GLONASS and BEIDOU satellites information, it will send the satellite information via the message **+GSV (GPS satellites information), +LSV (GLONASS satellites information), +BSV (BEIDOU satellites information), +GAV (GALILEO satellites information)** to the backend server.

- 18: **Read Battery Charging Data**. Get the charging current and charging voltage via the message **+BCD**.

2.1.2.5. PCL (Preset Command List)

The command **AT@PCL** is used to preset store command list, which is bind with trigger event id in **AT@ECL** command.

➢ **AT@PCL=**

Example: **AT@PCL=at,1,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@PCL=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Preset Command ID	<=1	0 - 31	
4	Command String	<=200	AT Command | NULL	
5	Serial Number	4	0000 – FFFF	
6	Tail	1	#	#

✧ <*Preset Command ID*>: A numeral to identify the preset command.

✧ <*Command String*>: The whole content of the preset command.

2.1.2.6. ECL (Event Driver Command List)

The command **AT@ECL** is used to bind input events and preset commands, the input events will trigger the corresponding preset commands.

➢ **AT@ECL=**

Example: **AT@ECL=at,1,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@ECL=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Group Number	<=2	0 - 15	0
4	Group Mode	1	0 - 1	0
5	Reserved	0		
6	Event ID Mask	<=8	0 - FFFFFFFF	0

7	Bind Command Mask	<=8	0 - FFFFFFFF	0
8	Command ACK	0	0 - 1	0
9	Serial Number	4	0000 – FFFF	
10	Tail	1	#	#

✧ <*Group Number*>: The group numbers to identify the input events and preset commands to be executed.

✧ <*Group Mode*>: The working mode of the event driver command group.

- 0: Disable the group function.
- 1: Enable the group function.

✧ <*Event ID Mask*>: The bitwise mask to indicate the trigger events included in the group.

- Bit 0: Ignition on.
- Bit 1: Ignition off.
- Bit 2: No moving.
- Bit 3: Moving.
- Bit 4: Reserved.
- Bit 5: Reserved.
- Bit 6: Battery charging.
- Bit 7: Battery no charging.

✧ <*Bind Command Mask*>: The bitwise mask of the preset commands which will be executed after the event state of the group becomes true.

✧ <*Command ACK*>: A numeral to indicate whether to return **+ACK** message after preset command is executed.

- 0: Don't send **+ACK** message when the preset command is executed.
- 1: Send **+ACK** message when the preset command is executed.

2.1.3. Alarm

2.1.3.1. MOV (Movement Alarm Setting)

The **AT@MOV** command is used to configure the movement alarm parameters.

➢ **AT@MOV=**

Example: **AT@MOV=at,2,1,30,1,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@MOV=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Motion Threshold	1	0 - 9	2
4	Motion Duration	<=2	1 – 10 (sec)	1
5	Stillness Duration	<=2	1 – 60 (sec)	30

6	Motion Event Report	1	0 - 1	1
7	Serial Number	4	0000 – FFFF	
8	Tail	1	#	#

✧ <*Motion Threshold*>: It indicates the threshold of motion detection. Its value range is 0 - 9.

- 0: Disable motion detection.
- 1: 0.03g (Highest sensitivity)
- 2: 0.06g
- 3: 0.09g
- 4: 0.12g
- 5: 0.15g
- 6: 0.18g
- 7: 0.21g
- 8: 0.24g
- 9: 0.27g (Lowest sensitivity)

✧ <*Motion Duration*>: This is the duration time of motion detection. If motion working mode is enabled, and the motion is above the sensitivity for <*Motion Duration*> seconds, the device considered to be in moving status.

✧ <*Stillness Duration*>: This is the duration time of stillness detection. If motion working mode is enabled, and the stillness is above the sensitivity for <Stillness Duration> seconds, the device considered to be in stillness status.

✧ <*Motion Event Report*>: this parameter control whether need report “moving event” of +RPT message when unit happen move or stillness state change.

2.1.3.2. SPD (Speed Alarm Setting)

This command is used to set the over speed alarm.

AT@SPD=

Example: **AT@SPD=at,0,100,10,60,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@SPD=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0|1	0
4	Over Speed Threshold	<=3	30 – 400 (km/h)	100
5	Over Speed Duration	<=4	5 – 3600 (sec)	10
6	Report Interval	<=4	30 – 3600 (sec)	60
7	Serial Number	4	0000 – FFFF	
8	Tail	1	#	#

✧ <*Mode*>: The working mode of the speed alarm function.

- 0: Disable speed alarm.
- 1: Enable speed alarm.

✧ <*Over Speed Threshold*>: it's the over speed threshold.

✧ <*Over Speed Duration*>: When the device detects the speed to higher than the <Over Speed Threshold> consistently for more than this duration time, device will report over speed alarm to backend server.

✧ <*Report Interval*>: The send interval of the speed alarm message.

2.1.3.3. GEO (Geo-Fence Setting)

The command **AT@GEO** is used to configure the parameters of circular Geo-Fence. (Circular Geo-Fence is a virtual perimeter around a geographic area using a location-based service. When the geo fencing terminal enters or exits the area, a notification will be generated. The notification contains information about the location of the terminal and could be sent to the backend server.)

➢ **AT@GEO=**

Example: **AT@GEO=at,1,3,121.123333,32.123456,50,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@GEO=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	GEO ID	<=2	1 – 32	
4	Mode	1	0 – 1	0
5	Longitude	<=11	(–)xxx.xxxxxx	
6	Latitude	<=10	(–)xx.xxxxxx	
7	Radius	<=7	50 – 60000 (m)	50
8	Check Interval	<=5	0|5 – 3600 (sec)	0
9	Serial Number	4	0000 – FFFF	
10	Tail	1	#	#

✧ <*GEO ID*>: The ID of the circular Geo-Fence. It supports total 32 GEO fences.

✧ <*Mode*>: The working mode of the zone's circular Geo-Fence function.

- 0: Disable Geo-Fence function.
- 1: Enable Geo-Fence function.

✧ <*Longitude*>: The longitude of a point which is defined as the center of the circular Geo-Fence region. The unit is degree, and accuracy is 6 decimal places. West longitude is defined as negative starting with the sign "–" and east longitude is defined as positive without "+". The range is -180.xxxxxx ~ 180.xxxxxx.

✧ <*Latitude*>: The latitude of a point which is defined as the center of the circular Geo-Fence region. The unit is degree, and accuracy is 6 decimal places. South latitude is defined as negative starting with the minus sign "–" and north latitude is defined as positive without "+".

The range is -90.xxxxxx ~ 90.xxxxxx.

- ✧ <*Radius*>: The radius of the circular Geo-Fence region. The value range is 50 – 6000000. Unit: meter.
- ✧ <*Check Interval*>: The interval of GNSS checking position information against the Geo-Fence alarm. It works for all of the GEO fences.

2.1.3.4. JAM (Jamming Alarm Setting)

The command **AT@JAM** is used to configure jamming detection and alarm parameters.

- ➢ **AT@JAM=**

Example: **AT@JAM=at,1,5,5,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@JAM=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0 – 1	0
4	Enter Jamming Duration	<=3	0 – 360 (*Sec)	5
5	Quit Jamming Duration	<=2	0 – 60 (*Sec)	5
6	RSRP (LTE)	<=4	-140 - -44	-105
7	RSRQ (LTE)	<=3	-19 - -3	-15
8	RSSI (LTE)	<=4	-120 - -20	-40
9	MINCH (GSM)	<=2	0 - 254	5
10	SINR (GSM)	<=2	0 - 63	3
11	RSSI (GSM)	<=4	-110 - 50	-80
12	Serial Number	4	0000 – FFFF	
13	Tail Character	1	#	#

- ✧ <*Mode*>: The working mode of the Jamming detection function.
  - 0: Disable this function.
  - 1: Enable this function.
- ✧ <*Enter Jamming Duration*>: The time parameter to measure whether the device enters jamming alarm status. It's maintained for a period time longer than the time defined by <*Enter Jamming Duration*>, jamming on alarm event will be triggered.
- ✧ <*Quit Jamming Duration*>: The time parameter to measure whether the device quits jamming alarm status. It's maintained for a period time longer than the time defined by <*Quit Jamming Duration*>, jamming off alarm event will be triggered.
- ✧ <*RSRP*>: The Reference Signal Receiving Power threshold (For LTE network only).
- ✧ <*RSRQ*>: The Reference Signal Receiving Quality threshold (For LTE network only).

✧ <*RSSI*/*LTE*>: The Received Signal Strength Indication threshold (For LTE network only).

2.1.3.5. RFS (RF433 Alarm Setting)

The command **AT@RFS** is used to initiate RF433 alarm setting. When the terminal receives the enable RF433 alarm mode command. The terminal will report interval base on <Report Interval> parameter and enable RF433 radio.

➢ **AT@RFS=**

Example: **AT@RFS=at,1,60,0,88,1,2,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@RFS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Working Mode	1	0 - 1	0
4	Report Interval	3	0 - 3600	60
5	Reserved	0		
6	PA Power	<=2	1 - 88	88
7	RF433 Channel	<=2	0 - 19	0
8	Transmission Interval	<=2	2 – 32 (*500ms)	2
9	Trigger RF433 RF Mask	<=2	00 – FF	01
10	Serial Number	4	0000 – FFFF	
11	Tail Character	1	#	#

✧ <*Working Mode*>: The working mode of the RF433 alarm function.

- 0: Disable the RF433 alarm function.
- 1: Enable the RF433 alarm function.

✧ <*Report Interval*>: The interval for sending position information in RF433 alarm mode.

✧ <*PA Power*>: A number indicate the power index of the RF433. The larger number, the greater the power.

