AVT80 Tracker Protocol

R1.04

Contents

0. Revision History

Revision	Date	Author	Description of Change
1.01	2025-11-29	Sherlock	Initial
1.02	2025-11-29	Sherlock	1. Added **AT@PEO** command to support polygon fence setting. 2. Added 40: PEO Fence Alarm Event and 41: PEO Fence Over Speed Alarm Event in **+RPT** message.
1.03	2026-1-30	Sherlock	1. Added UDP mode in <*Report Mode*> of **AT@BMS** command. 2. Added <*SACK Enable*> in **AT@BMS** command.
1.04	2026-2-25	Sherlock	1. PEO ID max extend from 32 to 50. 2. Added bit23: PEO <33 - 50> Status Mask in <*Event Data Mask*> of **AT@GCS** command. 3. Added <*Ignition On - Limit Outputs Mask*> parameter in **AT@IGN** 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

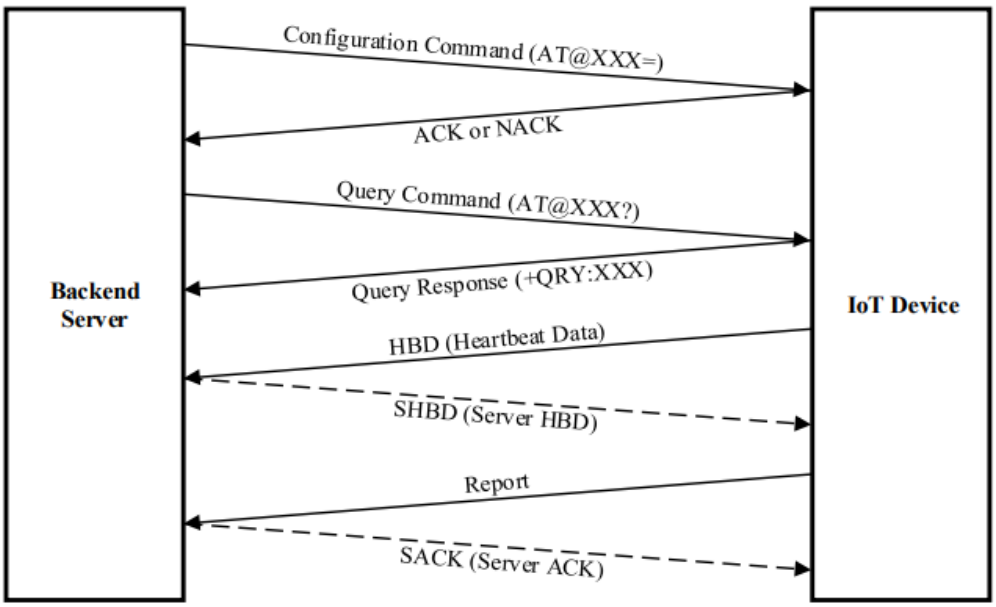
Data stream includes upstream and downstream.

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 (Main Server Information Settings)

The command **AT@SIS** is used to configure main 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	Reserved	0		
15	Reserved	0		
16	Resend Time No SACK	<=3	10 - 300	10
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.

- 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.

✧ <*Resend Time No SACK*>: It expresses the resend time of message, when the +SACK enable

and unit sent message to server, the unit never received +SACK message from server, main server and second server all controlled by <*Resend Time No SACK*>.

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.

✧ <*Message Filter Mode*>: it expresses the message filtering method to be used.

- 0: No need for filtering, all messages reporting.

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	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.

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			
5	Client ID	<=64	'0' -'9', 'a' -'z', 'A' -'Z' |'$'	$

6	User Name	<=64	ASCII String	
7	Password	<=64	ASCII String	
8	Subscribe Topic	<=64	ASCII String	
9	Subscribe QOS	1	0 - 2	
10	Publish Topic	<=64	ASCII String	
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.
  In addition, a single character '$' is defined to indicate the use of the IMEI number that will be used internally as the <*Client ID*>.
- <*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 Protocol Type	1	0	0
4	Certificate File Type	1	0 - 2	
5	Download URL	<=80	legal URL Address	
6	Serial Number	4	0000 – FFFF	
7	Tail	1	#	#

✧ <*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	Certificate File Type	1	0 - 2	
5	Total Package	<=3	1 - 255	
6	Current Package ID	<=3	1 - 255	
7	Certificate Data Length	<=3	1 - 768	
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.

✧ <*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 Length*>: the length of certificate data written to file.

✧ <*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	Low Main Power Threshold	<=5	8000 – 24000 (mV)	9000
9	GNSS Working Mode	1	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 – 2	0
17	Charging Mode	1	0 – 1	0
18	GNSS Timeout	<=4	1 – 2880 (min)	1
19	Serial Number	4	0000 – FFFF	
20	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 23	Reserved
Bit 22	Upgrade Config Information Mask
Bit 21	Reserved
Bit 20	BLE iBeacon Info Mask
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	Reserved
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 32	Reserved
Bit 23	PEO <33 - 50> Status Mask
Bit 22	Reserved
Bit 21	PEO <1 - 32> Status Mask
Bit 20	Reserved
…	…
Bit 15	Reserved
Bit 14	TLS Certificate Download Mask
Bit 13	Tilt Alarm Info Mask, this bit doesn't support configuration, when happen tilt alarm event, this bit will be enabled.
Bit 12	Crash Info Mask, this bit doesn't support configuration, when happen crash event, this bit will be enabled.
Bit 11	3Axis Self Calibration info Mask, this bit doesn't support configuration, when self-calibration success, this bit will be

	enabled.
Bit 10	Hour Meter Count Mask
Bit 9	1-wire Sensor Mask
Bit 8	ID Data Mask
Bit 7	GEO Status Mask
Bit 6	Reserved
Bit 5	Mileage Info Mask
Bit 4	Digital output Mask
Bit 3	Digital Input Mask
Bit 2	Ignition & Motion State Mask
Bit 1	Analog Input Mask
Bit 0	Main Power Mask

- <*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.
- <*Low Main Power Threshold*>: when main power voltage is lower than <*Low Main Power Threshold*>, the device will send the low main power alarm event to backend server.

  <*GNSS Working Mode*>: This parameter configures the GNSS working mode
  - 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	Fix 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 and wire ignition.
  - 2: Deep Power Saving Mode (G-sensor off): 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 only by wire ignition.
- <*Charging Mode*>: It configures the battery charging mode of the terminal.
  - 0: If the external power supply is connected, the backup battery is charged as needed.
  - 1: If the external power supply is connected, the backup battery is only charged when ignition on, the charge process will begin 3 minutes after ignition on and stop when

the ignition off.

✧ <*GNSS Timeout*>: When the ignition on state change to ignition off state and the ignition off state timer count reached GNSS timeout time and GNSS will close.

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

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

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

✧ <*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.

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 | 15| 17	
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.

- 15: **Read or clear self-calibration factor.** Get the self-calibration factor via the **+SCF** message or clear the self-calibration factor. It is used together with below:

Parameter	Length (Byte)	Range/Format	Default
SCF Action	1	0 – 1	
Reserved	0		0

- 17: **Read or clear Tilt calibration factor**. Get the tilt calibration factor via the **+TCF** message or clear the tilt calibration factor. It is used together with below:

Parameter	Length (Byte)	Range/Format	Default
TCF Action	1	0 – 1	
Reserved	0		0

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: Connect main power.
  - Bit 5: Disconnect main power.
  - Bit 6: Battery charging.
  - Bit 7: Battery no charging.
  - Bit 8: Digital input 1 off.
  - Bit 9: Digital input 1 on.
  - Bit 10: Digital output 1 off.
  - Bit 11: Digital output 1 on.
- ✧ <*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,3,1,30,0001#**				
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	Serial Number	4	0000 – FFFF	
7	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.

