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AM01 Communication Protocol

Change History

Prepared By	Date	Version	Reviewed By	Approved By	Description
Bian Yutao	2016-01-13	1.0.0			Initial release.
Bian Yutao	2016-04-08	1.0.2			Added the WiFi protocol packet.
Bian Yutao	2016-04-19	1.0.3			Added the LBS alarm packet protocol.
Bian Yutao	2016-06-14	1.0.4			Modified the WiFi protocol based on requirements.
Bian Yutao	2016-08-23	1.0.5			Added the protocol on forced response to GPS LBS packets.
Bian Yutao	2016-12-23	1.0.6			Added content to the synchronization Packet 94 04.
Bian Yutao	2017-04-05	1.0.7			Added the deep sleep alert and low battery alert (synchronized)
Bian Yutao	2017-04-24	1.0.8			Added device fall alert.
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Chen Long	2020-05-18	1.10.0			Added the temperature data packet.

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1. Protocol Packet Format

Format	Length (Byte)	Description
Start Bit	2	0x78 0x78 (1 byte) or 0x79 0x79 (2 bytes)
Packet Length	1 (2)	Length = Protocol number + information content + information sequence number (SN) + CRC
Protocol number	1	It indicates the type of the transfer packet (see the following table for details).
Information Content	N	It is determined by different applications and their corresponding "protocol numbers".
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

1.1 Protocol Number Details

Login packet	0x01
GPS location packet (UTC)	0x22
Heartbeat packet	0x13
Return packet (from terminal)	0x21
GPS Alarm data (UTC)	0x27
LBS Alarm data	0x19
GPS address request packet (UTC)	0x2A
LBS extended information packet	0x28
LBS address request packet	0x17
Online command	0x80
Time calibration packet	0x8A
Information transfer packet	0x94
Chinese address packet	0x17
English address packet	0x97

Protocol Packet Details

2.1 Login packet

Description:

- The login packet is used to establish a connection between the terminal and the platform. It carries terminal information.
- When the GPRS link is established, the terminal will send a login packet to the server. If a return packet is received within 5 seconds, the link is through; otherwise, the terminal will continue to send login packets.
- If no return packet is received within 5 seconds, the terminal will regard it as response timeout.
- If the timeout count reaches 3, the terminal will enable timed restart.

a. Login packet

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x01
Information Content	Terminal ID	8	For example: If IMEI is "123456789123456", then the terminal ID is "0x01 0x23 0x45 0x67 0x89 0x12 0x34 0x56".
	Type identification	2	It is used to judge the type of a terminal.
	Time zone/language	2	See the following table for details.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 11 01 07 52 53 36 78 90 02 42 70 00 32 01 00 05 12 79 0D 0A

Time zone/language

One and a half byte (bit15–bit4)	15	It is a value calculated by expanding the time zone by 100.	
	14		
	13		
	12		
	11		
	10		
	9		
	8		
	7		
	6		
	5		
	4		
Lower half byte (bit4–bit0)	3	GMT	
	2	It is not defined.	
	1	Language select bit	1
	0	Language select bit	0

Bit3 0-----Eastern time

1-----Western time

If: the extended bit "0x32 0x00" refers to "GMT+8:00",

then the GTM in hex is "0x0320", which is converted from "8*100=800".

The extended bit "0x4D 0xD8" refers to "GMT-12:45",

then the GTM in hex is "0x04,0xDD", which is converted from "12.45*100=1246".

Here, to save 4 bytes, the calculation result shifts to the left for 4 bits cyclically and combines eastern time, western time, and the language select bit.

b. Return packet (from server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x01

Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 05 01 00 05 9F F8 0D 0A

2.2 Heartbeat Packet

Description:

- The heartbeat packet is used to maintain GPRS link connectivity.
- When the GPRS link is established, the terminal will send a heartbeat packet to the server. If a return packet is received within 5 seconds, the link is through. In this case, new heartbeat packets will be sent in a timed manner.
- If no return packet is received within 5 seconds, the terminal will regard it as response timeout.
- If the timeout count reaches 3, the terminal will enable timed restart.

a. Heartbeat packet sent by terminal (0x13)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x13
Information Content	Terminal information content	1	See the following table for details.
	Voltage level	1	AM01 smart ankle bracelet: It uses percentage to indicate the battery strength, wherein 0x5a refers to 90%.
	GSM Signal Strength	1	0x00: No signal 0x01: Extremely weak signal 0x02: Weak signal 0x03: Good signal 0x04: Strong signal
	Language/extended port status	2	Latter bit, where "0x01" refers to Chinese and "0x02" English.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 0A 13 40 04 04 00 01 00 0F DC EE 0D 0A

Terminal information content details

It occupies 1 byte and indicates various status information of the mobile phone.

Bit		Code Connotation
BYTE	Bit7	Reserved
	Bit6	1: Positioned
		0: Not Positioned
	Bit5	Reserved
	Bit4	Reserved
	Bit3	Reserved
	Bit2	1: Charging with power connected
		0: Charging with no power connected
	Bit1	1: ACC on
		0: ACC off
	Bit0	1: Set defense
		0: Cancel defense

b. Return packet (from server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x13
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example: 78 78 05 13 01 00 E1 A0 0D 0A

2.3 GPS Location Packet

Description:

- The location packet carries the location data of the terminal.
- After the GPS module is positioned and the connection is established, the terminal will upload data about fixes by preset rules.
- After the connection is established and there are cache fixes, the terminal will upload these cache fixes.

a. Location packet (sent by terminal)

Location packet

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x22 (UTC) If the protocol number is "0x2D", then it is a location packet that requires a response; if the server doesn't respond, then a backup action will be performed.
Information Content	Date and time	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
	Number of Satellites	1	The first character refers to GPS Information Length; while the second character refers to Number of Satellites that involve in positioning (which must convert to decimal).
	Latitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Longitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Speed	1	It is a value in decimal.
	Course and Status	2	Convert to a 16-bit binary. Please calculate by bit (see Attachment 3).
	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	Cell ID	3	Cell Tower ID (Cell ID) (convert to decimal)
	ACC	1	It indicates the ACC status, where "00" refers to "ACC OFF" and "01" "ACC ON" (unavailable on GT06)
	Data upload mode	1	GPS data point upload type 0x00: Upload in fixed interval 0x01: Upload at fixed distance 0x02: Upload at cornering point 0x03: Upload upon ACC status change 0x04: Upload the last fix after the status changes from moving to still 0x05: Upload the last valid fix prior to network interruption and reconnection