✧ <*RF433 Channel*>: A number indicate the transmit channel frequency of the RF433.

Channel	Frequency (MHz)
0	433.0
1	433.1
2	433.2
3	433.3
4	433.4
5	433.5
6	433.6

7	433.7
8	433.8
9	433.9
10	434.0
11	434.1
12	434.2
13	434.3
14	434.4
15	434.5
16	434.6
17	434.7
18	434.8
19	434.9

- <*Transmission Interval*>: A number indicate the transmission interval of the RF433. The larger number, the lower the power consumption.
- <*Trigger RF433 Radio Mask*>: this mask indicates which event control the corresponding mask whether trigger enable RF433 Radio.
  - Bit 0: Jammer on event

2.1.3.6. LAS (Light Alarm Setting)

The command **AT@LAS** is used to configure light detection and alarm parameters.

- **AT@LAS=**

Example: **AT@LAS=at,1,5,5,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@LAS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Front Light Alarm Mode	1	0 – 1	0
4	Front Light Sensitivity	<=6	0.3 – 1000.0 (lux)	1.0
5	Front Light Duration	<=4	0 – 3600 (sec)	10
6	Front Light Alarm Interval	<=4	0|10 – 3600 (sec)	30
7	Reserved	0		
8	Reserved	0		
9	Rear Light Alarm Mode	1	0 – 1	0
10	Rear Light Sensitivity	<=6	0.3 – 1000.0 (lux)	1.0
11	Rear Light Duration	<=4	0 – 3600 (sec)	10

12	Rear Light Alarm Interval	<=4	0|10 – 3600 (sec)	30
13	Reserved	0		
14	Reserved	0		
15	Serial Number	4	0000 – FFFF	
16	Tail Character	1	#	#

- <*Front Light Alarm Mode*>: This parameter defines to enable front light alarm or not.
  - 0: Disable front light alarm.
  - 1: More or equal <*Light Sensitivity*> alarm.
- <*Front Light Sensitivity*>: It indicates the front light detection sensitivity.
- <*Front Light Duration*>: It is the delay time in seconds for front light detection. If front light detection is enabled, and the luminance is above the <*Sensitivity*> for <*Duration*> seconds, the light alarm event will report to server.
- <*Front Light Alarm Interval*>: the report interval of front light alarm event report to server. If the <*Front Light Alarm Interval*> set as 0, will only report one time.
- <*Rear Light Alarm Mode*>: This parameter defines to enable rear light alarm or not.
  - 0: Disable rear light alarm.
  - 1: More or equal <*Light Sensitivity*> alarm.
- <*Rear Light Sensitivity*>: It indicates the rear light detection sensitivity.
- <*Rear Light Duration*>: It is the delay time in seconds for rear light detection. If rear light detection is enabled, and the luminance is above the <*Sensitivity*> for <*Duration*> seconds, the light alarm event will report to server.
- <*Rear Light Alarm Interval*>: the report interval of rear light alarm event report to server. If the <*Rear Light Alarm Interval*> set as 0, will only report one time.

2.1.3.7. BTA (Build-in Temperature Alarm Setting)

The command **AT@BTA** is used to configure build-in temperature alarm parameters.

- **AT@BTA=**

Example: **AT@BTA=at,1,5,5,10,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@BTA=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Build-in Temperature Alarm Mode	1	0 – 4	0
4	High Temperature	<=3	-20 – 60 (℃)	0
5	Low Temperature	<=3	-20 – 60 (℃)	0
6	Temperature Duration	<=4	1 – 3600 (sec)	10

7	Serial Number	4	0000 – FFFF	
8	Tail Character	1	#	#

- <*Build-in Temperature Alarm Mode*>: This parameter defines to enable temperature alarm or not.
  - 0: Disable temperature alarm.
  - 1: Report the alarm message when the current temperature is more or equal than the <*High Temperature*>.
  - 2: Report the alarm message when the current temperature is lower than the <*Low Temperature*>.
  - 3: Report the alarm message when the current temperature is inside the temperature range.
  - 4: Report the alarm message when the current temperature is outside the temperature range.
- <*High Temperature*>: The upper limit of the temperature range.
- <*Low Temperature*>: The lower limit of the temperature range.
- <*Temperature Duration*>: If the temperature is in the specified temperature range and is maintained for a period of time specified by <*Temperature* Duration>, the temperature alarm will be triggered.

2.1.4. IO & ADC

2.1.4.1. IGN (Ignition Setting)

The command **AT@IGN** is used to configure the way of ignition detection.

- **AT@IGN=**

Example: **AT@IGN=at,1,5,60,,,,,,,,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@IGN=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Reserved			
4	Reserved			
5	Reserved			
6	Reserved			
7	Virtual Ignition Mode	1	0 | 2	0
8	VGF Rest Duration	<=3	5 - 180(sec)	60
9	VGN Motion Duration	<=3	5 – 180(sec)	5
10	Serial Number	4	0000 – FFFF	

11	Tail Character	1	#	#

✧ *Virtual Ignition Mode*>: A numeral to define the working mode of detecting virtual ignition state.

- 0: Disable the virtual ignition detection function
- 2: Enable the virtual ignition detection function, detection by G-sensor only.

✧ <*VGF Rest Duration*>: A time parameter to determine whether the device enters virtual ignition off state. The device will be considered in virtual ignition off state after the motion sensor detects rest and the stationary state is maintained for a period of time specified by the parameter <*VGF Rest Duration*>.

✧ <*VGN Motion Validity*>: A time parameter to determine whether the device enters virtual ignition on state. The device will be considered in virtual ignition on state after the motion sensor detects movement and the moving state is maintained for a period of time specified by the parameter <*VGN Motion Validity*>.

2.1.5. BLE

2.1.5.1. BSS (BLE Scan Setting)

The command AT@BSS is used to BLE scanning setting.

➢ **AT@BSS=**

Example: **AT@BSS=at,1,,,,,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@BSS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Scan Working Mode	1	0|1|2|3	0
4	Scan Frequency	<=5	1 – 65535 (sec)	10
5	Scan Duration	<=2	1 – 300 (100 msec)	1
6	Filter Group	1	1 – 4	
7	Group Working Mode	1	0|1	0
8	MAC address	0 - 12		
9	Data Clear Period	<=5	0 – 65535	0
10	Match & Save Group	2	<=10	10
11	EIR Data Type	2	HEX	
12	Data offset	<=2	0 - 99	0
13	Data Size	<=2	0 - 20	0
14	Action	1	0|1	0

15	I/O	<=2	0 – 13	0
16	Match	<=20	HEX	
17	Endian Type	1	0 – 1	0
18	Multiplier	<=8		0
19	Offset	<=6	-32768 – 32767	0
20	BSS Report Interval Motion	<=5	0|5 – 86400 (sec)	60
21	BSS Report Interval Motionless	<=5	0|5 – 86400 (sec)	60
22	Serial Number	4	0000 – FFFF	
23	Tail	1	#	#

- <*Scan Working Mode*>: It expresses scan working mode of BLE.
  - 0: Disable BLE Scanning.
  - 1: Enable BLE Scanning, when the unit move, scan only once.
  - 2: Enable BLE Scanning, the unit start moving, always scanning, the unit stop moving, stop scanning.
  - 3: Enable BLE Scanning, always scanning.
- <*Scan Frequency*>: It expresses BLE scanning frequency, the unit is second.
- <*Scan Duration*>: It expresses BLE scanning Duration, the unit is 100 milliseconds.
- <*Filter Group*>: It expresses need filter group numbers of BLE accessor.
- <*MAC Address*>: It expresses MAC address of current filter's BLE accessory.
- <*Data Clear Period*>: It expresses 0-disable, if value equal or higher than 1, it will clear sensors BLE IO elements values if they were not updated for configured amount of time.
- <*Match & Save Group*>: It expresses the group of matched and required data from broadcast package of BLE accessory.
- <*EIR Data Type*>: It expresses this parameter will indicate which type to look for and work with.
- <*Data Offset*>: It expresses start index of data we are interested in.
- <*Data Size*>: It expresses size of data we are interested in.
- <*Action*>: It expresses action to perform with data
  - 0: Match.
  - 1: Save.
- <*I/O*>: It expresses need get parameter, this parameter is used only when save active is selected, tells which elements data will be saved to.
  - 0: None.
  - 1: Battery.
  - 2: Temperature.
  - 3: Humidity.
  - 4: Door State.
  - 5: Luminosity.
  - 6: Fuel.

- 7: Fuel Frequency.
- 8: Custom1.
- 9: Custom2.
- 10: Custom3.
- 11: Custom4.
- 12: Custom5.
- 13: Custom6.
- 14: Distance

✧ <*Match*>: It expresses hexadecimal string to be matched with sensor data. This parameter is used only when match action is selected.

✧ <*Endian Type*>: It expresses the endian type of save data, this parameter is used only when save action is selected.

- 0: Little Endian.
- 1: Big Endian.

✧ <*Multiplier*>: It expresses set multiplier by which read data value will be multiplied. This parameter is used only when save action is selected.

✧ <*Offset*>: It expresses set value to add to or subtract from the register before saving it. This parameter is used only when save action is selected.

✧ <*BSS Report Interval Motion*>: It expresses the "BLE Common info Event" of +RPT message report interval when the unit enter into motion state, the unit is second.

✧ <*BSS Report Interval Motionless*>: It expresses the "BLE Common info Event" of +RPT message report interval when the unit enter into motionless state, the unit is second.

2.1.5.2. ETS (External Temperature Setting)

The command **AT@ETS** is used to configure external temperature alarm parameters.