2.1.3.2. TOW (TOW Alarm Setting)

The **AT@TOW** command is used to configure the moving alarm parameters.

➢ **AT@TOW=**

Example: **AT@TOW=at,0,120,60,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@TOW=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0|1	0

4	Tow Duration	<=4	120 – 3600 (sec)	120
5	Tow Alarm Interval	<=4	60 – 3600 (sec)	60
6	Serial Number	4	0000 – FFFF	
7	Tail	1	#	#

✧ <*Mode*>: The working mode of tow alarm function.
- 0: Disable the tow alarm.
- 1: Enable the tow alarm.

✧ <*Tow Duration*>: This parameter is used to measure whether the vehicle is towed . when the device detects consistent movement for this period time when ignition is off, it will report tow alarm to backend server.

✧ <*Tow Alarm Interval*>: The sending interval of the tow alarm. If <*Tow Alarm Interval*> is less than 60s, the GNSS will be always on.

2.1.3.3. 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 detect 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.

2.1.3.4. 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.

2.1.3.5. PEO (Polygon Fence Setting)

The command **AT@PEO** is used to configure the parameters of PEO fence. PEO fence is a

virtual perimeter around a geographic area using a location-based service. When the terminal with PEO fencing enters or exits the area, a notification containing information about the terminal's location is generated that can be sent to the backend server.

➢ **AT@PEO=**

Example: **AT@PEO=at,1,3,121.123333,32.123456,50,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@PEO=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	PEO ID	<=2	1 – 50	
4	Mode	1	0 – 3	0
5	Start Point	<=2	1 - 32	
6	End Point	<=2	3 - 32	
7	Longitude	<=11	(–)xxx.xxxxxx	
8	Latitude	<=10	(–)xx.xxxxxx	
9	Check Interval	<=5	0|5 – 3600 (sec)	0
10	Over Speed Alarm Mode	1	0|1	0
11	Over Speed Threshold	<=3	10 – 400 (km/h)	30
12	Over Speed Duration	<=4	0 – 60 (sec)	0
13	Serial Number	4	0000 – FFFF	
14	Tail	1	#	#

✧ <*PEO ID*>: The ID of the circular Peo-Fence. It supports total 50 PEO fences.

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

- 0: Disable Peo-Fence function.
- 1: Enable only enter the PEO zone alarm.
- 2: Enable only exit the PEO zone alarm.
- 3: Enable both enter and exit the PEO zone alarm.

✧ <*Start Points*>: The starting point of the PEO Fence formed by a set of points.

✧ <*End Points*>: The end point of the PEO Fence formed by a set of points.

✧ <*Longitude*>: The longitude of a point which is defined as the center of the PEO 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 PEO 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.

- <*Check Interval*>: The interval of GNSS checking position information against the PEO fence alarm. Different PEO fences used different check interval.
- <*Over Speed Alarm Mode*>: it's the mode of over speed alarm with PEO fence.
- <*Over Speed Threshold*>: it's the over speed threshold with PEO fence.
- <*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 PEO over speed alarm to backend server. If <*Over Speed Duration*> is equal to 0, device will report PEO over speed alarm immediately.

2.1.3.6. HBS (Harsh Behavior Setting)

The command **AT@HBS** is used to monitor the harsh driving behavior based on motion sensor.

- **AT@HBS=**

Example: **AT@HBS=at,1,3,121.123333,32.123456,50,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@HBS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0 - 1	0
4	Acceleration Threshold	<=3	10 - 100	20
5	Acceleration Duration	<=3	10 – 250 (*8ms)	25
6	Braking Threshold	2	10 - 100	25
7	Braking Duration	<=3	10 - 250(*8ms)	25
8	Cornering Threshold	2	10 - 100	20
9	Cornering Duration	<=3	10 - 250 (*8ms)	25
10	Serial Number	4	0000 – FFFF	
11	Tail	1	#	#

- <*Mode*>: The working mode of the harsh behavior monitoring function.
  - 0: Disable this function.
  - 1: Enable this function.
- <*Acceleration Threshold*>: The threshold for the 3-axial acceleration data measure whether the device is in harsh acceleration status.
- <*Acceleration Duration*>: The time parameter to measure whether the device enters harsh acceleration status. If the driving behavior is maintained for a period of time longer than the time defined by <*Acceleration Duration*>, harsh acceleration event will be triggered.
- <*Brake Threshold*>: The threshold for the 3-axial acceleration data measure whether the device is in harsh braking status.
- <*Brake Duration*>: The time parameter to measure whether the device enters harsh braking status. If the driving behavior is maintained for a period of time longer than <*Brake Duration*>,

harsh braking event will be triggered.

- ✧ <*Cornering Threshold*>: The threshold for the 3-axial acceleration data measure whether the device is in harsh cornering.
- ✧ <*Cornering Duration*>: The time parameter to measure whether the device enters harsh cornering status. If the driving behaviors are maintained for a period of time longer than the time defined by <*Cornering Duration*>, harsh cornering event will be triggered.

2.1.3.7. CRA (Crash Detection Setting)

The command **AT@CRA** is used to configure crash detection parameters.

- ➢ **AT@CRA=**

Example: **AT@CRA=at,1,4.0,,,,,,,,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@CRA=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0 – 1	0
4	X Axis Threshold	<=2	0 – 160 (*0.1g)	50
5	Y Axis Threshold	<=2	0 – 160 (*0.1g)	50
6	Z Axis Threshold	<=2	0 – 160 (*0.1g)	50
7	Serial Number	4	0000 – FFFF	
8	Tail Character	1	#	#

- ✧ <*Mode*>: The working mode of the crash detection function.
  - 0: Disable this function.
  - 1: Enable this function, it only works when Ignition is on.
- ✧ <*X Axis Threshold*>: The acceleration threshold for crash in X direction. The smaller value it is, the more sensitive to detect crash event. If <*X Axis Threshold*> is 0, the device will not monitor crash event in X axis. The unit is 0.1g.
- ✧ <*Y Axis Threshold*>: The acceleration threshold for crash in Y direction. The smaller value it is, the more sensitive to detect crash event. If <*Y Axis Threshold*> is 0, the device will not monitor crash event in Y axis. The unit is 0.1g.
- ✧ <*Z Axis Threshold*>: The acceleration threshold for crash in Z direction. The smaller value it is, the more sensitive to detect crash event. If <*Z Axis Threshold*> is 0, the device will not monitor crash event in Z axis. The unit is 0.1g.

2.1.3.8. JAM (Jamming Alarm Setting)

The command **AT@JAM** is used to configure jamming detection and alarm parameters. Jamming alarm function need work with normal power saving mode of <*Power Saving Mode*> in

AT@GCS command, because other power saving mode, the network module is off when the ignition off state and effect jamming detection function.

➢ **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	-50
9	Serial Number	4	0000 – FFFF	
10	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.

2.1.3.9. TAS (Tilt Alarm Setting)

The command **AT@TAS** is used to configure tile alarm parameters.

➢ **AT@TAS=**

Example: **AT@TAS=at,1,60,5,5,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@TAS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at

3	Mode	1	0 – 1	0
4	Tilt Angle	<=3	30 – 100 (°)	60
5	Enter Tilt Duration	<=3	0 – 30 (*Sec)	0
6	Quit Tilt Duration	<=3	0 – 30 (*Sec)	0
7	Serial Number	4	0000 – FFFF	
8	Tail Character	1	#	#

✧ <*Mode*>: The working mode of the tilt detection function.
- 0: Disable this function.
- 1: Enable this function.

✧ <*Tilt Angle*>: It expresses the threshold of tilt angle.