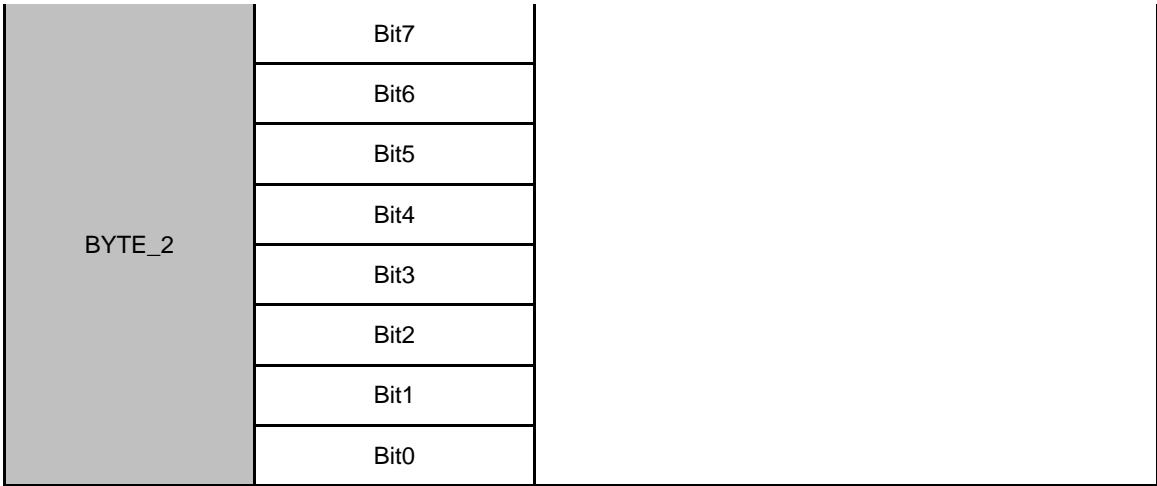
			0x06: Force to upload a GPS fix upon ephemeris refresh 0x07: Upload a fix upon key press 0x08: Upload location information upon power-on 0x09: Not used 0x0A: Upload the last longitude and latitude and update the time after the device goes still 0x0B: Parse the uploaded longitude and latitude packet over WiFi 0x0C: Upload upon LJDW (immediate position) command 0x0D: Upload the last longitude and latitude after the device goes still 0x0E: GPSDUP upload 0x0F: Exit tracking mode
	GPS data re-upload	1	0x00: Real-time upload; 0x01: Re-upload (unavailable on GT06)
	Mileage statistics	4	Convert to decimal to get the result (For products without this feature, there is no such place in the packet)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 22 22 0F 0C 1D 02 33 05 C9 02 7A C8 18 0C 46 58 60 00 14 00 01 CC 00 28 7D 00 1F 71 00 00 01 00 08 20 86 0D 0A

i. Status and course details

This occupies 2 bytes to indicate the moving direction of the terminal. The value range is 0–360°. It regards due north as 0° and counts clockwise.

BYTE_1	Bit7	0
	Bit6	0
	Bit5	GPS realtime/differential positioning
	Bit4	Positioned or not
	Bit3	East/West longitude
	Bit2	South/North latitude
	Bit1	Course
	Bit0	



如：值为 0x15 0x4C，变成二进制是 00010101 01001100，

BYTE_1 Bit7	0
BYTE_1 Bit6	0
BYTE_1 Bit5	0（实时 GPS）
BYTE_1 Bit4	1（GPS 已定位）
BYTE_1 Bit3	0（东经）
BYTE_1 Bit2	1（北纬）
BYTE_1 Bit1	0
BYTE_1 Bit0	1
BYTE_2 Bit7	0
BYTE_2 Bit6	1
BYTE_2 Bit5	0
BYTE_2 Bit4	0
BYTE_2 Bit3	1
BYTE_2 Bit2	1
BYTE_2 Bit1	0
BYTE_2 Bit0	0

→ 航向 332°（0101001100 二进制转换为十进制为 332）

即表示 GPS 已定位，实时 GPS、北纬、东经、航向 332°。

b. Return packet (from server)

For 0x22, no return packet is required from the server.

For 0x2D, a return packet (see the table below for details) is required from the server.

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	A location packet whose protocol number is "0x2D" requires a response from the server. If the server doesn't respond, a backup action will be performed.
Information SN	2	The SN will be automatically added by "1" for each data sending

		after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

2.4 LBS Extended Information Packet

Description:

- It is used to transmit location information when the terminal doesn't locate.

a. LBS extended information packet (sent by terminal)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x28 If the protocol number is "0x2E", then it is a location packet that requires a response; if the server doesn't respond, then a backup action will be performed.
Information Content	UTC	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	CI	3	Cell Tower ID (Cell ID) (convert to decimal)
	RSSI	1	It indicates the signal strength of a cell. Its value range is 0x00–0xFF, where "0x00" indicates the signal is the weakest; while "0xFF" the strongest.
	NLAC1	2	Same as LAC
	NCI1	3	Same as CI
	NRSSI1	1	Same as RSSI
	NLAC2	2	Same as LAC
	NCI2	3	Same as CI

	NRSSI2	1	Same as RSSI
	NLAC3	2	Same as LAC
	NCI3	3	Same as CI
	NRSSI3	1	Same as RSSI
	NLAC4	2	Same as LAC
	NCI4	3	Same as CI
	NRSSI4	1	Same as RSSI
	NLAC5	2	Same as LAC
	NCI5	3	Same as CI
	NRSSI5	1	Same as RSSI
	NLAC6	2	Same as LAC
	NCI6	3	Same as CI
	NRSSI6	1	Same as RSSI
	Timing advance	1	It refers to the difference between the actual length of time that a signal takes to reach the base station from a mobile station and the length of time that a signal takes to reach the base station from a mobile station when the distance between the two is "0".
	Language	2	0x00 0x01: Chinese; 0x00 0x02: English
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 3B 28 10 01 0D 02 02 02 01 CC 00 28 7D 00 1F 71 3E 28 7D 00 1F 72 31 28 7D
00 1E 23 2D 28 7D 00 1F 40 18 00 00 00 00 00 00 00 00 00 00 00 00 FF 00 02 00
05 B1 4B 0D 0A

b. Return packet (from server)

For 0x28, no return packet is required from the server.

For 0x2E, a return packet (see the table below) is required from the server.

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	A location packet whose protocol number is "0x2E" requires a response from the server. If the server doesn't respond, a backup action will be performed.
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

2.5 WIFI Information Packet

Description:

- It is used to transmit the packet received by the terminal from the WiFi network.

a. WiFi packet (sent by terminal)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x2C
Information Content	UTC	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
	MCC	2	It is the abbreviation of Mobile Country Code, which indicates the country to which a mobile subscriber belongs.
	MNC	1	It is the abbreviation of Mobile Network Code.
	LAC	2	It is the abbreviation of Location Area Code.
	CI	3	It is the abbreviation of Cell Tower ID.