➢ **AT@ETS=**

Example: **AT@ETS=at,,,0,0,0,10,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@ETS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Sensor Number	1	0 - 5	0
4	Sensor Type	1	2	2
5	Sensor ID	<=16		
6	Temperature Alarm Mode	1	0 – 4	0
7	High Temperature	<=3	-55 – 125 (℃)	0

8	Low Temperature	<=3	-55 – 125 (℃)	0
9	Reserved	0		
10	Temperature Duration	<=4	10 – 3600 (sec)	10
11	Serial Number	4	0000 – FFFF	
12	Tail	1	#	#

- <*Sensor Number*>: It indicates the amount of the sensors need to be set up.
  If sensor number is blank, device will show all of the sensors which are connected.
- <*Sensor Type*>: This parameter defines the type of current sensors.
  - 1: Reserved for 1wire temperature sensor.
  - 2: BLE temperature sensor.
- <Sensor ID>: The 1wire ID of the temperature sensor or MAC address of the BLE temperature sensor. Total of four sensors are supported.
- <*Temperature Alarm Mode*>: This parameter defines to enable temperature alarm or not.
  - 0: Disable temperature alarm.
  - 1: Report the alarm message when the current temperature is equal or higher than the <high *Temperature*>.
  - 2: Report the alarm message when the current temperature is lower than the <Low *Temperature*>.
  - 3: Report the alarm message when the current temperature is within the temperature range.
  - 4: Report the alarm message when the current temperature is outside the temperature range.
- <*High Temperature*>: The upper limit of the temperature range.
- <*Low Temperature*>: The lower limit of the temperature range.
- <*Temperature Duration*>: If the temperature is within the specified temperature range and maintained for a period of time specified by <*Temperature* Duration>, the temperature alarm will be triggered.

2.1.5.3. EHS (External Humidity Setting)

The command **AT@EHS** is used to configure external humidity alarm parameters.

- **AT@EHS=**

Example: **AT@EHS=at,,,0,0,0,10,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@EHS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Sensor Number	1	0 - 5	0

4	Sensor Type	1	2	2
5	Sensor ID	<=16		
6	Humidity Alarm Mode	1	0 – 4	0
7	High Humidity	<=2	5 – 95 %	5
8	Low Humidity	<=2	5 – 95 %	5
9	Reserved	0		
10	Humidity Duration	<=4	10 – 3600 (sec)	10
11	Serial Number	4	0000 – FFFF	
12	Tail	1	#	#

- <*Sensor Number*>: It indicates the amount of the sensors need to be set up.
  If sensor number is blank, device will show all of the sensors which are connected.
- <*Sensor Type*>: This parameter defines the type of current sensors.
  - 1: Reserved for 1wire humidity sensor.
  - 2: BLE humidity sensor.
- <Sensor ID>: The 1wire ID of the humidity sensor or the MAC address of the BLE humidity sensor. Total of four sensors are supported.
- <*Humidity Alarm Mode*>: This parameter defines to enable humidity alarm or not.
  - 0: Disable humidity alarm.
  - 1: Report the alarm message when the current humidity is equal or higher than the <*high Humidity*>.
  - 2: Report the alarm message when the current humidity is lower than the <*Low Humidity*>.
  - 3: Report the alarm message when the current humidity is within the humidity range.
  - 4: Report the alarm message when the current humidity is outside the humidity range.
- <*High Humidity*>: The upper limit of the humidity range.
- <*Low Humidity*>: The lower limit of the humidity range.
- <*Humidity Duration*>: If the humidity is within the specified humidity range and maintained for a period of time specified by <*Humidity* Duration>, the humidity alarm will be triggered.

2.1.5.4. EDS (External Distance Setting)

The command **AT@EDS** is used to configure external distance alarm parameters.

- **AT@EDS=**

Example: **AT@EDS=at,,,0,0,0,10,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@EDS=

2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Sensor Number	1	0 - 1	0
4	Sensor Type	1	2	2
5	Sensor ID	<=16		
6	Distance Alarm Mode	1	0 – 4	0
7	High Distance	<=5	1 – 30000 (mm)	500
8	Low Distance	<=5	1 – 30000 (mm)	500
9	Reserved	0		
10	Distance Duration	<=4	1 – 60 (sec)	3
11	Serial Number	4	0000 – FFFF	
12	Tail	1	#	#

- <*Sensor Number*>: It indicates the amount of the sensors need to be set up.
- <*Sensor Type*>: This parameter defines the type of current sensors.
  - 2: BLE distance sensor.
- <Sensor ID>: The MAC address of the BLE distance sensor.
- <*Distance Alarm Mode*>: This parameter defines to enable distance alarm or not.
  - 0: Disable distance alarm.
  - 1: Report the alarm message when the current distance is equal or higher than the <*High Distance*>.
  - 2: Report the alarm message when the current distance is lower than the <Low *Distance*>.
  - 3: Report the alarm message when the current distance is within the distance range.
  - 4: Report the alarm message when the current temperature is outside the distance range.
- <*High Distance*>: The upper limit of the distance range.
- <*Low Distance*>: The lower limit of the distance range.
- <*Distance Duration*>: If the distance is within the specified distance range and maintained for a period of time specified by <*Distance Duration*>, the distance alarm will be triggered.

2.1.6. OTA

2.1.6.1. UPF (OTA Upgrade Firmware)

The command AT@UPF is used to update the firmware over the air.

- **AT@UPF=**

Example: **AT@UPF=at,1,,,,,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**

1	Head	7	ASCII	AT@UPF=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Working Mode	1	0|1	1
4	Reserved	1	0	0
5	Reserved	0		
6	Download URL	<=80	legal URL Address	
7	Update Type	1	0 | 2	0
8	Serial Number	4	0000 – FFFF	
9	Tail	1	#	#

✧ <*Working Mode*>: The working mode of the firmware upgrade.

- 0: Stop firmware upgrade.
- 1: Start firmware upgrade.

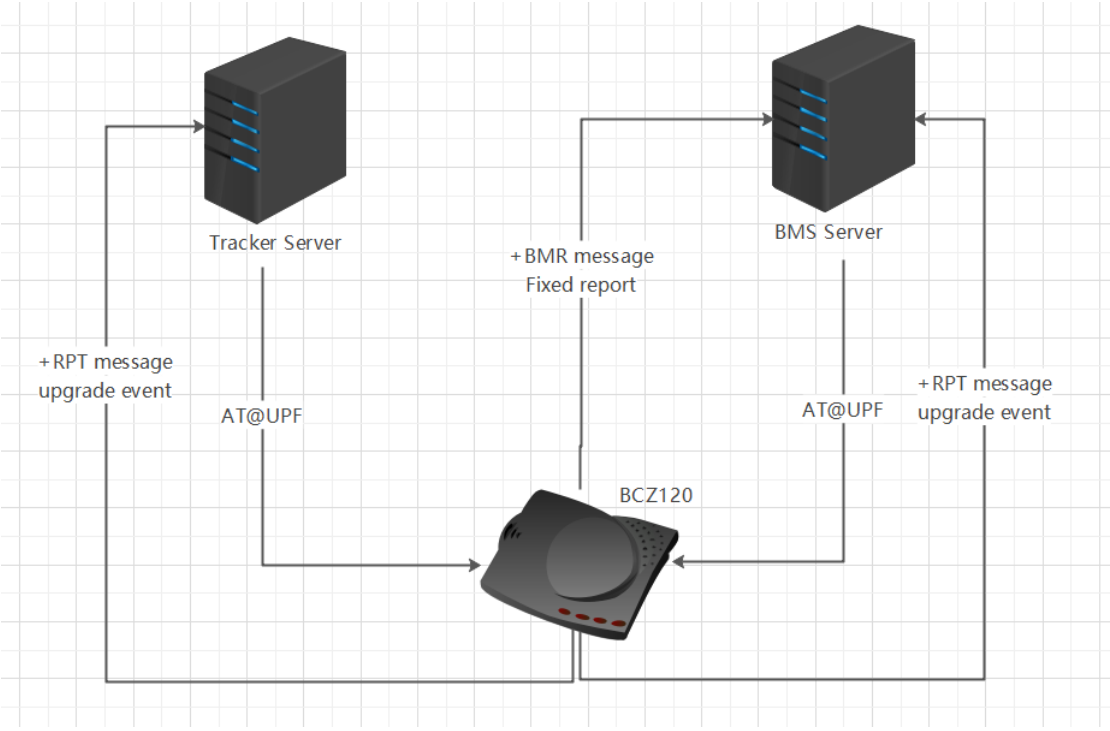
✧ <*Download URL*>: The URL to download the package.

✧ <*Update Type*>: The type of terminal update over the air.

- 0: Main MCU
- 2: Network Module

2.1.6.2. BMS (Device Manage System Setting)

The command **AT@BMS** is used to configure the device to report **+BMR** message to the BMS server. BMS server is a separate backend server for device management, firmware OTA and configuration OTA.



➢ **AT@BMS=**

Example: **AT@BMS=at,0,1,255.255.255.255,12345,30,,,1440,1,,,,,,,,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@BMS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Report Mode	1	0 - 1	0
4	Buffer Mode	1	0 - 2	1
5	BMS Server IP / Domain Name	<=60		
6	BMS Server Port	<=5	0 – 65535	
7	Connection Life	<=3	5 – 300 (sec)	5
8	Reserved	0		
9	Reserved	0		
10	Report Interval	<=5	1 – 2880 (min)	1440
11	BMR Data Mask	<=8	0 – FFFFFFFF	1
12	Serial Number	4	0000 – FFFF	
13	Tail	1	#	#

✧ <*Report Mode*>: This parameter defines the method of communication between the backend server and the device. Supported report modes are as follows:

- 0: Stop mode.
- 1: TCP mode. The device and BMS server will transmit data by TCP protocol.