✧ <*Enter Tilt Duration*>: The time parameter to measure whether the device enters tilt alarm status. If the current tilt angle more than <*Tilt Angle*>, and it is maintained for a period time longer than the time defined by <*Enter Tilt Duration*>, enter tilt alarm event will be triggered. If <*Enter Tilt Duration*> set as 0, device detected enter tilt, the unit will report enter tilt alar event at once.

✧ <*Quit Tilt Duration*>: The time parameter to measure whether the device quits tilt alarm status. If the current tilt angle less and qual than <*Tilt Angle*>, and it is maintained for a period time longer than the time defined by <*Enter Tilt Duration*>, enter tilt alarm event will be triggered.
If <*Quit Tilt Duration*> set as 0, device detected quit tilt, the unit will report enter tilt alar event at once.

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	Wire Ignition Mode	1	0|1	1
4	IGN Debounce Time	<=2	0 – 20 (*10ms)	5
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	Ignition On Voltage	<=5	250 – 28000 mV	13500
11	Voltage Offset	<=4	200 – 2000 mV	600
12	Ignition On Debounce	<=3	5 – 255 (× 1 sec)	10
13	Ignition Off Debounce	<=3	5 – 255 (× 1 sec)	5
14	Ignition On - Limit Outputs Mask	4	0000 – FFFF	0
15	Serial Number	4	0000 – FFFF	
16	Tail Character	1	#	#

- <*Wire Ignition Mode*>: The working mode of wire ignition.
  - 0: Disable the wire ignition function.
  - 1: Enable the wire ignition function.
- <*IGN Debounce Time*>: The time for interruptible ignition port debouncing.
- <*Virtual Ignition Mode*>: A numeral to define the working mode of detecting virtual ignition state.
  - 0: Disable the virtual ignition detection function
  - 1: Enable the virtual ignition detection function, detection by G-sensor and vehicle voltage combo.
  - 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*>.
- <*Ignition On Voltage*>: The external power voltage in ignition on state. Different vehicles have different voltage in ignition on state. This parameter should be set very close to the original external power, so that the device can detect ignition event more accurately.
- <*Voltage Offset*>: The offset from <*Ignition On Voltage*> used to determine ignition on or ignition off state. If the voltage of the external power is higher than <*Ignition On Voltage*> - <*Voltage Offset*> and is maintained for <*Ignition On Debounce*> seconds, the device will consider it as virtual ignition on state. If the voltage of the external power is lower than <*Ignition On Voltage*> - <*Voltage Offset*> and is maintained for <*Ignition Off Debounce*> seconds, the device will consider it as virtual ignition off state.
- <*Ignition On Debounce*>: The debounce time before updating virtual ignition on state according to the external power voltage. Unit: second.

Note: The device may adjust the <*Ignition On Voltage*> and <*Voltage Offset*> value automatically

by measuring the external power voltage data to make the ignition detection more precisely.

- <*Ignition Off Debounce*>: The debounce time of the virtual ignition off voltage.
- <*Ignition On - Limit Outputs Mask*>: It defines each output bit whether allow to control the corresponding output state when the device is ignition on. If <*Ignition On - Limit Outputs Mask*> set to 1, current state is ignition on, when send **AT@OUT** command to change output1 state or event trigger output1, output1 will not change state immediately, after the unit enter into ignition off state, the output1 will start change state.
  - Bit0: Output1.
  - Bit1: Output2.

2.1.4.2. DAM (Digital and Analog Input Multiplexing Setting)

The command **AT@DAM** is used to configure the input to work as analog input or digital input.

- **AT@DAM=**

Example: **AT@DAM=at,1,0,2,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@DAM=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Reserved	1		
4	Input Mode	1	0 – 2	0
5	Debounce Time	<=2	0 – 20 (*10ms)	2
6	Validity Time	<=2	0|1 – 12 (*2s)	0
7	Delta AIS Threshold	<=4	0 – 10 (*100mV)	0
8	Delta AIS Duration	<=2	0 – 12 (*1s)	0
9	Serial Number	4	0000 – FFFF	
10	Tail Character	1	#	#

- <*Input Mode*>: The working mode of multiplexing input port.
  - 0: Disable input mode.
  - 1: Digital input mode (negative trigger).
  - 2: Analog input mode.
- <*Debounce Time*>: The time for interruptible input port debouncing.
- <*Validity Time*>: The validity time of the input port. 0 means “Do not check the validity time”.
- <*Delta AIS Threshold*>: The threshold for the delta analog input. 0 means “Do not check delta AIS threshold”.
- <*Delta AIS Duration*>: The duration for the delta analog input. 0 means “Do not check delta AIS duration”, if the unit meet <*Delta AIS Threshold*>, the unit will trigger “delta AIS alarm event” of **+RPT** message at once.

Note: If the difference between the analog quantity read in the previous steady-state value and the current reading is greater than <*Delta AIS threshold*> parameter and this state lasts for <*Delta AIS Duration*>, the device will trigger "delta AIS alarm event" of **+RPT** message.

Note: <*Debounce Time*> and <*Validity Time*> parameters only use for digital input mode. <*Delta AIS Threshold*> and <*Delta AIS Duration*> parameter only use for analog input mode.

2.1.4.3. OUT (Digital Output Setting)

The **AT@OUT** command is used to output specified wave shape from the digital output ports. A total of four wave shapes are supported as shown below. If set to wave shape 1, the device will maintain this wave shape at the specified output port after power reset.

The digital output 1 is a latched output. The final status of the output will be latched during power off.

If a specified output port is set to wave shape 4, then the port will output square wave. When the main power is off, the port will stop outputting the wave; if the main power is turned on again, the port will start to output the wave again. If the device is rebooted, the port will still output the wave.

Wave Shape 1:

✓ <*Duration*> = 0ms, <*Toggle Times*> = 0

Figure 1: Wave Shape 1

Wave Shape 2:

✓ <*Duration*> = 500ms, <*Toggle Times*> = 1

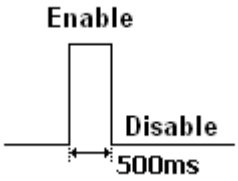


Figure 2: Wave Shape 2

Wave Shape 3:

✓ <*Duration*> = 800ms, <*Toggle Times*> = 3

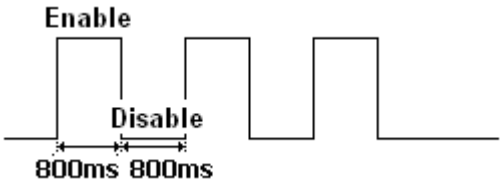


Figure 3: Wave Shape 3

Wave Shape 4:

✓ <*Duration*> = 800ms, <*Toggle Times*> = 0

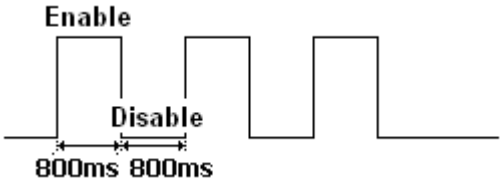


Figure 4: Wave Shape 4

➢ **AT@OUT=**

Example: **AT@OUT=at,1,0,2,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@OUT=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Output Number	1	1 - 2	
4	Output ID	1	1 - 2	
5	Output Status	1	0 – 1	
6	Duration	<=3	0 – 255 (*100ms)	
7	Toggle Times	<=3	0 – 255	
8	Serial Number	4	0000 – FFFF	
9	Tail Character	1	#	#

✧ <*Output Number*>: A numerical to indicate the number of output ports to be set.

✧ <*Output ID*>: A numerical to indicate the ID of output ports.

✧ <*Output Status*>: Valid only for the wave shape 1 as shown in **Figure 1** and used to set the final status of the output port.

- 0: Disable status.
- 1: Enable status.