	RSSI	1	It indicates the signal strength of a cell. Its value range is 0x00–0xFF, where "0x00" indicates the signal is the weakest; while "0xFF" the strongest.
	NLAC1	2	Same as LAC
	NCI1	3	Same as CI
	NRSSI1	1	Same as RSSI
	NLAC2	2	Same as LAC
	NCI2	3	Same as CI
	NRSSI2	1	Same as RSSI
	NLAC3	2	Same as LAC
	NCI3	3	Same as CI
	NRSSI3	1	Same as RSSI
	NLAC4	2	Same as LAC
	NCI4	3	Same as CI
	NRSSI4	1	Same as RSSI
	NLAC5	2	Same as LAC
	NCI5	3	Same as CI
	NRSSI5	1	Same as RSSI
	NLAC6	2	Same as LAC
	NCI6	3	Same as CI
	NRSSI6	1	Same as RSSI
	Timing advance	1	It refers to the difference between the actual length of time that a signal takes to reach the base station from a mobile station and the length of time that a signal takes to reach the base station from a mobile station when the distance between the two is "0".
	Number of WiFi Networks	1	It is used to determine the number of WiFi networks carried in the packet. "0" means no WiFi is detected.
	WiFi MAC1	6	It is the MAC address of WiFi1 received (transmitted based on the actual number of WiFi networks searched, that is, if one or multiple WiFi networks are searched, then one/multiple MAC addresses will be transmitted. If none is searched, then none will be transmitted.)

	WIFI1 Strength	1	It indicates the strength of WiFi1.
	WIFI MAC2	6	As above
	WIFI2 Strength	1	As above

Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 48 2C 10 06 0E 02 2D 35 01 CC 00 28 7D 00 1F 71 2D 28 7D 00 1E 17 25 28 7D
00 1E 23 1E 28 7D 00 1F 72 1C 28 7D 00 1F 40 12 00 00 00 00 00 00 00 00 00 00 FF 02 80 89
17 44 98 B4 5C CC 7B 35 36 61 A6 5B 00 1F A0 04 0D 0A

b. Return packet (from server)

No response is required from the server.

2.6 Alarm Packet (GPS)

Description:

- It is used to transmit the terminal-defined alarm content.
- The server responds to the alarm content received and sends the address parsed from the longitude and latitude to the terminal.
- Then the terminal sends the address received to the preset SOS number.

a. Alarm packet (sent by terminal)

Alarm packet (single geo fence)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x26 (UTC)
Information Content	Date and time	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)

	Number of Satellites	1	The first character refers to GPS Information Length; while the second character refers to Number of Satellites that involve in positioning (which must convert to decimal).
	Latitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Longitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Speed	1	It is a value in decimal.
	Course and Status	2	Convert to a 16-bit binary. Please calculate by bit (see GPS location packet for details).
	LBS 长度	1	Total length of LBS information (self-length + MCC + MNC + LAC + Cell ID)
	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	Cell ID	3	Cell Tower ID (Cell ID) (convert to decimal)
	Terminal information	1	See the following table for details.
	Voltage level	1	AM01 smart ankle bracelet: It uses percentage to indicate the battery strength, wherein 0x5a refers to 90%.
	GSM signal strength	1	0x00: No signal 0x01: Extremely weak signal 0x02: Weak signal 0x03: Good signal 0x04: Strong signal
	Alert and language	2	See the following table for details.
	Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
	Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
	Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 25 26 0F 0C 1D 03 0B 26 C9 02 7A C8 18 0C 46 58 60 00 04 00 09 01 CC 00 28 7D 00 1F 71 80 04 04 13 02 00 0C 47 2A 0D 0A

Alarm packet (multiple geo fences)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x27 (UTC)
Information Content	Date and time	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
	Number of Satellites	1	The first character refers to GPS Information Length; while the second character refers to Number of Satellites that involve in positioning (which must convert to decimal).
	Latitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Longitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Speed	1	It is a value in decimal.
	Course and Status	2	Convert to a 16-bit binary. Please calculate by bit (see GPS location packet for details).
	LBS length	1	Total length of LBS information (self-length + MCC + MNC + LAC + Cell ID)
	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	Cell ID	3	Cell Tower ID (Cell ID) (convert to decimal)
	Terminal information	1	See the following table for details.
	Voltage level	1	AM01 smart ankle bracelet: It uses percentage to indicate the battery strength, wherein 0x5a refers to 90%.
	GSM signal strength	1	0x00: No signal 0x01: Extremely weak signal 0x02: Weak signal 0x03: Good signal 0x04: Strong signal
	Alert and language	2	See the following table for details.

	Fence No.	1	This byte is valid for geo-fence alerts. 0: Fence No. 1; 1: Fence No. 2; ...; FF: Invalid
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 26 27 10 04 19 09 2D 07 C5 02 7A C9 1C 0C 46 58 00 00 05 37 09 00 00 00 00 00 00 00 00 80 02 00 0C 01 FF 00 00 4D F6 0D 0A

ii. Terminal information details

Bit		Code Connotation
BYTE	Bit7	Reserved
	Bit6	1: Positioned
		0: Not Positioned
	Bit3–Bit5	011: Low battery alert
		000: Normal
	Bit2	1: Charging with power connected
		0: Charging with no power connected
	Bit1	1: ACC on
		0: ACC off
	Bit0	1: Set defense
		0: Cancel defense

iii. Alarm and language details

Byte 1	0x00: Normal
	0x01: SOS alert
	0x02: Power cut alert
	0x03: Vibrating alert
	0x04: Entered fence alert
	0x05: Left fence alert
	0x06: Speed alert

	0x09: Tow/theft alert
	0x0A: Entered GPS blind spot alert
	0x0B: Left GPS blind spot alert
	0x0C: Powered on alert
	0x0D: GPS first fix alert
	0x0E: Low external battery alert
	0x0F: External battery low voltage protection alert
	0x10: SIM changed alert
	0x11: Powered off alert
	0x12: Airplane mode on following external battery low voltage protection
	0x13: Tamper alert
	0x14: Door alert
	0x15: Powered off due to low battery
	0x16: Sound-control alert
	0x17: Rogue base station detected alert
	0x18: Cover removed alert
	0x19: Low internal battery alert
	0x1A: Exited transit mode alert
	0x1B: Suspected of leaving the herd
	0x20: Entered deep sleep mode alert
	0x21: Reserved (Do not use)
	0x22: Reserved (Do not use)
	0x23: Fall alert
	0x24: Charger connected alert
	0x25: Light detected alert
	0x26: Reserved
	0x27: Wire cut alert
	0x28: Solicited offline (powered off) alert
	0x29: Harsh acceleration
	0x2A: Sharp left cornering alert