✧ <*Buffer Mode*>: The working mode of the buffer report function. If the buffer report function is enabled and the device goes into areas without EGPRS network coverage or couldn't receive +SACK message from server, the device will store all reports locally. If the device goes back to areas with EGPRS network coverage, it will then send all the buffered reports through EGPRS.

- 0: Disable buffer function
- 1: Low priority - Enable the buffer report function: In this mode, the device will send the buffered messages after sending real time messages.
- 2: High priority - Enable the buffer report function: In this mode, the device will send the real time messages after sending buffered messages.

✧ <*BMS Server IP / Domain Name*>: The IP address or the domain name of the BMS server.

✧ <*BMS Server Port*>: The port of the BMS server.

✧ <*Connection Life*>: A numeral to indicate the time to maintain TCP connection for receiving commands from the BMS server. If there is no data transmission within the time specified by <*Connection Life*>, the TCP connection will be closed. The unit is second.

✧ <*Report Interval*>: The time interval for sending **+BMR** message. The value range is 1 – 2880.

Unit: minute.

✧ <*BMR Data Mask*>: Component mask of the **+BMR/-BMR** message.

Mask Bit	Item
Bit 31	Reserved
…	…
Bit 9	Reserved
Bit 8	Module Version Mask
Bit 7	SIM Info Mask
Bit 6	GNSS Info Mask
Bit 5	IGN State Mask
Bit 4	Reserved
Bit 3	Config Version Mask
Bit 2	Reserved
Bit 1	Battery Level Mask
Bit 0	Reserved

2.1.7. DEBUG

2.1.7.1. DBG (OTA Debug Log)

The command **AT@DBG** is used to configure catch debug log and report to backend server, default TCP connection.

➢ **AT@DBG=**

Example: **AT@DBG=at,1,1,255.255.255.255,12345,,,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@DBG=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Working Mode	1	0 - 1	0
4	Debug Info Mask	8	00000000 – FFFFFFFF	0
5	Server IP / Domain Name	<=60		
6	Server Port	<=5	0 – 65535	0
7	Serial Number	4	0000 – FFFF	
8	Tail	1	#	#

✧ <*Working Mode*>: The working mode of OTA debug log.

- 0: Stop catching log.
- 1: Start catching log.

✧ <*Debug info Mask*>: Component mask of catch logging.

Mask Bit	Item
Bit 31	Reserved
…	…
Bit 8	Reserved
Bit 7	Network Log
Bit 6	HTTP Log
Bit 5	G-sensor Log
Bit 4	IO Log
Bit 3	GPS Log
Bit 2	Report Message Log
Bit 1	Protocol Log
Bit 0	NMEA Log

✧ <*Server IP / Domain Name*>: The IP address or the domain name of the debug logging server.

✧ <*Server Port*>: The port of the debug logging server.

2.2. Query Command

The query commands are used to query the current working parameters of the terminal. All query commands are encoded using printable ASCII code, and the character "," is used to separate the adjacent parameter characters, their frame format is:

Example:
AT@SIS?at,,#
AT@NIS?at,,#
AT@GMT?at,,#
AT@GCS?at,,#
AT@RRS?at,,#

No	Parameter	Length (Byte)	Range / Format	Default
1	Header	3	ASCII	AT@

2	Command Key	<=N		
3	Leading Symbol	1	ASCII	?
4	Password	2 - 20	'0' - '9', 'a' - 'z', 'A' - 'Z'	at
5	Reserved	0		
6	Serial Number	4	0000 – FFFF	
7	Tail Character	1	#	#

3. Message Structure

3.1. Message Format

+/-RPT , +/-BMR and +HBD message uses the following data format:

Header Zone				Data Zone	Tail Zone		
Head	Length	IMEI	Device ID	Data	G-time	SN	Tail
5 Bytes	2 Bytes	8 Bytes	1 Byte	Variable	7 Bytes	2 Bytes	1 Byte
ASCII	HEX	HEX	HEX	HEX	HEX	HEX	ASCII

Data Zone is encoded using HEX code.

+SACK , +SHBD message is encoded using ASCII code.

The other messages (+ACK, +QRY, +ALL, +QNI, +VER , +GSV, +LSV, +BSV, +CVS, +CMI)use the following data format:

Header Zone				Data Zone	Tail Zone		
Head	Length	IMEI	Device ID	Data	G-Time	SN	Tail
5 Bytes	2 Bytes	8 Bytes	1 Byte	Variable	7 Bytes	2 Bytes	1 Byte
ASCII	HEX	HEX	HEX	ASCII	HEX	HEX	ASCII

Data Zone is encoded using ASCII code, and the character "," is used to separate the adjacent parameter characters.

3.2. Report Message

'**+RSP'** is real-time reports, which is generated and sent successfully in 3 minutes.
'-RSP' is historical reports, which are saved in buffer.

3.2.1. +RPT/-RPT

This message is the main data generated by different conditions and settings. All of the GNSS related messages and events share the same format.
In order to reduce the frame size and data consumption, all reports frames are uniformly encoded using Hexadecimal codes. And the big-endian byte order is used for multi-byte data types (int, float, etc). For example, for the integer 305419896 (i.e., 12345678H), the byte 12H will be sent first, and then 34H, 56H,78H.

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Header	5	ASCII	+RPT:/-RPT:
2	Length	2		
3	IMEI	8		
4	Device ID	1	0x30	0x30
5	Protocol Version	2		
6	Event Type	1		
7	Event State	1		
8	Data Mask	4		
1	Frame Count	1		**Bit 0:** Multi-Packet
2	Frame ID	1		
1	Network Type	1	0|3|8	**Bit 1:** Network Type
1	Battery Voltage	2	4200 (mV)	**Bit2:** Battery Information
2	Battery Level	1	0 – 100 (%)	
1	GNSS Info Mask	2	0000 - FFFF	
2	GNSS number	1	1 - 15	
3	**Bit0：**	1	(0,1) | (0,2,3)	

	GNSS Fixing Type			**Bit 3:** GNSS Information
4	**Bit1:** HDOP	1		
5	**Bit2:** Speed	2	0 – 999 (Km/h)	
6	**Bit3:** Azimuth	2	0 - 359	
7	**Bit4:** Altitude	2		
8	**Bit5:** Latitude	4		
9	**Bit6:** Longitude	4		
10	**Bit7:** UTC Time	7	YYYYMMDDHHMMSS	
11	**Bit8:** Satellites Number Mask	1		
12	**Bit8:** GPS Satellite number	1		
13	**Bit8:** BEIDOU Satellite number	1		
14	**Bit8:** GALILEO Satellite number	1		
15	**Bit8:** GLONASS Satellite number	1		
1	MCC	2	0000 – FFFF	**Bit 4:** Cell Information
2	MNC	2	0000 – FFFF	
3	LAC	2	0000 – FFFF	
4	Cell ID	4	00000000 – FFFFFFFF	
5	CSQ	1	0 – 31	
1	Neighboring Cell Number	1		**Bit 5:** Neighboring Cell Information
2	Neighboring MCC	2	0000 – FFFF	
3	Neighboring MNC	2	0000 – FFFF	

4	Neighboring LAC	2	0000 – FFFF	
5	Neighboring CELL ID	4	00000000 – FFFFFFFF	
6	Neighboring CSQ	1	0 – 31	
1	Upgrade Code	1		**Bit 7:** Upgrade information
2	Reserved	2		
	Event Data Mask	4		**Bit 8:** Event Data Mask
1	**Bit 2:** Ignition & Motion State	1		
1	**Bit 5:** Current Mileage	2	0 – 65535 (hm)	
2	**Bit 5:** Total Mileage	4	0 – 42949679 (hm)	
1	**Bit 7:** All GEO Status	4	00000000 - FFFFFFFF	
1	**Bit 10:** Current Hour Meter Count	3	HHMMSS	
2	**Bit 10:** Total Hour Meter Count	5	HHHHHHMMSS	
1	**Bit 14:** Server Protocol Type	1	0	
2	**Bit 14:** Certificate File Type	1	0 - 2	
3	**Bit 14:** Download Code	1	11 | 12 | 21 | 22	
1	**Bit 16:** RF433 State	1	0 | 1	
2	**Bit 16:** RF433 Channel	1	0 - 19	
1	**Bit 18** Build-in Temperature	2	-200 – 600 (0.1℃)	
1	**Bit 19** Front Light Lux	2	0 –65000 (0.1 lux)	
2	**Bit 20** Rear Light Lux	2	0 –65000 (0.1 lux)	

	BLE Sensor Number	1	0 – 128	**Bit19:** BLE Information Mask
	MAC Address	6		
	BLE RSSI	1		
	BLE Info Mask	2	0000 – FFFF	
0	BLE Battery Voltage	2		
1	BLE Temperature	2		
2	BLE Humidity	2		
3	BLE Door State	1		
4	BLE Luminous	2		
5	BLE Fuel	2		
6	BLE Fuel Frequency	4		
7	Custom1 Length	1		
	Custom1 Data	N		
8	Custom2 Length	1		
	Custom2 Data	N		
9	Custom3 Length	1		
	Custom3 Data	N		
10	Custom4 Length	1		
	Custom4 Data	N		
11	Custom5 Length	1		
	Custom5 Data	N		
12	Custom6 Length	1		
	Custom6 Data	N		
13	Distance	2		
1	Generated Time	7	YYYYMMDDHHMMSS	
2	Serial Number	2	0000 – FFFF	
3	Tail Character	1	#	#

✧ <*IMEI*>: the IMEI of the device is used as the unique ID of the device. IMEI is a 15-digit string. In the HEX format message, each 2 digits are encoded into one byte as an integer.

IMEI	**13**	**57**	**90**	**24**	**68**	**11**	**22**	**5**
HEX	**0D**	**39**	**5A**	**18**	**44**	**0B**	**16**	**05**

✧ <*Device ID*>: The ID of the terminal project.