✧ <*Duration*>: Please refer to **Figure 1, Figure 2, Figure 3** and **Figure 4**. Unit: 100ms.

✧ <*Toggle Times*>: Please refer to **Figure 1, Figure 2, Figure 3** and **Figure 4**.
When <*Duration*> is set to 0, <*Toggle Times*> must be set to 0 rather than other values. Otherwise, the command is invalid.

2.1.4.4. AOS (Alarm Output Setting)

The **AT@AOS** command is used to alarm event output specified wave shape from the digital output ports. Such as GEO fence alarm event, over speed alarm event, Harsh Behavior event and Driver ID authorization event.

➢ **AT@AOS=**

Example: **AT@AOS=at,7,1,0,2,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@AOS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Alarm OUT1 Trigger Mask	<=8	0 – FFFFFFFF	0
4	Output ID	1	1	1
5	Output Status	1	0 – 1	
6	Duration	<=3	0 – 255 (*100ms)	
7	Toggle Times	<=3	0 – 255	
8	Output1 Alarm Report	1	0 – 1	0
9	Alarm OUT2 Trigger Mask	<=8	0 – FFFFFFFF	0
10	Output ID	1	2	2
11	Output Status	1	0 – 1	
12	Duration	<=3	0 – 255 (*100ms)	
13	Toggle Times	<=3	0 – 255	
14	Output2 Alarm Report	1	0 – 1	0
15	Serial Number	4	0000 – FFFF	
16	Tail Character	1	#	#

✧ <*Alarm OUT1 Trigger Mask*>: Component mask of the alarm output1 trigger.

- Bit 0: (AT@GEO) Quit GEO fence alarm event.
- Bit 1: (AT@GEO) Enter GEO fence alarm event.
- Bit 2: (AT@SPD) Over speed alarm event.
- Bit 3: (AT@HBS) Harsh Behavior alarm event.
- Bit 4: (AT@DRV) Driver ID authorization event based on relay.
- Bit 5: (AT@DAM) negative trigger input 1 On event.
- Bit 6: (AT@DAM) negative trigger input 1 Off event.

- Bit 7: (AT@JAM) Jamming On event.
- Bit 8: (AT@BWS) BLE iBeacon Whitelist Scanned valid accessory.
- Bit 9: (AT@DRV) Driver ID authorization control buzzer based on Ignition wire.
- Bit 10: (AT@PEO) Quit PEO fence alarm event.
- Bit 11: (AT@PEO) Enter PEO fence alarm event.
- Bit 12: (AT@PEO) PEO over speed alarm event.

✧ <*Output1 Alarm Report*>: it will control "output alarm event" of **+RPT** whether report to server, when state of output wave 1 change.

- 0: Disable Report.
- 1: Enable Report.

✧ <*Alarm OUT2 Trigger Mask*>: Component mask of the alarm output2 trigger.

- Bit 0: (AT@GEO) Quit GEO fence alarm event.
- Bit 1: (AT@GEO) Enter GEO fence alarm event.
- Bit 2: (AT@SPD) Over speed alarm event.
- Bit 3: (AT@HBS) Harsh Behavior alarm event.
- Bit 4: (AT@DRV) Driver ID authorization event based on relay .
- Bit 5: (AT@DAM) negative trigger input 1 On event.
- Bit 6: (AT@DAM) negative trigger input 1 Off event.
- Bit 7: (AT@JAM) Jamming On event.
- Bit 8: (AT@BWS) BLE iBeacon Whitelist Scanned valid accessory.
- Bit 9: (AT@DRV) Driver ID authorization control buzzer based on Ignition wire.
- Bit 10: (AT@PEO) Quit PEO fence alarm event.
- Bit 11: (AT@PEO) Enter PEO fence alarm event.
- Bit 12: (AT@PEO) PEO over speed alarm event.

✧ <*Output2 Alarm Report*>: it will control "output alarm event" of **+RPT** whether report to server, when state of output wave 1 change.

- 0: Disable Report.
- 1: Enable Report.

2.1.5. 1wire

2.1.5.1. WAS (1wire Application Setting)

The command **AT@WAS** is used to configure the parameters of 1-wire devices including iButton and temperature sensors.

➢ **AT@WAS=**

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

3	iButton Timer	<=2	0 – 10 (sec)	0
4	Temperature Timer	<=3	0|10 – 255 (sec)	0
5	1wire Data Mask	<=2	00 – FF	0
6	Serial Number	4	0000 – FFFF	
7	Tail Character	1	#	#

- <*iButton Timer*>: The check interval of searching the iButton ID.
  Note: The sequence of iButton ID is in reverse order of the ID on iButton. The ID structure is composed of <*1 byte family ID*> + <*6 bytes serial number*> + <*1 byte CRC*>. Thus, the first byte of the ID number represents iButton's family ID. For example, if the ID on iButton is 12 345678901234 01, then the actual iButton ID is 01 341290785634 12.
- <*Temperature Timer*>: The interval of reading the temperature sensor value. If more than one temperature sensors are connected, the device will read the temperature sensors one by one at the interval specified by <Temperature Timer>. 0 means “Disable temperature detection”.
- <*1wire Data Mask*>: it controls which 1wire data will be reported when the bit 9 of <Event Data Mask> in the AT@GCS command is enabled.
  - Bit 0: Temperature Mask.
  - Bit 1: Humidity Mask.

2.1.5.2. WOS (1wire Alarm Output Setting)

The **AT@WOS** command is used to alarm event output specified wave shape from the 1wire output ports. Such as GEO fence alarm event, over speed alarm event, Harsh Behavior event and Driver ID authorization event.

- **AT@WOS=**

Example: **AT@WOS=at,7,1,0,2,0,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@WOS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	AWR201 Buzzer Trigger Mask	<=8	0 – FFFFFFFF	0
4	Output ID	1	1	1
5	Output Status	1	0 – 1	
6	Duration	<=3	0 – 255 (*100ms)	
7	Toggle Times	<=3	0 – 255	
8	Reserved	0		
9	Serial Number	4	0000 – FFFF	
10	Tail Character	1	#	#

✧ <*AWR201 Buzzer Trigger Mask*>: Component mask of the alarm output trigger.

- Bit 0: (AT@GEO) Quit GEO fence alarm event.
- Bit 1: (AT@GEO) Enter GEO fence alarm event.
- Bit 2: (AT@SPD) Over speed alarm event.
- Bit 3: (AT@HBS) Harsh Behavior alarm event.
- Bit 4: Reserved.
- Bit 5: (AT@DAM) negative trigger input 1 On event.
- Bit 6: (AT@DAM) negative trigger input 1 Off event.
- Bit 7: (AT@JAM) Jamming On event.
- Bit 8: Reserved.
- Bit 9: (AT@DRV) Driver ID authorization control buzzer based on Ignition wire.
- Bit 10: (AT@PEO) Quit PEO fence alarm event.
- Bit 11: (AT@PEO) Enter PEO fence alarm event.
- Bit 12: (AT@PEO) PEO over speed alarm event.

✧ <*Output ID*>: refer to the following output id defined.

- 1: the buzzer of AWR201.

2.1.5.3. DRV (Driver ID Setting)

The command **AT@DRV** is used to driver ID authorization. In order to us this function, we need get the driver ID by iButton/RFID reader/BLE Beacon and control the engine starter by external relay. When the device gets an ID, It will check if the ID is in the white list. If yes, It will be authorized to start the engine. At the same time, it will report this ID to the backend server. The drivers need to scan their IDs each time before they start the engine.