	0x2B: Sharp right cornering alert
	0x2C: Collision alert
	0x30: Harsh braking
	0x31: Left the herd alert
	0x32: Reserved
	0x33: Locked alert
	0x34: Unlocked alert
	0x35: Illegal unlocked alert
	0x36: Unlock failed alert
	0x37: Knocking alert
	0x38: Reserved
	0x39: Reserved
	0x3A: Anklet recovered
	0x52: Temperature exception
	0x64: Temperature exception recovered
	0x65: Alert on the device being violently damaged canceled
	0xFF: ACC OFF
	0xFE: ACC ON
Byte 2	0x01: Chinese
	0x02: English
	0x00: No response from the platform is required

Note: As alerts accumulate, the alerts and alarm bytes in the terminal information may overlap, in which case the alarm byte will be regarded as the baseline. That means when the alarm byte is "0x00", the alarm content in the terminal information can be determined.

b. Return packet (from server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x26 (UTC)
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.

Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 05 26 00 1C 9D 86 0D 0A

c. Server returns the Chinese address

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x17
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ALARMSMS	8	Alarm code flag (ASCII)
	&&	2	Alarm code flag (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is "0" for all uploaded alarm packets (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 9F 17 99 00 00 00 01 41 4C 41 52 4D 53 4D 53 26 26 97 07 52 A8 62 A5 8B 66 00 3A 00 47 00 54 00 30 00 36 00 44 00 2D 00 31 00 32 00 38 00 33 00 36 00 2D 00 5A 00 4A 00 4D 00 2C 5E 7F 4E 1C 77 01 00 2E 60 E0 5D DE 5E 02 00 2E 60 E0 57 CE 53 3A 00 2E 4E 91 5C 71 89 7F 8D EF 00 2E 79 BB 60 E0 5D DE 5E 02 5B 66 59 27 65 59 80 B2 7E A6 00 32 00 37 7C 73 00 2E 00 2C 00 31 00 30 00 3A 00 34 00 33 26 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 1C EA 97 0D 0A

d. Server returns the English address

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		2	0x97
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ALARMSMS	8	Alarm code flag (ASCII)
	&&	2	Alarm code flag (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is "0" for all uploaded alarm packets (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 79 79 00 BC 97 00 B5 00 00 00 01 41 4C 41 52 4D 53 4D 53 26 26 00 4A 00 4D 00 30 00 31 00 2D 00 38 00 39 00 37 00 33 00 31 00 3A 00 53 00 4F 00 53 00 20 00 61 00 6C 00 61 00 72 00 6D 00 2E 00 68 00 74 00 74 00 70 00 3A 00 2F 00 2F 00 6D 00 61 00 70 00 73 00 2E 00 67 00 6F 00 6F 00 67 00 6C 00 65 00 2E 00 63 00 6F 00 6D 00 2F 00 6D 00 61 00 70 00 73 00 3F 00 71 00 3D 00 4E 00 32 00 32 00 2E 00 35 00 37 00 33 00 35 00 36 00 2C 00 45 00 31 00 31 00 33 00 2E 00 39 00 32 00 31 00 37 00 31 26 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 69 15 9B 0D 0A

2.7 Alarm Packet (LBS)

Description:

- It is used to transmit the terminal-defined alarm content.
- The server responds to the alarm content received and sends the address parsed from

the LBS information to the terminal.

- Then the terminal sends the address received to the preset SOS number.

a. Alarm packet (sent by terminal)

Alarm packet

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x19
Information Content	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	Cell ID	3	Cell Tower ID (Cell ID) (convert to decimal)
	Terminal information	1	See the following table for details.
	Voltage level	1	AM01 smart ankle bracelet: It uses percentage to indicate the battery strength, wherein 0x5a refers to 90%.
	GSM signal strength	1	0x00: No signal 0x01: Extremely weak signal 0x02: Weak signal 0x03: Good signal 0x04: Strong signal
Alert and language		2	See the following table for details.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 12 19 01 CC 00 28 7D 00 1F 71 20 04 04 01 01 00 94 6C 89 0D 0A

iv. Terminal information details

Bit	Code Connotation
-----	------------------

BYTE	Bit7	Reserved
	Bit6	1: Positioned
		0: Not Positioned
	Bit3–Bit5	011: Low battery alert
		000: Normal
	Bit2	1: Charging with power connected
		0: Charging with no power connected
	Bit1	1: ACC on
		0: ACC off
	Bit0	1: Set defense
		0: Cancel defense

v. Alarm and language details

Byte 1	0x00: Normal
	0x01: SOS alert
	0x02: Power cut alert
	0x03: Vibrating alert
	0x04: Entered fence alert
	0x05: Left fence alert
	0x06: Speed alert
	0x09: Tow/theft alert
	0x0A: Entered GPS blind spot alert
	0x0B: Left GPS blind spot alert
	0x0C: Powered on alert
	0x0D: GPS first fix alert
	0x0E: Low external battery alert
	0x0F: External battery low voltage protection alert
	0x10: SIM changed alert
	0x11: Powered off alert
	0x12: Airplane mode on following external battery low voltage protection

	0x13: Tamper alert
	0x14: Door alert
	0x15: Powered off due to low battery
	0x16: Sound-control alert
	0x17: Rogue base station detected alert
	0x18: Cover removed alert
	0x19: Low internal battery alert
	0x1A: Exited transit mode alert
	0x1B: Suspected of leaving the herd
	0x20: Entered deep sleep mode alert
	0x21: Reserved (Do not use)
	0x22: Reserved (Do not use)
	0x23: Fall alert
	0x24: Charger connected alert
	0x25: Light detected alert
	0x26: Reserved
	0x27: Wire cut alert
	0x28: Solicited offline (powered off) alert
	0x29: Harsh acceleration
	0x2A: Sharp left cornering alert
	0x2B: Sharp right cornering alert
	0x2C: Collision alert
	0x30: Harsh braking
	0x31: Left the herd alert
	0x32: Reserved
	0x33: Locked alert
	0x34: Unlocked alert
	0x35: Illegal unlocked alert
	0x36: Unlock failed alert
	0x37: Knocking alert
	0x3A: Anklet recovered

	0x52: Temperature exception
	0x64: Temperature exception recovered
	0x65: Alert on the device being violently damaged canceled
	0xFF: ACC OFF
	0xFE: ACC ON
Byte 2	0x01: Chinese 0x02: English 0x00: No response from the platform is required

b. Return packet (from server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x26 (UTC)
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 05 26 00 1C 9D 86 0D 0A

c. Server returns the Chinese address

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x17
Information Content	Length	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	It is used by the server to mark the specific alert.
	ALARMSMS	Alarm code flag (ASCII)