✧ <*Protocol version*>: First byte indicates the major version number of the protocol. the last byte indicates the minor version number of the protocol, for example: **0x0B01** means version **11.01**.

✧ <*Event Type*>: The type of event trigger message.

Event Type	Item
0	Terminal Power Event
1	Regular Report Event
2	Moving Event
3	Battery Alarm Event
4 – 7	Reserved
8	Light Alarm Event
9	Built-in Temperature Alarm Event
10	Reserved
11	Upgrade Firmware Event
12	External Temperature Alarm Event
13	Ignition Event
14 – 15	Reserved
16	Over Speed Alarm Event
17 - 20	Reserved
21	Geo Fence Alarm Event
29	PDP Alarm Event
30	BLE Common info Event
31	External Humidity Alarm Event
32	Jamming Alarm Event
35	TLS Certificate File Download Event
36	RF433 Alarm Event
42	External Distance Alarm Event

✧ <*Event State*>: The state of event trigger message.

- 0: Nothing.
- Others, please refer to the following event type corresponding event state:

(**Event Type 0)** Terminal Power Event

Event State	Item
1	Power on with normal

2	Power on with abnormal
3	Power off with RTO Reboot
4	Power off with RTO power-off
5	Power off with Battery Low
6	Power on with key
7	Power off with key
10	Power on with upgrade firmware
11	Power on with wakes up PING interval

(**Event Type 1)** Regular Report Event:

Event State	Item
0	Regular Report
1	RTO request position
2	SOS button alarm

(**Event Type 2)** Moving Event:

Event State	Item
1	Start Moving
2	Stop Moving

(**Event Type 3)** Battery Alarm Event:

Event State	Item
1	Low Battery Alarm
2	Battery Start Charge
3	Battery Stop Charge
4	Battery Full Charge

(**Event Type 8)** Light Alarm Event:

Event state data zone consists of light type and alarm type. First half byte is light type, second half byte is alarm type.

Light Type	Item	Alarm Type	Item
0	Front Light	0	Quit Light Alarm

1	Rear Light	1	Enter Light alarm, The current Light lux is more or equal than the light threshold

(**Event Type 9)** Built-in Temperature Alarm Event:

Event State	Item
0	Temperature alarm cancel
1	Report the temperature alarm event of +RPT message when the current temperature is more or equal than the temperature specified by <*High Temperature*>.
2	Report the temperature alarm event of +RPT message when the current temperature is less than the temperature specified by <*Low Temperature*>.
3	Report the temperature alarm event of +RPT message when the current temperature is inside the temperature range.

(**Event Type 11)** Upgrade Firmware Event:

Event State	Item
1	Main MCU Upgrade
5	Network Module Upgrade

(**Event Type 12)** External Temperature Alarm Event:

Event state data zone consists of sensor type and alarm type. First half byte is sensor type, second half byte is alarm type.

Sensor Type	Item	Alarm Type	Item
0	Reserved	0	Temperature alarm cancel
1	Reserved	1	Report the temperature alarm event of +RPT message when the current temperature is more or equal than the temperature specified by <*High Temperature*>.
2	BLE Sensor	2	Report the temperature alarm event of +RPT message when the current temperature is less than the temperature specified by <*Low*

			Temperature>.
		3	Report the temperature alarm event of +RPT message when the current temperature is inside the temperature range.
		4	Report the temperature alarm event of +RPT message when the current temperature is outside the temperature range.

(**Event Type 13)** Ignition Event:

Event State	Item
3	Virtual ignition off
4	Virtual ignition on

(**Event Type 21)** Geo Fence Alarm Event:

Event state data zone consists of GEO trigger id and GEO trigger state. Bit 1 to Bit 7 is GEO trigger id, bit 0 is GEO trigger state.

Bit 1 ~ Bit 7 GEO Trigger ID	Item	Bit 0 GEO Trigger State	Item
0	GEO ID 1	0	Quit GEO-Fence
1 ……	GEO ID 2 ……	1	Enter GEO-Fence

(**Event Type 30)** BLE Common info Event:

Event State	Item
0	Regular Report
1	Door State Change Event

(**Event Type 31)** External Humidity Alarm Event:

Event state data zone consists of sensor type and alarm type. First half byte is sensor type, second half byte is alarm type.

Sensor Type	Item	Alarm Type	Item
0	Reserved	0	Humidity alarm cancel
1	Reserved	1	Report the humidity alarm event of +RPT message when the current humidity is more or equal than the humidity specified by <*High Humidity*>.

2	BLE Sensor	2	Report the humidity alarm event of +RPT message when the current humidity is less than the humidity specified by <*Low Humidity*>.
		3	Report the humidity alarm event of +RPT message when the current humidity is inside the humidity range.
		4	Report the humidity alarm event of +RPT message when the current humidity is outside the humidity range.

(Event Type 32) Jamming Alarm Event:

Event State	Item
1	Jamming On
2	Jamming Off

(Event Type 32) RF433 Alarm Event:

Event State	Item
1	Enter RF433 Alarm
2	Quit RF433 Alarm

(**Event Type 42)** External Distance Alarm Event:

Event state data zone consists of sensor type and alarm type. First half byte is sensor type, second half byte is alarm type.

Sensor Type	Item	Alarm Type	Item
0	Reserved	0	Distance alarm cancel
1	Reserved	1	Report the distance alarm event of +RPT message when the current distance is more or equal than the distance specified by <*High Distance*>.
2	BLE Sensor	2	Report the distance alarm event of +RPT message when the current distance is less than the distance specified by <*Low Distance*>.
		3	Report the distance alarm event of +RPT message when the current distance is inside the distance range.
		4	Report the distance alarm event of +RPT message when the current distance is outside

	the distance range.

- ✧ <*Data Mask*>: Please refer to the <*Data Mask*> in **AT@GCS** command.
- ✧ <*Frame Count*>: It indicates the number of reports generated by dividing the message. When the length of the message is too long, the terminal will automatically split it into multiple reports to send to the backend server.
- ✧ <*Frame ID*>: It indicate the sequence of the current multiple reports.
- ✧ <*Network Type*>: Current network type.
  - 0: EGPRS
  - 3: CAT-1
  - 8: Unknow
- ✧ <*Battery Voltage*>: Voltage of battery, the unit is mV.
- ✧ <*Battery Level*>: Battery Percent Information, the unit is 1%.
- ✧ <*GNSS Info Mask*>: This is GNSS information mask, control which part of GNSS data report.

Mask Bit	Item
Bit 15	Reserved
…	…
Bit 8	GNSS Satellites Number
Bit 7	UTC Time
Bit 6	Longitude
Bit 5	Latitude
Bit 4	Altitude
Bit 3	Azimuth
Bit 2	Speed
Bit 1	HDOP
Bit 0	Fix Type

- ✧ <*GNSS Number*>: the number of GNSS information report.
- ✧ <*GNSS Fixing Type*>: GNSS fixing type consists of GNSS generated type and fixing result. First half byte is GNSS generated type, second half byte is fixing result.

GNSS Generated Type	Item	Fixing Result	Item
0	Periodic Fix	0	No fixed
1	Corner Turning	1	Reserved
2	Reserved	2	2D fixed type.
3	Reserved	3	3D fixed type.

- ✧ <*HDOP*>: The current HDOP of GNSS, it expresses GNSS fixing accuracy, the smaller the value, the higher the positioning accuracy.

- 1 - 2: The satellite distribution is good, and the horizontal positioning accuracy is high.
- 3 - 5: The satellite distribution is general, and the horizontal positioning accuracy is moderate.
- 6 - 8: The satellite distribution is poor and horizontal positioning accuracy is low.
- >=9: The satellite distribution is very poor, and the horizontal positioning accuracy is very low.

✧ <*Speed*>: The current speed. The unit is km/h.

✧ <*Azimuth*>: The azimuth of the GNSS fix.

✧ <*Altitude*>: The altitude from GNSS. If the altitude is negative, it is represented in 2's complement format, the unit is meter.

✧ <*Latitude*>: The latitude of the current position. Total 4 bytes. The device converts the latitude to an integer with 6 implicit decimals and reports this integer in HEX format. If the value of the latitude is negative, it is represented in 2's complement format.

Latitude 31.164503	**31164503**			
HEX	**01**	**DB**	**88**	**57**

✧ <*Longitude*>: The longitude of the current position. 4 bytes in total. The device converts the longitude to an integer with 6 implicit decimals and reports this integer in HEX format. If the value of the longitude is negative, it is represented in 2's complement format.

Longitude 121.390847	**121390847**			
HEX	**07**	**3C**	**46**	**FF**

✧ <*GNSS UTC Time*>: UTC time is the GNSS fixing time. 7 bytes in total. The first 2 bytes are for year, and the other 5 bytes are for month, day, hour, minute and second respectively.

GNSS UTC Time	**2011**		**07**	**14**	**08**	**24**	**13**
HEX	**07**	**DB**	**07**	**0E**	**08**	**18**	**0D**

✧ <*MCC*>: Mobile country code of main cell.

✧ <*MNC*>: Mobile network code of main cell.

✧ <*LAC*>: Location area code of main cell.

✧ <*Cell ID*>: Cell ID of main base station.

✧ <*CSQ*>: The signal strength level of main cell.

CSQ RSSI	**Signal Strength (dBm)**
0	<-113
1	-111
2 - 30	-109 - -53
31	>-51
99	Unknown

✧ <*Neighboring Cell Number*>: the number of neighboring cells.

✧ <*Neighboring MCC*>: Mobile country code of neighboring cell.

✧ < *Neighboring MNC*>: Mobile network code of neighboring cell.