➢ **AT@DRV=**

Example: **AT@DRV=at,1,10,0001#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@DRV=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Mode	1	0|1|2	0
4	Reserved	0		
5	Start Index	<=3	1 – 1024	
6	End Index	<=3	1 – 1024	
7	ID Number List	<=16*28	'0' – '9','a' – 'f', 'A' – 'F' | "NULL"	
8	ID Authorized Validity Time	<=3	15 – 600 (sec)	30
9	Authorized Timeout after IGF	<=3	0|15 – 600 (sec)	30
10	DRV Report Mode	1	0 – 7	7

11	Serial Number	4	0000 – FFFF	
12	Tail Character	1	#	#

- <*Mode*>: The working mode of the ID authentication function.
  - 0: Disable function.
  - 1: Enable function, only authorized ID cards can start the engine.
  - 2: Enable function, any ID card can unlock the vehicle.
- <*Start Index*>, <*End Index*>: The index range of the driver ID white list. For example, if <*Start Index*> is set to 1 and <*End Index*> is set to 2, then the first two ID numbers in the white list will be updated by the numbers provided in the parameter <*ID Number List*>. <*Start Index*> and <*End Index*> determine the total amount of ID numbers that will be updated. If any of them is blank, there should be no <*ID Number List*> updated in the blank value. Maximum of 8 numbers can be updated each time.
- <*ID Number List*>: A list of comma-separated ID numbers to be updated to the white list. The quantity of the ID numbers is determined by <*Start Index*> and <*End Index*>.
- **Note:** If more ID Numbers are needed, please adjust <*Start Index*> and <*End Index*> for appropriate setup. If some ID Numbers in <*ID Number List*> are blank, then the corresponding ID Numbers will be deleted. For example, to delete the 4th, 5th and 6th ID Numbers of the <*ID Number List*>, please set <*Start Index*> to 4 and set <*End Index*> to 6 and keep the three ID Numbers of <ID Number List> blank.
- <*ID Authorized Validity Time*>: It will remain authorized for this period time, when the ID is valid. If the driver has not trigger ignition on in the <*ID Authorized Validity Time*> period time of after authorized ID, the driver needs re-swipe card to be authorized.
- <*Authorized Timeout after IGF*>: It is the timeout to quit the authorization after ignition off. Drivers don't need to scan the ID within this period time to start the engine again.
- <*DRV Report Mode*>: The mode of reporting authorized ID.
  - Bit 0: Report the ID which is authorized.
  - Bit 1: Report the ID which is unauthorized.
  - Bit 2: Report the ID which has logged out.

2.1.6. BLE

2.1.6.1. 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	iBeacon UUID Filter Group	1	5	5
21	Filter by iBeacon UUID Enable	1	0 – 1	0
22	iBeacon Lost Count	<=2	1 – 60	6
23	UUID number	<=2	0 – 10	0
24	UUID String	32		
25	iBeacon Info Mask	<=2	00 - FF	
26	Beacon MAC Whitelist Group	1	6	6
27	Check BWS MAC Whitelist	1	0 - 1	0
28	Beacon Event Report	1	0 - 1	0
29	Data Clear Period	<=5	0 – 65535	0
30	Match & Save Group	2	<=10	10
31	EIR Data Type	2	HEX	
32	Data offset	<=2	0 - 99	0

33	Data Size	<=2	0 - 20	0
34	Action	1	0|1	0
35	I/O	<=2	0 - 13	0
36	Match	<=20	HEX	
37	Endian Type	1	0 – 1	0
38	Multiplier	<=8		0
39	Offset	<=6	-32768 – 32767	0
40	BSS Report Interval Motion	<=5	0|5 – 86400 (sec)	60
41	BSS Report Interval Motionless	<=5	0|5 – 86400 (sec)	60
42	Serial Number	4	0000 – FFFF	
43	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.

✧ <*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.

✧ <*iBeacon UUID Filter Group*>: It expresses group 5 used for iBeacon UUID filter.

✧ <*Filter by iBeacon UUID Enable*>: It expresses enable the function of filter by iBeacon UUID.

- 0: Disable filter UUID.
- 1: Enable filter UUID.

✧ <*iBeacon Lost Count*>: The terminal will send "BLE iBeacon Info Event" of +RPT message, when the iBeacon is lost or be scanned within <iBeacon Lost Count> * <Scan Frequency> seconds.

✧ <*UUID Number*>: It expresses need filter the number of iBeacon UUID.

✧ <*UUID String*>: It expresses filter the proximity UUID of iBeacon, this UUID consist of 16 bytes.

✧ <*iBeacon Info Mask*>: This mask using for control show iBeacon information in "BLE iBeacon Info Event" of **+RPT** message, bitwise masks refer to the following:

Mask Bit	Item	Description
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Battery Level	
Bit 4	Tx Power	
Bit 3	Minor	

Bit 2	Major	
Bit 1	UUID	
Bit 0	MAC Address	

✧ <*Check BWS MAC Whitelist*>: It expresses whether checked the MAC whitelist of **AT@BWS** command.

- 0: Disable check MAC whitelist of **AT@BWS**.
- 1: Enable check MAC whitelist of **AT@BWS**.

✧ <*Beacon Event Report*>: It expresses whether report beacon lost or scanned event by MAC whitelist of **AT@BWS** command, such as "BLE Accessory Lost Event" and "BLE Accessory Scanned.

- 0: Disable Report.
- 1: Enable Report.

2.1.6.2. BWS (BLE Beacon Whitelist Setting)

The command **AT@BWS** is used to BLE Beacon whitelist setting.

➢ **AT@BWS=**

Example: **AT@BWS=at,1,,,,,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@BWS=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Reserved	0		
4	Reserved	0		
5	Start Index	<=3	1 - 256	
6	End Index	<=3	1 - 256	
7	MAC Number List	<=12*32		
8	Serial Number	4	0000 – FFFF	
9	Tail	1	#	#

✧ <*Start Index*>, <*End Index*>: The index range of the driver ID white list. For example, if <*Start Index*> is set to 1 and <*End Index*> is set to 2, then the first two ID numbers in the white list will be updated by the numbers provided in the parameter <*ID Number List*>. <*Start Index*> and <*End Index*> determine the total amount of ID numbers that will be updated. If any of them is blank, there should be no <*MAC Number List*> updated in the blank value. Maximum of 8 numbers can be updated each time.

✧ <*MAC Number List*>: A list of comma-separated ID numbers to be updated to the white list. The quantity of the ID numbers is determined by <*Start Index*> and <*End Index*>.

2.1.6.3. 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: 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.

2.1.6.4. 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: 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.

2.1.7. OTA

2.1.7.1. 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| 3	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: APP firmware of main MCU.
- 2: Network Module.
- 3: Boot firmware of main MCU.

2.1.7.2. UPC (OTA Upgrade Configuration)

The command **AT@UPC** is used to update the configuration over the air.

➢ **AT@UPC=**

Example: **AT@UPC=at,1,,,,,,FFFF#**				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	7	ASCII	AT@UPC=
2	Password	2 - 19	'0' -'9', 'a' -'z', 'A' -'Z'	at
3	Working Mode	1	1	1
4	Reserved	1	0	0
5	Reserved	0		
6	Download URL	<=80	legal URL Address	
7	Serial Number	4	0000 – FFFF	
8	Tail	1	#	#