	&&	2	Alarm code flag (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is "0" for all uploaded alarm packets (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 9F 17 99 00 00 00 01 41 4C 41 52 4D 53 4D 53 26 26 97 07 52 A8 62 A5 8B 66 00 3A 00 47 00 54 00 30 00 36 00 44 00 2D 00 31 00 32 00 38 00 33 00 36 00 2D 00 5A 00 4A 00 4D 00 2C 5E 7F 4E 1C 77 01 00 2E 60 E0 5D DE 5E 02 00 2E 60 E0 57 CE 53 3A 00 2E 4E 91 5C 71 89 7F 8D EF 00 2E 79 BB 60 E0 5D DE 5E 02 5B 66 59 27 65 59 80 B2 7E A6 00 32 00 37 7C 73 00 2E 00 2C 00 31 00 30 00 3A 00 34 00 33 26 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 1C EA 97 0D 0A

d. Server returns the English address

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		2	0x97
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ALARMSMS	8	Alarm code flag (ASCII)
	&&	2	Alarm code flag (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is "0" for all uploaded alarm packets (ASCII)
	##	2	Separator (ASCII)

Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 79 79 00 BC 97 00 B5 00 00 00 01 41 4C 41 52 4D 53 4D 53 26 26 00 4A 00 4D 00 30 00 31 00 2D 00 38 00 39 00 37 00 33 00 31 00 3A 00 53 00 4F 00 53 00 20 00 61 00 6C 00 61 00 72 00 6D 00 2E 00 68 00 74 00 74 00 70 00 3A 00 2F 00 2F 00 6D 00 61 00 70 00 73 00 2E 00 67 00 6F 00 6F 00 67 00 6C 00 65 00 2E 00 63 00 6F 00 6D 00 2F 00 6D 00 61 00 70 00 73 00 3F 00 71 00 3D 00 4E 00 32 00 32 00 2E 00 35 00 37 00 33 00 35 00 36 00 2C 00 45 00 31 00 31 00 33 00 2E 00 39 00 32 00 31 00 37 00 31 26 26 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 69 15 9B 0D 0A

2.8 GPS Address Request Packet

Description:

- The user sends an address request command to the terminal, which sends an address request packet to the server to request for address parsing.
- Then the terminal sends the address parsed and returned by the server to the user.

a. Address request packet (sent by terminal)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x2A
Information Content	Date and time	6	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
	Number of Satellites	1	The first character refers to GPS Information Length; while the second character refers to Number of Satellites that involve in positioning (which must convert to decimal).
	Latitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Longitude	4	Convert to decimal which is further divided by 1,800,000 to get the result.
	Speed	1	It is a value in decimal.

	Course and Status	2	Convert to a 16-bit binary. Please calculate by bit (see GPS location packet for details).
	Phone number	21	Phone number
	Alert and language	2	Latter bit, where "0x01" refers to Chinese and "0x02" English.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 2E 2A 0F 0C 1D 07 11 39 CA 02 7A C8 00 0C 46 58 00 00 14 D8 31 32 35 32 30 31 33 35 33 32 31 37 37 30 37 39 00 00 00 00 00 00 01 00 2A 6E CE 0D 0A

b. Server returns the Chinese address

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x17
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ADDRESS	7	Address request code flag (ASCII)
	&&	2	Separator (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is the phone number used by the server to transmit back the terminal request packet (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.

Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 6E 17 68 00 00 00 01 41 44 44 52 45 53 53 26 26 4F 4D 7F 6E 00 3A 5E 7F 4E 1C 77 01 00 2E 60 E0 5D DE 5E 02 00 2E 60 E0 57 CE 53 3A 00 2E 4E 91 5C 71 89 7F 8D EF 00 2E 79 BB 60 E0 5D DE 5E 02 5B 66 59 27 65 59 80 B2 7E A6 00 32 00 35 7C 73 00 2E 26 26 38 36 31 33 34 32 31 36 33 32 36 39 39 00 00 00 00 00 00 00 00 23 23 00 16 C1 EC 0D 0A

c. Server returns the English address

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x97
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ADDRESS	7	Address request code flag (ASCII)
	&&	2	Separator (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is the phone number used by the server to transmit back the terminal request packet (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 79 79 00 BB 97 00 B5 00 00 00 01 41 44 44 52 45 53 53 26 26 00 4A 00 4D 00 30 00 31 00 2D 00 38 00 39 00 37 00 33 00 31 00 3A 00 53 00 4F 00 53 00 20 00 61 00 6C 00 61 00 72 00 6D 00 2E 00 68 00 74 00 74 00 70 00 3A 00 2F 00 2F 00 6D 00 61 00 70 00 73 00 2E 00 67 00 6F 00 6F

00 67 00 6C 00 65 00 2E 00 63 00 6F 00 6D 00 2F 00 6D 00 61 00 70 00 73 00 3F 00 71 00 3D 00 4E
 00 32 00 32 00 2E 00 35 00 37 00 33 00 35 00 36 00 2C 00 45 00 31 00 31 00 33 00 2E 00 39 00 32 00
 31 00 37 00 31 26 26 38 36 31 33 34 32 31 36 33 32 36 39 39 00 00 00 00 00 00 00 23 23 00 16 8E
 A5 0D 0A

2.9 LBS Address Request Packet

Description:

- The user sends an address request command to the terminal, which sends an address request packet to the server to request for address parsing.
- Then the terminal sends the address parsed and returned by the server to the user.

a. Address request packet (sent by terminal)

		Length	Details
Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x17
Information Content	MCC	2	Mobile country code (convert to decimal)
	MNC	1	Mobile network code (convert to decimal)
	LAC	2	Location area code (convert to decimal)
	Cell ID	3	Cell Tower ID (Cell ID) (convert to decimal)
	Phone number	21	Phone number
	Alert and language	2	Latter bit, where "0x01" refers to Chinese and "0x02" English.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 24 17 01 CC 00 28 7D 00 1F 71 31 32 35 32 30 31 33 35 33 32 31 37 37 30 37 39
 00 00 00 00 00 00 01 00 2A 7D D6 0D 0A

b. Server returns the Chinese address

	Length	Details
--	--------	---------

Start Bit		2	0x78 0x78
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x17
Information Content	Length	1	It is the length of the data between the server flag bit and the information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ADDRESS	7	Address request code flag (ASCII)
	&&	2	Separator (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is the phone number used by the server to transmit back the terminal request packet (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 6E 17 68 00 00 00 01 41 44 44 52 45 53 53 26 26 4F 4D 7F 6E 00 3A 5E 7F 4E 1C 77 01 00 2E 60 E0 5D DE 5E 02 00 2E 60 E0 57 CE 53 3A 00 2E 4E 91 5C 71 89 7F 8D EF 00 2E 79 BB 60 E0 5D DE 5E 02 5B 66 59 27 65 59 80 B2 7E A6 00 32 00 35 7C 73 00 2E 26 26 38 36 31 33 34 32 31 36 33 32 36 39 39 00 00 00 00 00 00 00 00 23 23 00 16 C1 EC 0D 0A

c. Server returns the English address

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x97
Information	Length	1	It is the length of the data between the server flag bit and the