✧ < *Neighboring LAC*>: Location area code of neighboring cell.

✧ < *Neighboring Cell ID*>: Cell ID of neighboring base station.

✧ < *Neighboring CSQ*>: The signal strength level of neighboring cell.

CSQ RSSI	Signal Strength (dBm)
0	<-113
1	-111
2 - 30	-109 - -53
31	>-51
99	Unknown

✧ <*Upgrade Code*>: The code of the upgrade status.

- 0: The device prepares to download the package.
- 1: The device starts downloading the package.
- 2: The device finishes downloading the package successfully.
- 3: The firmware package download failed.
- 4: The device refuse to start the downloading process because the battery is low.
- 11: The device starts upgrading the firmware.
- 12: The device finishes upgrading the firmware successfully.
- 13: The firmware update is failed.
- 14: The upgrade process has been postponded because the battery is low.

✧ <Ignition & Motion State>: The state of ignition and motion, please refer to the following:

- 0x11 (Ignition Off & Rest): The device status is ignition off and motionless.
- 0x12 (Ignition Off & Motion): The device status is ignition off and moving before it is considered as being towed.
- 0x13 (Tow): The device status is ignition off and it is being towed.
- 0x21 (Ignition On & Rest): The device status is ignition on and motionless.
- 0x22 (Ignition On & Motion): The device status is ignition on and moving.

✧ <*Current Mileage*>: It's the mileage traveled of current journey. The unit is hectometer.

✧ <*Total Mileage*>: It's the total mileage traveled. The unit is hectometer.

✧ <*Satellites Number Mask*>: The mask of satellites number, it consists of GPS, GLONASS, BEIDOU, GALILEO Satellites.

Satellites Number Mask	Description
Bit 0	**GPS Satellite number**
Bit 1	**BEIDOU Satellite number**
Bit 2	**GALILEO Satellite number**
Bit 3	**GLONASS Satellite number**

✧ <*ALL GEO Status*>: The bitwise mask for trigger condition composition of the corresponding GEO ID. Each bit from bit 0 to bit 31 represents the logical state of the corresponding GEO ID to trigger the entering or exiting event. 1 means "The event of the GEO ID set is triggered", and 0 means "The event of the GEO ID set is not triggered".

For example, if the Area Mask is 03, it means entering or exiting events of GEO-ID0 and GEO-ID1 occur at the same time.

✧ <*Server Protocol Type*>: The type of communication protocol using for obtain data from the server.

- 0: HTTP.

✧ <*Certificate File Type*>: It expresses the type of certificate file to download from the server.

- 0: CA certificate.
- 1: Client certificate.
- 2: Client Key.

✧ <*Download Code*>: The code of the download TLS certificate status

- 11 – start to download the certificate file.
- 12 – download command error
- 21 – download success.
- 22 – download fail.

✧ <*RF433 State*>: It indicates the state of RF433 radio.

- 0: RF433 off state.
- 1: RF433 on state.

✧ <*RF433 Channel*>: A number indicate the transmit channel frequency of the RF433.

Channel	Frequency (MHz)
0	433.0
1	433.1
2	433.2
3	433.3
4	433.4
5	433.5
6	433.6
7	433.7
8	433.8
9	433.9
10	434.0
11	434.1
12	434.2
13	434.3
14	434.4
15	434.5
16	434.6
17	434.7
18	434.8
19	434.9

✧ <*Build-in Temperature*>: the current build-in temperature value, Unit: 0.1℃.

✧ <*Front Light Lux*>: the current front light lux value, Unit: 0.1 lux.

✧ <*Rear Light Lux*>: the current rear light lux value, Unit: 0.1 lux.

✧ <*BLE Info Mask*>: BLE information read from BLE accessories, bitwise masks refer to the following:

Mask Bit	Item	Description

Bit 15	Reserved	
Bit 14	Reserved	
Bit 13	Distance	
Bit 12	Custom6	
Bit 11	Custom5	
Bit 10	Custom4	
Bit 9	Custom3	
Bit 8	Custom2	
Bit 7	Custom1	
Bit 6	BLE Fuel Frequency	
Bit 5	BLE Fuel	
Bit 4	BLE Luminous	
Bit 3	BLE Door State	
Bit 2	BLE Humidity	
Bit 1	BLE Temperature	
Bit 0	BLE Battery Voltage	

- <*BLE Battery Voltage*>: the battery voltage of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535, the unit is mV.
- <*BLE Temperature*>: the temperature of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535, the unit is 0.01°C.
- <*BLE Humidity*>: the humidity of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535, the unit is 0.01%.
- <*BLE Door State*>: the door state of BLE accessory, the data size is 1 byte, the range is from 0 to 1.
- <*BLE Luminous*>: the Luminous of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535.
- <*BLE Fuel*>: the fuel of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535.
- <*BLE Fuel Frequency*>: the fuel frequency of BLE accessory, the data size is 4 bytes, the range is from 0 to 4294967295.
- <*Custom1*>: the custom1 data of BLE accessory, the data size max is 20 bytes.
- <*Custom2*>: the custom2 data of BLE accessory, the data size max is 20 bytes.
- <*Custom3*>: the custom3 data of BLE accessory, the data size max is 20 bytes.
- <*Custom4*>: the custom4 data of BLE accessory, the data size max is 20 bytes.
- <*Custom5*>: the custom5 data of BLE accessory, the data size max is 20 bytes.
- <*Custom6*>: the custom6 data of BLE accessory, the data size max is 20 bytes.
- <*Distance*>: the distance data of BLE distance accessory, the unit is mm.

3.2.2. +BMR/-BMR

'**+BMR'** is real-time report. These are the reports sent to the device management server.
'-BMR' is historical report which are saved in buffer.

Example: 2B 41 43 4B 3A 00 26 56 14 2C 06 32 38 17 01 10 42 4D 53 2C 30 31 30 31 2C 2C 30 2C 07 E7 08 1F 10 16 0C 14 41 23				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+BMR:/-BMR:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	BMS Protocol Version	2		
6	Track Protocol Version	2		
7	BB Hardware Version	1		
8	BB Firmware Version	2		
9	BMR Data Mask	4		
1	Battery Level	1	0 – 100 (%)	**Bit 1:** Battery Level Mask
1	Config Version	2		**Bit 3:** Config Version Mask
1	Ignition & Motion State	1		**Bit 5:** IGN State Mask
1	GNSS On	1	0|1	**Bit 6:** GNSS Info Mask
2	Satellite Number	1	0 - 6	
3	Satellite ID	1		
4	Satellite Power	1		
5	Last GNSS HDOP	1		
6	GNSS UTC Time	7	YYYYMMDDHHMMSS	
1	IMSI	8		**Bit 7:** SIM Info Mask
2	ICCID	10		
1	Module Version Length	1		**Bit 8:**

2	Module Version	<=50	String	Module Version Mask
1	Generated Time	7	YYYYMMDDHHMMSS	
2	Serial Number	2	0000 – FFFF	
3	Tail	1	#	#

- <*BB Hardware Version*>: The hardware version. The first two characters represent the major version and the last two characters represent the minor version. For example, **010B** means the version **1.11**.
- <*BB Firmware Version*>: The firmware version. The first two characters represent the major version and the last two characters represent the minor version. For example, **010B** means the version**1.11**.
- <*BMR Data Mask*>: Component mask of the **+BMR/-BMR** message, set this parameter with the **AT@BMS** command.
- <*Battery Level*>: Battery Percent Information.

3.3. Heart Beat Data

3.3.1. +HBD

In order to maintain the connection between backend server and terminal, the terminal provides this heartbeat mechanism: the terminal periodically sends a **+HBD** frame to the server when there is no data transmitted between server and terminal in this periodical time. The backend server should responds with a **+SHBD** frame to the terminal when it receives a +HBD message. The heartbeat feature is configured by the **AT@SIS** command. please refer to the frame format below.

The **+HBD** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+HBD:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
6	Protocol Version	2		
10	Generated Time	7	YYYYMMDDHHMMSS	
11	Serial Number	2	0000 – FFFF	

12	Tail	1	#	#

✧ <*Protocol version*>: First byte indicates the major version number of the protocol. the last byte indicates the minor version number of the protocol, for example: **0x0B01** means version **11.01**.

3.3.2.+SHBD

The **+SHBD** is encoded using printable ASCII code, its frame format is:

Example: +SHBD:04FF# +SHBD:0502# +SHBD:04F9#				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	6	ASCII	+SHBD:
2	Serial Number	4	0000 – FFFF	
3	Tail	1	#	#

✧ <*Serial Number*>: It corresponds to the serial number in the report. For example, the serial number in the report is 0x01F7, here it is ASCII "01F7".

3.4. Acknowledgement

When the terminal receives a command, it responds an ACK to the backend server as an acknowledgement of receiving the command.

In addition, when the backend server successfully receives a report sent by terminal, it can also respond with a **+SACK** to the terminal when necessary, indicating that the report is received.

The frame formats of **+ACK**, and **+SACK** are shown below.

3.4.1.+ACK

The **+ACK** frame format is:

Example: 2B 41 43 4B 3A 00 26 56 14 2C 06 32 37 51 01 10 43 43 53 2C 30 31 30 31 2C 2C 30 2C 07 E7 08 18 09 0D 0E 05 01 23				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+ACK:
2	Length	2		
3	IMEI	8		

4	Device ID	1		0x30
5	Protocol Version	4		
6	Command Key	<=N		
7	Sub Command	<=N		
8	Result	<=2		
9	Reserved	0		
10	Generated Time	7	YYYYMMDDHHMMSS	
11	Serial Number	2	0000 – FFFF	
12	Tail	1	#	#

✧ <*Command Key*>: Please refer to the "Command Key" in Configuration Command.