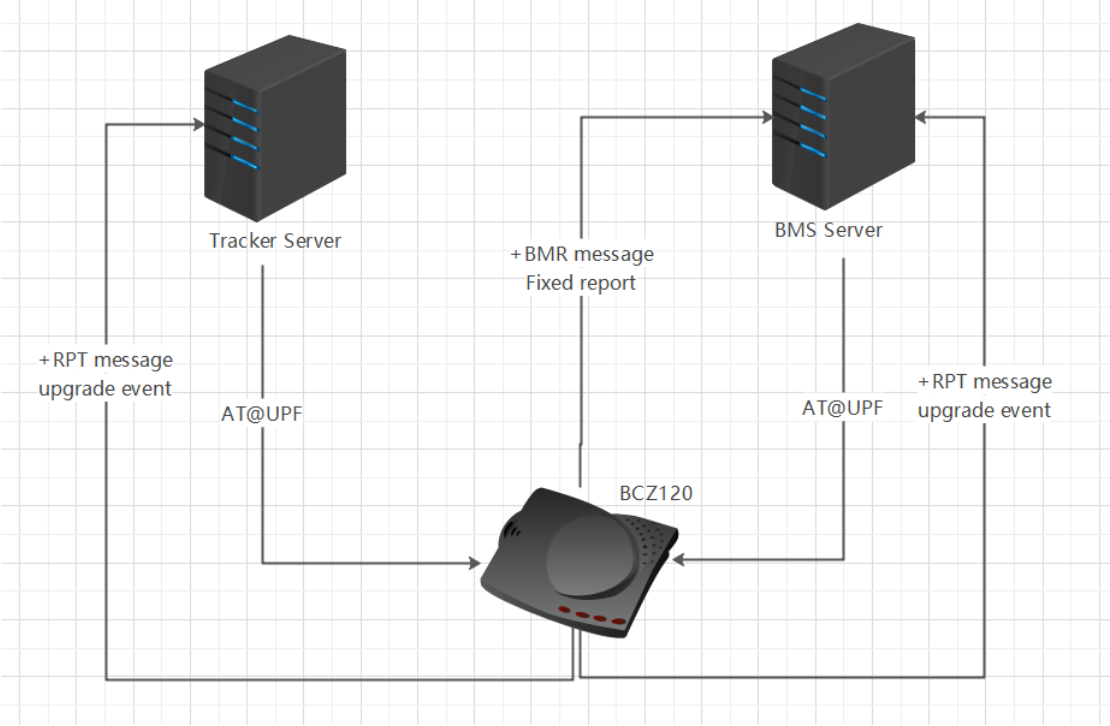
✧ <*Working Mode*>: The working mode of the firmware upgrade.

- 1: Start firmware upgrade.

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

2.1.7.3. 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 - 2	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	SACK Enable	1	0 - 1	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.
- 2: UDP mode, the device and BMS server will transmit data by UDP 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.

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

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

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

Mask Bit	Item
Bit 31	Reserved
…	…
Bit 10	Reserved
Bit 9	BOOT Firmware of Main MCU Mask
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	Main Power Mask

2.1.8.DEBUG

2.1.8.1. 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 13	Reserved
Bit 12	1wire Log
Bit 11	Harsh Behavior Log
Bit 10	Crash Log
Bit 9	Self-correcting log
Bit 8	Reserved

Bit 7	Network Log
Bit 6	HTTP Log
Bit 5	G-sensor Log
Bit 4	Input and output 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	#	#

Note:

If query command sent by server, the corresponding command parameters will response to server. If query command sent by mobile SMS, the corresponding command parameters will response to mobile SMS.

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

'**+RPT'** is real-time reports, which is generated and sent successfully in 3 minutes.
'-RPT' 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	0x26	0x26
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	**Bit 3:** GNSS Information
2	GNSS number	1	1 - 40	
3	**Bit0 :** GNSS Fixing Type	1	(0,1) | (0,2,3)	
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	Upgrade Code	1		**Bit 7:** Upgrade information
2	Reserved	2		
	Event Data Mask	4		**Bit 8:** Event Data Mask
1	**Bit 0:** Main Power VCC	2	0 – 10000 (*10mV)	
1	**Bit 1:** Analog Input Number	1	1	
2	**Bit 1:** Analog Input Voltage	2	0 – 16000 (mV)	
1	**Bit 2:** Ignition & Motion State	1		
1	**Bit 3:** Digital Input State	1	0x00 – 0x03	
1	**Bit 4:** Digital Output State	1	0x00 – 0x01	
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 8** ID Length	1		
2	**Bit 8:** ID Data	n		
1	**Bit 9:** 1wire Number	1	0 – 4	
2	**Bit 9:** 1wire Sensor ID	8		
3	**Bit 9:** 1wire Data Mask	1	00 – FF	
4	**Bit 9:** 1wire Temperature (Optional)	2	-550 – 1250 (* 0.1℃)	
5	**Bit 9:** 1wire Humidity (Optional)	1	1 – 100 (%)	
1	**Bit 10:** Current Hour Meter Count	3	HHMMSS	
2	**Bit 10:** Total Hour Meter Count	5	HHHHHHMMSS	
1	**Bit 11:** ASC X Forward	1	-100 – 100	
2	**Bit 11:** ASC Y Forward	1	-100 – 100	
3	**Bit 11:** ASC Z Forward	1	-100 – 100	
4	**Bit 11:** ASC X Horizontal	1	-100 – 100	
5	**Bit 11:** ASC Y Horizontal	1	-100 – 100	
6	**Bit 11:** ASC Z Horizontal	1	-100 – 100	
7	**Bit 11:** ASC X Gravity	1	-100 – 100	

8	**Bit 11:** ASC Y Gravity	1	-100 – 100	
9	**Bit 11:** ASC Z Gravity	1	-100 – 100	
1	**Bit 12:** Crash Counter	1	00 – FF	
2	**Bit 12:** ASC Status	1	0 – 2	
3	**Bit 12:** Crash X Value	2	-1311 – 1312	
4	**Bit 12:** Crash Y Value	2	-1311 – 1312	
5	**Bit 12:** Crash Z Value	2	-1311 – 1312	
1	**Bit 13:** Tilt Angle	1	0 – 180	
2	**Bit 13:** Install Position X Axle	2	-1311 – 1312	
3	**Bit 13:** Install position Y Axle	2	-1311 – 1312	
4	**Bit 13:** Install position Z Axle	2	-1311 – 1312	
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 21:** PEO <1 - 32> Status	4	00000000 - FFFFFFFF	
1	**Bit 23:** PEO <33 - 50> Status	4	00000000 - FFFFFFFF	
	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 Level (mV / %)	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		
	iBeacon Info Mask	1	00 - FF	**Bit20:** BLE iBeacon Info Mask
	iBeacon Number	1	0 - 10	
1	MAC Address	6		
2	UUID	16		
3	Major	2		
4	Minor	2		
5	Tx Power	1		
6	Battery Level	1		
1	Command ID	2		**Bit22:**
2	Upgrade CFG Code	1		

3	Download URL Length	1		Upgrade Config Information Mask
4	Download URL	<=80		
5	Reserved	4	00000000	
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 ~ 6	Reserved
7	Crash Alarm Event
8 – 10	Reserved
11	Upgrade Firmware Event
12	External Temperature Alarm Event
13	Ignition Event
14	Main Power Alarm Event
15	Tow Alarm Event
16	Over Speed Alarm Event
17 - 18	Reserved
19	Harsh Behavior Alarm Event
20	G-Sensor Self-Calibration Event
21	Geo Fence Alarm Event

22	Digital Input Event
23	ID Authorized Event
24 – 26	Reserved
27	Output Alarm Event
28	Delta AIS Alarm Event
29	PDP Alarm Event
30	BLE Common info Event
31	External Humidity Alarm Event
32	Jamming Alarm Event
33	Tilt Alarm Event
34	BLE iBeacon Info Event
35	TLS Certificate File Download Event
38	Upgrade Configuration Event
39	GNSS Spoofing Alarm Event
40	PEO Fence Alarm Event
41	PEO Fence Over Speed 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
10	Power on with upgrade firmware

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

Event State	Item
0	Regular Report
1	RTO request position

(**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 11)** Upgrade Firmware Event:

Event State	Item
1	APP Firmware of Main MCU Upgrade
5	Network Module Upgrade
6	BOOT Firmware of Main MCU 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	1wire Sensor	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 inside the temperature range.