Content			information SN.
	Server flag bit	4	It is used by the server to mark the specific alert.
	ADDRESS	7	Address request code flag (ASCII)
	&&	2	Separator (ASCII)
	Address content	M	It is the address parsed by the server (UNICODE)
	&&	2	Separator (ASCII)
	Phone number	21	It is the phone number used by the server to transmit back the terminal request packet (ASCII)
	##	2	Separator (ASCII)
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 79 79 00 BB 97 00 B5 00 00 00 01 41 44 44 52 45 53 53 26 26 00 4A 00 4D 00 30 00 31 00 2D 00 38 00 39 00 37 00 33 00 31 00 3A 00 53 00 4F 00 53 00 20 00 61 00 6C 00 61 00 72 00 6D 00 2E 00 68 00 74 00 74 00 70 00 3A 00 2F 00 2F 00 6D 00 61 00 70 00 73 00 2E 00 67 00 6F 00 6F 00 67 00 6C 00 65 00 2E 00 63 00 6F 00 6D 00 2F 00 6D 00 61 00 70 00 73 00 3F 00 71 00 3D 00 4E 00 32 00 32 00 2E 00 35 00 37 00 33 00 35 00 36 00 2C 00 45 00 31 00 31 00 33 00 2E 00 39 00 32 00 31 00 37 00 31 26 26 38 36 31 33 34 32 31 36 33 32 36 39 39 00 00 00 00 00 00 00 00 23 23 00 16 8E A5 0D 0A

2.10 Online Command

Description:

- The online command is delivered by the server and used to control the terminal to execute tasks.
- The terminal then responds to the server with the execution results.

a. Online command (sent by server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC

Protocol number		1	0x80
Information Content	Length	1	Server flag bit + command content length
	Server flag bit	4	It is reserved for server recognition. The terminal returns to the server the data it receives as it is in binary in a return packet.
	Command content	M	It is a character string in ASCII. It is compatible with the SMS command.
	Language	2	Latter bit, where "0x01" refers to Chinese and "0x02" English.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 78 78 0E 80 08 00 00 00 00 73 6F 73 23 00 01 6D 6A 0D 0A

- b. The terminal responds to the online command (0x21)

Return packet sent by the terminal (universal command)

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x21
Information Content	Server flag bit	4	It is reserved for server recognition. The terminal returns to the server the data it receives as it is in binary in a return packet.
	Coding	1	0x01: ASCII code 0x02: UTF16-BE code
	Content	M	It refers to the data to be sent (by the coding format).
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Example data: 79 79 00 9D 21 00 00 00 00 01 42 61 74 74 65 72 79 3A 34 2E 31 36 56 2C 4E 4F 52 4D 41 4C 3B 20 47 50 52 53 3A 4C 69 6E 6B 20 55 70 3B 20 47 53 4D 20 53 69 67 6E 61 6C 20 4C 65

76 65 6C 3A 53 74 72 6F 6E 67 3B 20 47 50 53 3A 53 65 61 72 63 68 69 6E 67 20 73 61 74 65 6C 6C
 69 74 65 2C 20 53 56 53 20 55 73 65 64 20 69 6E 20 66 69 78 3A 30 28 30 29 2C 20 47 50 53 20 53
 69 67 6E 61 6C 20 4C 65 76 65 6C 3A 3B 20 41 43 43 3A 4F 46 46 3B 20 44 65 66 65 6E 73 65 3A 4F
 46 46 00 2E 26 DF 0D 0A

2.11 Time Calibration Packet

Description:

- The time calibration packet is sent by the terminal to the server upon power-on to request for time synchronization to resolve the issue of time error when the terminal is not positioned.
- The server responds with the correct UTC in correct format.

a. Time calibration packet (sent by terminal)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x8A
Information SN	2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 05 8A 00 06 88 29 0D 0A

b. Return packet (from server)

	Length	Details
Start Bit	2	0x78 0x78
Packet Length	1	Length = Protocol number + information content + information SN + CRC
Protocol number	1	0x8A (UTC)
Information Content	Date and time	Year (1 byte) Month (1 byte) Day (1 byte) Hour (1 byte) Minute (1 byte) Second (1 byte) (which must convert to decimal)
Information SN	2	The SN will be automatically added by "1" for each data

		sending after power-on.
Error Check	2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit	2	It is fixed at 0x0D 0x0A.

Example data: 78 78 0B 8A 0F 0C 1D 00 00 15 00 06 F0 86 0D 0A

2.12 Information Transfer Packet

Description:

- It is used to transmit all kinds of non-location data.

a. Information transfer packet (sent by terminal)

		Length	Details
Start Bit		2	0x79 0x79
Packet Length		1	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x94
Information Content	Information type (sub-protocol No.)	1	00: External battery voltage 01–03: Customized 04 Terminal status synchronization 05: Door status 08: Self-check parameters 0x09: Satellite status 0x0A: ICCID 0x11: Vibration count (customized) …… to be added
	Data content	N	Different content will be transmitted according to different information types. For details, see the table below.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).

Stop Bit	2	It is fixed at 0x0D 0x0A.
----------	---	---------------------------

Example data: 79 79 00 7F 94 04 41 4C 4D 31 3D 43 34 3B 41 4C 4D 32 3D 43 43 3B 41 4C 4D 33 3D 34 43 3B 53 54 41 31 3D 43 30 3B 44 59 44 3D 30 31 3B 53 4F 53 3D 2C 2C 3B 43 45 4E 54 45 52 3D 3B 46 45 4E 43 45 3D 46 65 6E 63 65 2C 4F 4E 2C 30 2C 32 33 2E 31 31 31 38 30 39 2C 31 31 34 2E 34 30 39 32 36 34 2C 34 30 30 2C 49 4E 20 6F 72 20 4F 55 54 2C 30 3B 4D 49 46 49 3D 4D 49 46 49 2C 4F 46 46 00 0A 06 1E 0D 0A

Transferred information content

When the information type is "00", it carries the voltage of the external battery, which is a 2-bit hex. The hex is then converted into a decimal and further divided by 100. Take "0x04,0x9F" for example, "049F" is 1183 in decimal and is 11.83 after being divided by 100, which means the voltage of the external battery is 11.83V.