✧ <*Sub Command*>: Please refer to sub command in the **AT@RTO** command.

✧ <*Result*>: it is used to indicate the specific reason for the **+ACK** to be triggered.

- 0: Success.
- 1: Password error.
- 2: Parameters error.
- 3: Command is not supported.

3.4.2.+SACK

The **+SACK** is encoded using printable ASCII code, its frame format is:

Example:
+SACK:04FF#
+SACK:0502#
+SACK:04F9#

No	Parameter	Length (Byte)	Range / Format	Default
1	Head	6	ASCII	+SACK:
2	Serial Number	4	0000 – FFFF	
3	Tail	1	#	#

✧ <*Serial Number*>: It corresponds to the serial number in the report. For example, the serial number in the report is 0x01F7, here it is ASCII "01F7".

3.5. Command Query Data

3.5.1. +QRY

When the terminal receives a **Query Command** from the backend server, it will use the following frame format to respond with the current parameters of the command to the server. The **+QRY** frame format as the following:

Example: **+QRY:RTO,862044065055811,10,0101#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+QRY:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4		
6	Command Key	<=N		
7	Parameters	<=N		
8	Generated Time	7	YYYYMMDDHHMMSS	
9	Serial Number	2	0000 – FFFF	
10	Tail	1	#	#

✧ <*Parameters*>: The current working parameters of the terminal device. Its content is determined by 'Command Key', which is consistent with 'Parameters' in 'Configuration Command'.

3.5.2. +ALL

When the terminal receives a query all commands (**AT@RTO**) from the backend server, it will use the following frame format to respond with the current parameters of the command to the server. The **+ALL** frame format as the following:

No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+ALL:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30

1	Protocol Version	4		
2	Last Packet Flag	1	0|1	
	SIS	3		SIS
1	Report Mode	1	0 - 2	0
2	Buffer Mode	1	0 - 2	1
3	Main Server IP / Domain Name	<=60		
4	Main Server Port	<=5	0 – 65535	
5	Reserved	0		
6	Reserved	0		
7	SACK Enable	1	0 - 1	0
8	Heartbeat Interval	<=3	0|2 – 360 (min)	0
9	PDP Enable	1	0 - 1	0
10	TLS Enable	1	0 - 1	0
11	TLS Verification Mode	1	0 - 2	0
12	Connection Life	<=3	5 – 300 (sec)	5
	SSI	3		SSI
1	Report Mode	1	0 - 3	0
2	Buffer Mode	1	0 - 2	1
3	Second Server IP / Domain Name	<=60		
4	Second Server Port	<=5	0 – 65535	
5	Reserved	0		
6	Reserved	0		
7	SACK Enable	1	0 - 1	0
8	Heartbeat Interval	<=3	0|2 – 360 (min)	0
9	Reserved	0		
10	TLS Enable	1	0 - 1	0
11	TLS Verification Mode	1	0 - 2	0
12	Reserved	0		
13	Reserved	0		

	NIS	3		NIS
1	APN	<=42		
2	APN User Name	<=32	NULL	
3	APN Password	<=32	NULL	
4	Reserved	0		
5	Reserved	0		
6	Reserved	0		
7	Network Scan Mode	1	0 - 2	0
8	Search No Signal Cover	<=4	0|10 – 1440 (min)	0
	MQT	3		MQT
1	Server Index	1	0 - 1	0
2	Reserved			
3	Client ID	<=64	'0' -'9', 'a' -'z', 'A' -'Z' |'$'	$
4	User Name	<=64	ASCII String	
5	Password	<=64	ASCII String	
6	Subscribe Topic	<=64	ASCII String	
7	Subscribe QOS	1	0 - 2	
8	Publish Topic	<=64	ASCII String	
9	Publish QOS	1	0 - 2	
10	Keep Alive	<=4	0 - 3600	120
	GMT	3		GMT
1	Time Zone Direction	1	0|1	
2	Time Zone	<=2	0 - 12	
	GCS	3		GCS
1	New Password	4 - 19	'0' - '9', 'a' - 'z', 'A' - 'Z'	
2	Data Mask	<=8	(HEX)	
3	Event Data Mask	<=8	(HEX)	
4	LED Mode	1	0|1	0
5	Low Battery Threshold	<=2	5 – 30 (%)	10
6	Reserved	0		

7	GNSS Working Mode	1	0|1|3|4	1
8	GNSS Info Mask	2	0000 - FFFF	FF
9	AGPS Mode	1	0|1	0
10	ODO Enable	1	0|1	0
11	ODO Initial Mileage	<=9	0.0 – 4294967.0 (Km)	0.0
12	Hour Meter Enable	1	0|1	0
13	Initial Hour Meter Count	11	00000:00:00 - 99999:59:59	00000:00:00
14	Power Saving Mode	1	0 – 1	0
15	Charging Mode	1	0 – 1	0
	RRS	3		RRS
1	Mode	1	0 – 2	0
2	IGN GNSS Sample Interval	<=4	0 – 3600 (sec)	0
3	IGN Send Interval	<=4	1 – 3600 (sec)	30
4	IGF Send Interval	<=4	0 – 86400 (sec)	3600
5	Discard No Fix	<=1	0|1	1
6	Reserved	0		
7	Corner Angle	<=3	0|5– 90	30
8	Reserved	0		
9	Reserved	0		
10	Reserved	0		
11	Reserved	0		
12	Long Standby Start Mode	1	1 - 2	1
13	Wake Up Init Time	4	HHMM	0800
14	Wake Up Ping Interval	<=2	1|2|3|4|6|8|12|24	24
15	Wake Up Positioning Interval	<=2	1|2|3|4|6|8|12|24	24
16	Wake Up Weekly Index	<=1	1 - 7	1
17	Daily Wake Up Time Index	<=1	0 - 6	0
18	Daily Wake Up Time	4	HHMM	
	MOV	3		MOV

1	Motion Threshold	1	0 - 9	2
2	Motion Duration	<=2	1 – 10 (sec)	1
3	Stillness Duration	<=2	1 – 60 (sec)	30
4	Motion Event Report	1	0 - 1	1
	SPD	3		SPD
1	Mode	1	0|1	0
2	Over Speed Threshold	<=3	30 – 400 (km/h)	100
3	Over Speed Duration	<=4	5 – 3600 (sec)	10
4	Report Interval	<=4	30 – 3600 (sec)	60
	GEO	3		GEO
1	GEO ID	<=2	1 – 32	
2	Mode	1	0 – 1	0
3	Longitude	<=11	(–)xxx.xxxxxx	
4	Latitude	<=10	(–)xx.xxxxxx	
5	Radius	<=7	50 – 60000 (m)	50
6	Check Interval	<=5	0|5 – 3600 (sec)	0
	HBS	3		HBS
1	Mode	1	0 - 1	0
2	Acceleration Threshold	<=3	10 - 100	20
3	Acceleration Duration	<=3	10 – 250 (*8ms)	25
4	Braking Threshold	2	10 - 100	25
5	Braking Duration	<=3	10 - 250(*8ms)	25
6	Cornering Threshold	2	10 - 100	30
7	Cornering Duration	<=3	10 - 250 (*8ms)	25
	CRA	3		CRA
1	Mode	1	0 – 1	0
2	X Axis Threshold	<=2	0 – 160 (*0.1g)	50
3	Y Axis Threshold	<=2	0 – 160 (*0.1g)	50
4	Z Axis Threshold	<=2	0 – 160 (*0.1g)	50
	IGN	3		IGN

1	Reserved			
2	Reserved			
3	Reserved			
4	Reserved			
5	Virtual Ignition Mode	1	0|1	1
6	VGF Rest Duration	<=3	5 - 180(sec)	5
7	VGN Motion Duration	<=3	5 – 180(sec)	20
8	Ignition On Voltage	<=5	250 – 28000 mV	13500
9	Voltage Offset	<=4	200 – 2000 mV	600
10	Ignition On Debounce	<=3	5 – 255 (× 1 sec)	10
11	Ignition Off Debounce	<=3	5 – 255 (× 1 sec)	5
	BMS	3		BMS
1	Report Mode	1	0 - 1	0
2	Buffer Mode	1	0 - 2	1
3	BMS Server IP / Domain Name	<=60		
4	BMS Server Port	<=5	0 – 65535	
5	Connection Life	<=3	5 – 300 (sec)	5
6	Reserved	0		
7	Reserved	0		
8	Report Interval	<=5	1 – 2880 (min)	1440
9	BMR Data Mask	<=8	0 – FFFFFFFF	1
	DBG	3		DBG
1	Working Mode	1	0 - 1	0
2	Debug Info Mask	8	00000000 – FFFFFFFF	0
3	Server IP / Domain Name	<=60		
4	Server Port	<=5	0 – 65535	0
	ECL	3		ECL
1	Group Number	<=2	0 - 15	0
2	Group Mode	1	0 - 1	0

3	Reserved	0		
4	Event ID Mask	<=8	0 - FFFFFFFF	0
5	Bind Command Mask	<=8	0 - FFFFFFFF	0
6	Command ACK	0	0 - 1	0
	PCL	3		PCL
1	Preset Command ID	<=1	0 - 31	
2	Command String	<=200	AT Command | NULL	
	BSS	3		BSS
1	Scan Working Mode	1	0|1|2|3	1
2	Scan Frequency	<=5	1 – 65535 (sec)	10
3	Scan Duration	<=2	1 – 300 (100 msec)	1
4	Filter Group	1	1 – 4	
5	Group Working Mode	1	0|1	0
6	MAC address	0 - 12		
7	Data Clear Period	<=5	0 – 65535	0
8	Match & Save Group	2	<=10	10
9	EIR Data Type	2	HEX	
10	Data offset	<=2		0
11	Data Size	<=2		0
12	Action	1	0|1	0
13	I/O	<=2	0 – 12	0
14	Match	<=20	HEX	
15	Endian Type	1	0 – 1	0
16	Multiplier	<=8		0
17	Offset	<=6	-32768 – 32767	0
18	BSS Report Interval Motion	<=5	0|5 – 86400 (sec)	60
19	BSS Report Interval Motionless	<=5	0|5 – 86400 (sec)	60
	JAM	3		JAM
1	Mode	1	0 – 1	0