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

Event State	Item
1	Wired ignition off
2	Wired ignition on
3	Virtual ignition off
4	Virtual ignition on

(**Event Type 14)** Main Power Alarm Event:

Event State	Item
1	Disconnect the main power supply
2	Connect the main power supply
3	The low main power alarm

(**Event Type 15)** TOW Alarm Event:

Event State	Item
1	Enter TOW State
2	Quit TOW State

(**Event Type 19)** Harsh Behavior Alarm Event:

Event State	Item
1	Harsh braking behavior
2	Harsh acceleration behavior
3	Harsh cornering behavior
4	Harsh braking and cornering behavior
5	Harsh acceleration and cornering behavior

(**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 22)** Digital Input Event:

Event State	Item
1	Digital Input 1 On
2	Digital Input 1 Off

(**Event Type 23)** ID Authorized Event:

Event State	Item
1	ID Authorized Disable
2	ID Unauthorized
3	ID Authorized
4	ID Authorized-timeout
5	ID Authorized-logout

(**Event Type 27)** Output Alarm Event:

Event state data zone consists of output trigger id and output trigger state. Bit 2 to Bit 7 is output trigger id, bit 0 to bit 1 is output trigger state.

Bit 2 ~ Bit 7 Output Trigger ID	Item	Bit 0 ~ Bit 1 Output Trigger State	Item
0	Output 1	0	Output State Off
1	Output 2	1	Output State ON

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

Event State	Item
0	Regular Report
1	Door State Change Event
2	BLE Accessory Lost Event
3	BLE Accessory Scanned 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	1wire Sensor	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 33)** Tilt Alarm Event:

Event State	Item
1	Enter Tilt State
2	Quit Tilt State

- **(Event Type 40)** PEO Fence Alarm Event:

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

- **(Event Type 41)** PEO Fence Over Speed Alarm Event:

Event State	Item
1	Enter Over Speed Alarm
2	Quit Over Speed Alarm

- <*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.
- <*MNC*>: Mobile network code.
- <*LAC*>: Location area code.
- <*Cell ID*>: Cell ID of base station.
- <*CSQ*>: The signal strength level.

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.

✧ <*Main Power VCC*>: The voltage of the main power supply, the unit is 10mV.

✧ <*Analog Input Number*>: The number of the analog input.

✧ <*Analog Input Voltage*>: The voltage of the analog input.

✧ <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.

✧ <Digital Input State>: The status of ignition detection and digital input1

Digital Input State	
Bit 0	**Ignition Detection**
Bit 1	**Digital Input1**

✧ <Digital Output State>: The status mask of digital output1.

Digital Output State	
Bit 0	**Digital Output1**
Bit 1	**Digital Output2**

✧ <*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.

- <*ID Length*>: The length of RFID or ibutton ID.
- <*ID Data*>: The data of RFID or ibutton ID.
- <*1wire Number*>: The total amount of 1wire accessories connected, it Contains multiple groups of <*1wire Sensor ID*>, <*1wire Data Mask*>, <*1wire Temperature*> and <*1wire Humidity*>.
- <*1wire Sensor ID*>: The sensor id of 1wire sensor, for example DS18B20, TH200 etc. the 1wire sensor ID is HEX format.
- <*1wire Data Mask*>: It refers to the <*1wire Data Mask*> parameter of the AT@WAS command.
- <*1wire Temperature*>: The temperature value of 1wire sensor, it’s controlled by <*1wire Data Mask*>.
- <*1wire Humidity*>: The Humidity value of 1wire sensor, it’s controlled by <*1wire Data Mask*>.
- <*Current Hour Meter Count*>: it is the engine on time of the current trip. 3 bytes in total, the first byte represents the hour part, the second byte represents the minute part, and the third byte represents the second part.

Current Hour Meter Count	**99**	**59**	**59**
HEX	**63**	**3B**	**3B**

- <*Total Hour Meter Count*>: It is the total engine on time. 5 bytes in total, the first 3 bytes represent the hour part, the fourth byte represents the minute part, and the fifth byte represents the second part.

Total Hour Meter Count	**99999**			**59**	**59**
HEX	**01**	**86**	**9F**	**3B**	**3B**

- <*ASC X Forward*>, <*ASC Y Forward*>, <*ASC Z Forward*>: These parameters are used to calculate the new acceleration in forward direction.
- <*ASC X Horizontal*>, <*ASC Y Horizontal*>, <*ASC Z Horizontal*>: These parameters are used to calculate the new acceleration in horizontal direction.
- <*ASC X Gravity*>, <*ASC Y Gravity*>, <*ASC Z Gravity*>: These parameters are used to calculate the new acceleration in gravity direction.
- <*Crash Counter*>: It indicates how long time the crash happens. It circles from 0x00 to 0xFF.
- <*ASC Status*>: The status of the self-calibration status.
  - 1: ASC Doing.
  - 2: ASC Finish.
- <*Crash X Value*>: It indicates X axis value when crash event happens.
- <*Crash Y Value*>: It indicates Y axis value when crash event happens.
- <*Crash Z Value*>: It indicates Z axis value when crash event happens.
- <*Tilt Angle*>: It indicates tilt angle of enter tilt alarm or quit tilt alarm.
- <*Install Position X Axle*>: It indicates X axis value after finish install position calibration.
- <*Install Position Y Axle*>: It indicates Y axis value after finish install position calibration.
- <*Install Position Z Axle*>: It indicates Z axis value after finish install position calibration.
- <*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.
- <*PEO <1 - 32> Status*>: The bitwise mask for trigger condition composition of the corresponding PEO ID. Each bit from bit 0 to bit 31 represents the logical state of the corresponding PEO ID to trigger the entering or exiting event. 1 means "The event of the PEO ID set is triggered", and 0 means "The event of the PEO ID set is not triggered".
  For example, if the Area Mask is 03, it means entering or exiting events of PEO-ID 1 and PEO-ID 2 occur at the same time.
- <*PEO <33 - 50> Status*>: The bitwise mask for trigger condition composition of the corresponding PEO ID. Each bit from bit 0 to bit 31 represents the logical state of the corresponding PEO ID to trigger the entering or exiting event. 1 means "The event of the PEO ID set is triggered", and 0 means "The event of the PEO ID set is not triggered".
  For example, if the Area Mask is 03, it means entering or exiting events of PEO-ID 33 and PEO-ID 34 occur at the same time.
- <*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	Reserved	
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 Level	

- <*BLE Battery Level*>: the battery level of BLE accessory, the data size is 2 bytes, the range is from 0 to 65535, the unit is mV or %.
- <*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.
- <*iBeacon Number*>: it expresses iBeacon number scanned.
- <*iBeacon Info Mask*>: This mask using for control show iBeacon information in "BLE iBeacon Info Event" of **+RPT** message, bitwise masks refer to the following:

Mask Bit	Item	Description
Bit 7	Reserved	
Bit 6	Reserved	
Bit 5	Battery Level	
Bit 4	Tx Power	
Bit 3	Minor	
Bit 2	Major	
Bit 1	UUID	
Bit 0	MAC Address	

- <*MAC Address*>: it expresses mac address of iBeacon.
- <*UUID* >: it expresses proximity UUID of iBeacon.
- <*Major*>: it expresses major number of iBeacon.
- <*Minor*>: it expresses minor number of iBeacon.
- <*Tx Power*>: it expresses the measured signal strength RSSI value of iBeacon.