When the information type is "04", it carries the terminal status synchronization information and is of variable-length in ASCII coding.

(Parsing method: Extract the information content from the packet, convert the ASCII code into characters, and then parse IDs one by one according to definitions of these IDs.)

Content IDs

Definition	ID
Alarm byte 1	ALM1
Alarm byte 2	ALM2
Alarm byte 3	ALM3
Alarm byte 4	ALM4
Status byte 1	STA1
SOS number	SOS
Center number	CENTER
Geo-fence	FENCE
Fuel/power cutoff status	DYD
Mode	MODE
IMSI	IMSI
ICCID	ICCID
From start to login success	STARTTIME
Login packet count	LOGINPACKET
Restart retries	RESTART

✧ ALM1 (status)

Bit	Definition	Remarks
bit7	Vibrating alert	1: ON; 0: OFF
bit6	Alert via GPRS	1: ON; 0: OFF
bit5	Alert via call	1: ON; 0: OFF
bit4	Alert via SMS	1: ON; 0: OFF
bit3	Tow/theft alert	1: ON; 0: OFF
bit2	Alert via GPRS	1: ON; 0: OFF
bit1	Alert via call	1: ON; 0: OFF
bit0	Alert via SMS	1: ON; 0: OFF

✧ ALM2 (status)

Bit	Definition	Remarks
bit7	Low internal battery alert	1: ON; 0: OFF
bit6	Alert via GPRS	1: ON; 0: OFF
bit5	Alert via call	1: ON; 0: OFF
bit4	Alert via SMS	1: ON; 0: OFF
bit3	Low external battery alert	1: ON; 0: OFF
bit2	Alert via GPRS	1: ON; 0: OFF
bit1	Alert via call	1: ON; 0: OFF
bit0	Alert via SMS	1: ON; 0: OFF

✧ ALM3 (status)

Bit	Definition	Remarks
bit7	Speed alert	1: ON; 0: OFF
bit6	Alert via GPRS	1: ON; 0: OFF
bit5	Alert via call	1: ON; 0: OFF
bit4	Alert via SMS	1: ON; 0: OFF
bit3	Power cut alert	1: ON; 0: OFF
bit2	Alert via GPRS	1: ON; 0: OFF
bit1	Alert via call	1: ON; 0: OFF

bit0	Alert via SMS	1: ON; 0: OFF
------	---------------	---------------

✧ ALM4 (status)

Bit	Definition	Remarks
bit7	SOS alert	1: ON; 0: OFF
bit6	Alert via GPRS	1: ON; 0: OFF
bit5	Alert via call	1: ON; 0: OFF
bit4	Alert via SMS	1: ON; 0: OFF
bit3	Sound-control alert	1: ON; 0: OFF
bit2	Alert via GPRS	1: ON; 0: OFF
bit1	Alert via call	1: ON; 0: OFF
bit0	Alert via SMS	1: ON; 0: OFF

✧ STA1 (status)

Bit	Definition	Remarks
bit7	Defense status	1: Defense on; 0: Defense off
bit6	Auto defense	1: ON; 0: OFF
bit5	Manual defense	1: ON; 0: OFF
bit4	Remote cancelation of defense	1: ON; 0: OFF
bit3	To be defined	
bit2	To be defined	
bit1	Tamper switch	1: ON; 0: OFF
bit0	Tamper alert	1: ON; 0: OFF

✧ Fuel/power cutoff status

Bit	Definition	Remarks
bit7	Undefined	/
bit6	Undefined	/
bit5	Undefined	/
bit4	Undefined	/
bit3	Delay execution	1: Valid; 0: Invalid

	because the speed is too high	
bit2	Delay execution because the terminal is not positioned	1: Valid; 0: Invalid
bit1	Cut fuel/power	1: Valid; 0: Invalid
bit0	Connect fuel/power	1: Valid; 0: Invalid

- ✧ **SOS:** It transmits in ASCII coding (multiple SOS numbers are separated by commas [,]).
- ✧ **Center number:** It transmits in ASCII coding.
- ✧ **Geo-fence:** It transmits in ASCII coding.
- ✧ **Mode:** It transmits in ASCII coding (parameters are separated by commas [,]).

Example:

ALM1=FF;ALM2=FF;ALM3=FF;STA1=CO;DYD=01;SOS=12345,2345,5678;CENTER=987654;FENCE=FENCE,ON,0,-22.277120,-113.516763,5,IN,1; MODE= MODE,1,20,500

Note: Not all of the content will be transmitted. The platform can parse according to bits. The content uploaded varies with products.

When the information type is "05", it carries the detection (door detection) status of the external I/O in hex.

Bit	Definition	Remarks
bit7	TBD	
bit6	TBD	
bit5	TBD	
bit4	TBD	
bit3	TBD	
bit2	I/O port status	1: High; 0: Low
bit1	Trigger status	1: Level high; 0: Level low
bit0	Door status	1: ON; 0: OFF

When the information type is "06", it carries the terminal self-check parameters and is of variable-length in ASCII coding.

When the information type is "09", it carries the status information of the satellites for the terminal in hex.

GPS module status	1	0x00: No such feature; 0x01: Satellite searching; 0x02: 2D positioning; 0x03: 3D positioning; 0x04: Sleeping
Number of GPS satellites engaged in position fix	1	This is the basis for determining the volume of satellite signal strength.
GPS1 strength	1	Strength of GPS location satellite 1
GPS2 strength	1	Strength of GPS location satellite 2
.....
Number of GPS satellites that are visible but not engaged in position fix	1	This is the basis for determining the volume of satellite signal strength.
Visible GPS1 strength	1	Strength of visible satellite 1
Visible GPS2 strength	1	Strength of visible satellite 2
.....
BDS module status	1	0x00: No such feature; 0x01: Satellite searching; 0x02: 2D positioning; 0x03: 3D positioning; 0x04: Sleeping
Number of BDS satellites engaged in position fix	1	This is the basis for determining the volume of satellite signal strength.
BDS1 strength	1	Strength of BDS location satellite 1
BDS2 strength	1	Strength of BDS location satellite 2
.....
Number of BDS satellites that are visible but not engaged in position fix	1	This is the basis for determining the volume of satellite signal strength.
Visible BDS1 strength	1	Strength of visible satellite 1
Visible BDS2 strength	1	Strength of visible satellite 2
.....
Extended bit length	1	It is reserved for feature expansion. If no extended bit is added, then it

		is "0x00" (Note: For future feature expansion, you are advised to reserve the extended bit during protocol debugging).
Extended bit	N	It changes as the extended bit length changes. When the extended bit length is "0x00", the extended bit will not be transmitted.