2	Enter Jamming Duration	<=3	0 – 60 (*Sec)	5
3	Quit Jamming Duration	<=2	0 – 60 (*Sec)	5
4	RSRP (LTE)	<=4	-140 - -44	-105
5	RSRQ (LTE)	<=3	-19 - -3	-15
6	RSSI (LTE)	<=4	-120 - -20	-40
7	MINCH (GSM)	<=2	0 - 254	5
8	SINR (GSM)	<=2	0 - 63	3
9	RSSI (GSM)	<=4	-110 - 50	-80
	TAS	3		TAS
1	Mode	1	0 – 1	0
2	Tilt Angle	<=3	30 – 100 (°)	60
3	Enter Tilt Duration	<=3	0 – 30 (*Sec)	0
4	Quit Tilt Duration	<=3	0 – 30 (*Sec)	0
1	Generated Time	7	YYYYMMDDHHMMSS	
2	Serial Number	2	0000 – FFFF	
3	Tail	1	#	#

3.5.3. +QNI

When the terminal receives a query network information command (**AT@RTO**) from the backend server, it will use the following frame format to respond with the current parameters of the command to the server. The **+QNI** frame format as the following:

Example:

2B 51 4E 49 3A 00 71 56 14 2C 06 32 37 51 01 10 30 31 30 31 2C 2C 2C 2C 2C 2C 2C 34 36 30 30 38 34 33 38 37 35 30 39 34 33 33 2C 38 39 38 36 30 34 43 33 32 31 32 32 32 30 32 31 39 34 34 38 2C 30 2C 39 39 2C 30 2C 31 30 2E 36 31 2E 33 30 2E 35 37 2C 31 33 39 2E 31 39 36 2E 32 31 39 2E 35 2C 2C 32 2C 2C 2C 2C 07 E7 08 18 08 15 32 04 DD 23

No	Parameter	Length (Byte)	Range / Format	Default
1	Head	5		+QNI:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4		

6	APN	<=42		
7	APN User Name	<=32		
8	APN Password	<=32		
9	Reserved			
10	Reserved			
11	Reserved			
12	IMSI	<=15		
13	ICCID	20		
14	CSQ RSSI	<=2	0 – 31 | 99	
15	CSQ BER	<=2	0 - 7 | 99	
16	Cell ID	4 | 8	XXXX | XXXXXXXX	
17	IP Address	<=15	(IP)	
18	Reserved			
19	Reserved			
20	Network Type	1	0|3|8	
21	Reserved			
22	Reserved			
23	Reserved			
24	Reserved			
25	Generated Time	7	YYYYMMDDHHMMSS	
26	Serial Number	2	0000 – FFFF	
27	Tail	1	#	#

✧ <*CSQ RSSI*>: The signal strength level.

CSQ RSSI	Signal Strength (dBm)
0	<-133
1	-111
2 - 30	-109 - -53
31	>-51
99	Unknow

✧ <*CSQ BER*>: The strength of the signal. The range is 0-7 and 99 means unknown.

✧ <*Cell ID*>: Cell ID in hex format.

✧ <*IP Address*>: The IP address of the device.

✧ <*Main DNS*>: The main DNS server.

✧ <*Network Type*>: Current network type.

- 0: EGPRS
- 3: CAT-1
- 8: Unknow

3.5.4. +VER

When the terminal receives a query version information command (**AT@RTO**) from the backend server, it will use the following frame format to respond with the current parameters of the command to the server. The **+VER** frame format is:

Example:
2B 56 45 52 3A 00 2F 56 14 2C 06 32 37 51 01 10 30 31 30 31 2C 30 31 30 31 31 30 2C 30 31 2C 2C 2C 2C 2C 2C 2C 07 E7 08 18 06 39 33 04 B6 23

No	Parameter	Length (Byte)	Range / Format	Default
1	Head	5		+VER:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4		
6	Firmware Version	6		
7	Hardware Version	2		
8	Reserved	0		
9	Modem Software Version	<=50		
10	Reserved			
11	Reserved			
12	Reserved			
13	Reserved			
14	Reserved			
15	Generated Time	7	YYYYMMDDHHMMSS	
16	Serial Number	2	0000 – FFFF	
17	Tail	1	#	#

✧ <*Firmware Version*>: The firmware version. The first two characters represent the major version and the last two characters represent the minor version. For example, **010B** means the version**1.11**.

- <*Hardware Version*>: The hardware version. The first two characters represent the major version and the last two characters represent the minor version. For example, **010B** means the version **1.11**.
- <*Modem Software Version*>: It gives the modem software version information of this device.

3.5.5. +GSV

After the device receives the command **AT@RTO** to get the GPS satellite information, it will send the GPS satellite information via the message **+GSV** to the backend server. The **+GSV** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+GSV:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4		
6	GPS SV Count	2	0-24	
7	SV ID	2	> =0	
8	SV Power	2	> =0	
9	…			
10	SV ID	2	> =0	
11	SV Power	2	> =0	
12	Reserved			
13	Reserved			
14	Generated Time	7	YYYYMMDDHHMMSS	
15	Serial Number	2	0000 – FFFF	
16	Tail	1	#	#

- <*GPS SV Count*>: The count of satellites the GPS finds.
- <*SV ID*>: The satellite ID. In case of no satellite, the field is filled with zero.
- <*SV Power*>: Satellite power. In case of no satellite, the field is filled with zero.

3.5.6. +LSV

After the device receives the command **AT@RTO** to get the GLONASS satellite information,

it will send the GLONASS satellite information via the message **+LSV** to the backend server. The **+LSV** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+LSV:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4		
6	GLONASS SV Count	2	0-24	
7	SV ID	2	> =0	
8	SV Power	2	> =0	
9	…			
10	SV ID	2	> =0	
11	SV Power	2	> =0	
12	Reserved			
13	Reserved			
14	Generated Time	7	YYYYMMDDHHMMSS	
15	Serial Number	2	0000 – FFFF	
16	Tail	1	#	#

✧ <*GLONASS SV Count*>: The count of satellites the GLONASS finds.

✧ <*SV ID*>: The satellite ID. In case of no satellite, the field is filled with zero.

✧ <*SV Power*>: Satellite power. In case of no satellite, the field is filled with zero.

3.5.7. +BSV

After the device receives the command **AT@RTO** to get the BEIDOU satellite information, it will send the BEIDOU satellite information via the message **+BSV** to the backend server. The **+BSV** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**

1	Head	5		+BSV:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4	(HEX)	
6	BEIDOU SV Count	2	0-24	
7	SV ID	2	> =0	
8	SV Power	2	> =0	
9	…			
10	SV ID	2	> =0	
11	SV Power	2	> =0	
12	Reserved			
13	Reserved			
14	Generated Time	7	YYYYMMDDHHMMSS	
15	Serial Number	2	0000 – FFFF	
16	Tail	1	#	#

✧ <*BEIDOU SV Count*>: The count of satellites the BEIDOU finds.

✧ <*SV ID*>: The satellite ID. In case of no satellite, the field is filled with zero.

✧ <*SV Power*>: Satellite power. In case of no satellite, the field is filled with zero.

3.5.8. +GAV

After the device receives the command **AT@RTO** to get the GALILEO satellite information, it will send the GALILEO satellite information via the message **+GAV** to the backend server. The **+GAV** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+GAV:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30

5	Protocol Version	4	(HEX)	
6	GALILEO SV Count	2	0-24	
7	SV ID	2	> =0	
8	SV Power	2	> =0	
9	…			
10	SV ID	2	> =0	
11	SV Power	2	> =0	
12	Reserved			
13	Reserved			
14	Generated Time	7	YYYYMMDDHHMMSS	
15	Serial Number	2	0000 – FFFF	
16	Tail	1	#	#

- ✧ <*GALILEO SV Count*>: The count of satellites the GALILEO finds.
- ✧ <*SV ID*>: The satellite ID. In case of no satellite, the field is filled with zero.
- ✧ <*SV Power*>: Satellite power. In case of no satellite, the field is filled with zero.

3.5.9. +BCD

After the device receives the command **AT@RTO** to get the read battery charging data, it will send the charging current and charging voltage information via the message **+BCD** to the backend server. The **+BCD** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+BCD:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x30
5	Protocol Version	4	(HEX)	
6	Charging State	1	0 - 6	
7	Charging Voltage	5	<= 12000 mV	
8	Charging Current	4	<= 3000 mA	

9	Battery Voltage	<=4	<= 4350 mV	
10	Battery Percent	<=3	1 - 100	
11	Generated Time	7	YYYYMMDDHHMMSS	
12	Serial Number	2	0000 – FFFF	
13	Tail	1	#	#

- ✧ <Charging State>: It expresses battery charging current, the unit is mA
- ✧ <Charging Voltage>: It expresses battery charging voltage, the unit is mV.
- ✧ <Charging Current>: It expresses battery charging state, check the following defined:
  - 0: Low discharge
  - 1: Normal discharge
  - 2: Normal no charge
  - 3: Start charge
  - 4: Repeat charge
  - 5: Full charge
  - 6: Charge error
- ✧ <Battery Voltage>: It expresses battery voltage, the unit is mV
- ✧ <Battery Percent>: It expresses battery power percent, the unit is %