- <*Battery Level*>: it expresses the battery level of iBeacon accessory.
- <*Command ID*>: it expresses the command ID in the update configuration file. It's always 0 before the device starts to update the configuration. It indicates the total number of the commands when the response code is 12, It indicates wrong format of command ID when the response code is 13.
- <*Upgrade CFG Code*>: The code of the upgrade configuration.
  - 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 refuses to start the downloading process because the battery is low.
  - 11: The device starts update configuration.
  - 12: The device finishes update configuration successfully.
  - 13: The device update configuration fails, command incorrect.
  - 14: The device update configuration fails, configuration file incorrect.
- <*Download URL Length*>: The length of download URL.
- <*Download URL*>: The complete URL to download the configuration. It includes the file name.

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		0x26
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	Main Power VCC	2	0 – 10000 (*10mV)	**Bit 0:** Main Power Mask

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:** Module Version Mask
2	Module Version	<=50	String	
1	BOOT Firmware Version	2		**Bit 9:** BOOT Firmware of Main MCU Mask
1	Generated Time	7	YYYYMMDDHHMMSS	
2	Serial Number	2	0000 – FFFF	
3	Tail	1	#	#

- <*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.
- <*BOOT Firmware Version*>: The BOOT firmware version of main MCU. The first byte represents the boot type and the last byte represent the BOOT version. For example,**0102** means 0x01 of the boot type express AVT boot. 0x02 express Boot version is V02.

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		0x26
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		0x26
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		0x26
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		0x26
1	Protocol Version	4		
2	Last Packet Flag	1	0|1	
	SIS	3		SIS
1	Report Mode	1	0 - 3	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	Reserved	0		
13	Reserved	0		
14	Resend Time No SACK	<=3	10 - 300	10
	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
	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	Low Main Power Threshold	<=5	8000 – 24000 (mV)	9000
7	GNSS Working Mode	1	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 – 2	0
15	Charging Mode	1	0 – 1	0
16	GNSS Timeout	<=4	1 – 2880 (min)	1
	RRS	3		RRS
1	Mode	1	0|1	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
	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
	TOW	3		TOW
1	Mode	1	0|1	0
2	Tow Duration	<=4	120 – 3600 (sec)	120
3	Tow Alarm Interval	<=4	60 – 3600 (sec)	60
	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	20
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	Wire Ignition Mode	1	0|1	1
2	IGN Debounce Time	<=2	0 – 20 (*10ms)	5
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
12	Ignition On - Limit Outputs Mask	4	0000 – FFFF	0
	DAM	3		DAM
1	Reserved	1		
2	Input Mode	1	0 – 2	0
3	Debounce Time	<=2	0 – 20 (*10ms)	2
4	Validity Time	<=2	0|1 – 12 (*2s)	0
	AOS	3		AOS
1	Alarm OUT1 Trigger Mask	<=8	0 – FFFFFFFF	0
2	Output ID	1	1	1

3	Output Status	1	0 – 1	
4	Duration	<=3	0 – 255 (*100ms)	
5	Toggle Times	<=3	0 – 255	
	BMS	3		BMS
1	Report Mode	1	0 - 2	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	SACK Enable	1	0 - 1	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
1	Filter Group	1	1 – 4	
2	Group Working Mode	1	0|1	0
3	MAC address	0 - 12		
4	Data Clear Period	<=5	0 – 65535	0
5	Match & Save Group	2	<=10	10
1	EIR Data Type	2	HEX	
2	Data offset	<=2		0
3	Data Size	<=2		0
4	Action	1	0|1	0
5	I/O	<=2	0 – 12	0
6	Match	<=20	HEX	
7	Endian Type	1	0 – 1	0
8	Multiplier	<=8		0
9	Offset	<=6	-32768 – 32767	0
1	iBeacon UUID Filter Group	1	5	5
2	Filter by iBeacon UUID Enable	1	0 – 1	0
3	iBeacon Lost Count	<=2	1 – 60	6
4	UUID number	<=2	0 – 10	0
5	UUID String	32		
6	iBeacon Info Mask	<=2	00 - FF	
1	Beacon MAC Whitelist Group	1	6	6
2	Check BWS MAC Whitelist	1	0 - 1	0
3	Beacon Event Report	1	0 - 1	0
4	Data Clear Period	<=5	0 – 65535	0
5	Match & Save Group	2	<=10	10

1	EIR Data Type	2	HEX	
2	Data offset	<=2	0 - 99	0
3	Data Size	<=2	0 - 20	0
4	Action	1	0|1	0
5	I/O	<=2	0 - 13	0
6	Match	<=20	HEX	
7	Endian Type	1	0 – 1	0
8	Multiplier	<=8		0
9	Offset	<=6	-32768 – 32767	0
1	BSS Report Interval Motion	<=5	0|5 – 86400 (sec)	60
2	BSS Report Interval Motionless	<=5	0|5 – 86400 (sec)	60
	BWS	3		BWS
1	Reserved	0		
2	Reserved	0		
3	Start Index	<=3	1 - 256	
4	End Index	<=3	1 - 256	
5	MAC Number List	<=12*32		
	JAM	3		JAM
1	Mode	1	0 – 1	0
2	Enter Jamming Duration	<=3	0 – 360 (*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	-50
	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 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		0x26
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		0x26
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.
- ✧ <*Sensor ID*>: It indicates the type of the sensor currently used by the 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		0x26
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		0x26
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		0x26
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		0x26
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. +SCF

After the device receives the command **AT@RTO** to get self-calibration factor, it will send the self-calibration factor via the message **+SCF** to the backend server. The **+SCF** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+SCF:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x26
5	ASC Status	1		
6	ASC X Forward	<=4	-100 – 100	
7	ASC Y Forward	<=4	-100 – 100	
8	ASC Z Forward	<=4	-100 – 100	
9	ASC X Horizontal	<=4	-100 – 100	
10	ASC Y Horizontal	<=4	-100 – 100	
11	ASC Z Horizontal	<=4	-100 – 100	
12	ASC X Gravity	<=4	-100 – 100	
13	ASC Y Gravity	<=4	-100 – 100	
14	ASC Z Gravity	<=4	-100 – 100	
15	ASC Stable number	<=3		
16	ASC Stable X	<=4		
17	ASC Stable Y	<=4		
18	ASC Stable Z	<=4		
19	Generated Time	7	YYYYMMDDHHMMSS	
20	Serial Number	2	0000 – FFFF	
21	Tail	1	#	#

✧ <*ASC Status*>: The status of the self-calibration status.
- Bit0: ASC initial.

- Bit1: ASC Stable.
- Bit2: ASC Success.

✧ <*ASC X Forward*>, <*ASC Y Forward*>, <*ASC Z Forward*>: These parameters are used to calculate the new acceleration in forward direction.

✧ <*ASC X Horizontal*>, <*ASC Y Horizontal*>, <*ASC Z Horizontal*>: These parameters are used to calculate the new acceleration in horizontal direction.

✧ <*ASC X Gravity*>, <*ASC Y Gravity*>, <*ASC Z Gravity*>: These parameters are used to calculate the new acceleration in gravity direction.

3.5.10. +TCF

After the device receives the command **AT@RTO** to get tilt calibration factor, it will send the tilt calibration factor via the message **+TCF** to the backend server. The **+TCF** frame format is:

Example:				
No	**Parameter**	**Length (Byte)**	**Range / Format**	**Default**
1	Head	5		+TCF:
2	Length	2		
3	IMEI	8		
4	Device ID	1		0x26
5	ASC Status	1		
6	Install position X	<=4		
7	Install position Y	<=4		
8	Install position Z	<=4		
9	Reserved			
10	Reserved			
11	Reserved			
12	Generated Time	7	YYYYMMDDHHMMSS	
13	Serial Number	2	0000 – FFFF	
14	Tail	1	#	#

✧ <*ASC Status*>: The status of the tilt calibration status.

- 0: Tilt Calibration Doing.
- 1: Tilt Calibration success.

✧ <*Install position X*>, <*Install position Y*>, <*Install position Z*>: These parameters are terminal install position after tilt calibration success.