When the information type is "0A", it carries the ICCID information in hex.

IMEI	8	For example: If IMEI is "123456789123456", then the terminal ID is "0x01 0x23 0x45 0x67 0x89 0x12 0x34 0x56".
IMSI	8	For example: If IMSI is "123456789123456", then the terminal ID is "0x01 0x23 0x45 0x67 0x89 0x12 0x34 0x56".
ICCID	10	For example: If ICCID is "12345123456789123456", then the terminal ID is "0x12 0x34 0x51 0x23 0x45 0x67 0x89 0x12 0x34 0x56".

When the information type is "0x11", it carrier the customized vibration counts information in a 2-digit hex.

(AT4H) If the type is set to 0x31, the data content is the BT connection and disconnection information uploaded by the MCU.

Definition		Length	Description
	BT connected or disconnected flag bit	1	Connected: 0x01 Disconnected: 0x00
	MAC address	12	12
	RSSI value (the absolute signal value)	2	There is no RSSI value if the BT flag bit is "0x00" in the uploaded information.

b. Return packet (from server)

No response is required from the server.

2.13 Plug-in Module Transparent Protocol

- It is used to transparently transmit data of the plug-in module.

a. The module returns data to the server.

	Length	Details
--	--------	---------

Start Bit		2	0x79 0x79
Packet Length		2	Length = Protocol number + information content + information SN + CRC
Protocol number		1	0x9c
Information Content	Module type code	1	The response is the same as the sending.
	Transparently-transmitted data.	N	Transparently-transmitted data.
Information SN		2	The SN will be automatically added by "1" for each data sending after power-on.
Error Check		2	It is the CRC-ITU value from "Packet Length" to "Information SN". If the receiver receives a packet that contains a CRC error, it ignores the error and discards the packet (See 3.1 for algorithm details).
Stop Bit		2	It is fixed at 0x0D 0x0A.

Module type code	Description
0x04	Upload the temperature data

Information Content	Module type code	1	0x04: Temperature data upload (which is carried in 0x9C packet)
	Transparently-transmitted data.	2	Temperature, which is signed short data

Attachments

3.1 Attachment 1 CRC-ITU Algorithm in C (Fragments)

```
static const U16 crctab16[] =
{
    0X0000, 0X1189, 0X2312, 0X329B, 0X4624, 0X57AD, 0X6536, 0X74BF,
    0X8C48, 0X9DC1, 0XAF5A, 0XBED3, 0XCA6C, 0XDBE5, 0XE97E, 0XF8F7,
    0X1081, 0X0108, 0X3393, 0X221A, 0X56A5, 0X472C, 0X75B7, 0X643E,
    0X9CC9, 0X8D40, 0XBFDB, 0XAE52, 0XDAED, 0XCB64, 0XF9FF, 0XE876,
    0X2102, 0X308B, 0X0210, 0X1399, 0X6726, 0X76AF, 0X4434, 0X55BD,
    0XAD4A, 0XBCC3, 0X8E58, 0X9FD1, 0XEB6E, 0XFAE7, 0XC87C, 0XD9F5,
```

```

0X3183, 0X200A, 0X1291, 0X0318, 0X77A7, 0X662E, 0X54B5, 0X453C,
0XBDCB, 0XAC42, 0X9ED9, 0X8F50, 0XFBEF, 0XEA66, 0XD8FD, 0XC974,
0X4204, 0X538D, 0X6116, 0X709F, 0X0420, 0X15A9, 0X2732, 0X36BB,
0XCE4C, 0XD5FC, 0XED5E, 0XFCD7, 0X8868, 0X99E1, 0XAB7A, 0XBAF3,
0X5285, 0X430C, 0X7197, 0X601E, 0X14A1, 0X0528, 0X37B3, 0X263A,
0XDECD, 0XCF44, 0XFDDF, 0XEC56, 0X98E9, 0X8960, 0XBBFB, 0XAA72,
0X6306, 0X728F, 0X4014, 0X519D, 0X2522, 0X34AB, 0X0630, 0X17B9,
0XEF4E, 0XFEC7, 0XCC5C, 0XDDD5, 0XA96A, 0XB8E3, 0X8A78, 0X9BF1,
0X7387, 0X620E, 0X5095, 0X411C, 0X35A3, 0X242A, 0X16B1, 0X0738,
0XFFCF, 0XEE46, 0XDCDD, 0XCD54, 0XB9EB, 0XA862, 0X9AF9, 0X8B70,
0X8408, 0X9581, 0XA71A, 0XB693, 0XC22C, 0XD3A5, 0XE13E, 0XF0B7,
0X0840, 0X19C9, 0X2B52, 0X3ADB, 0X4E64, 0X5FED, 0X6D76, 0X7CFF,
0X9489, 0X8500, 0XB79B, 0XA612, 0XD2AD, 0XC324, 0XF1BF, 0XE036,
0X18C1, 0X0948, 0X3BD3, 0X2A5A, 0X5EE5, 0X4F6C, 0X7DF7, 0X6C7E,
0XA50A, 0XB483, 0X8618, 0X9791, 0XE32E, 0XF2A7, 0XC03C, 0XD1B5,
0X2942, 0X38CB, 0X0A50, 0X1BD9, 0X6F66, 0X7EEF, 0X4C74, 0X5DFD,
0XB58B, 0XA402, 0X9699, 0X8710, 0XF3AF, 0XE226, 0XD0BD, 0XC134,
0X39C3, 0X284A, 0X1AD1, 0X0B58, 0X7FE7, 0X6E6E, 0X5CF5, 0X4D7C,
0XC60C, 0XD785, 0XE51E, 0XF497, 0X8028, 0X91A1, 0XA33A, 0XB2B3,
0X4A44, 0X5BCD, 0X6956, 0X78DF, 0X0C60, 0X1DE9, 0X2F72, 0X3EFB,
0XD68D, 0XC704, 0XF59F, 0XE416, 0X90A9, 0X8120, 0XB3BB, 0XA232,
0X5AC5, 0X4B4C, 0X79D7, 0X685E, 0X1CE1, 0X0D68, 0X3FF3, 0X2E7A,
0XE70E, 0XF687, 0XC41C, 0XD595, 0XA12A, 0XB0A3, 0X8238, 0X93B1,
0X6B46, 0X7ACF, 0X4854, 0X59DD, 0X2D62, 0X3CEB, 0X0E70, 0X1FF9,
0XF78F, 0XE606, 0XD49D, 0XC514, 0XB1AB, 0XA022, 0X92B9, 0X8330,
0X7BC7, 0X6A4E, 0X58D5, 0X495C, 0X3DE3, 0X2C6A, 0X1EF1, 0X0F78,

```

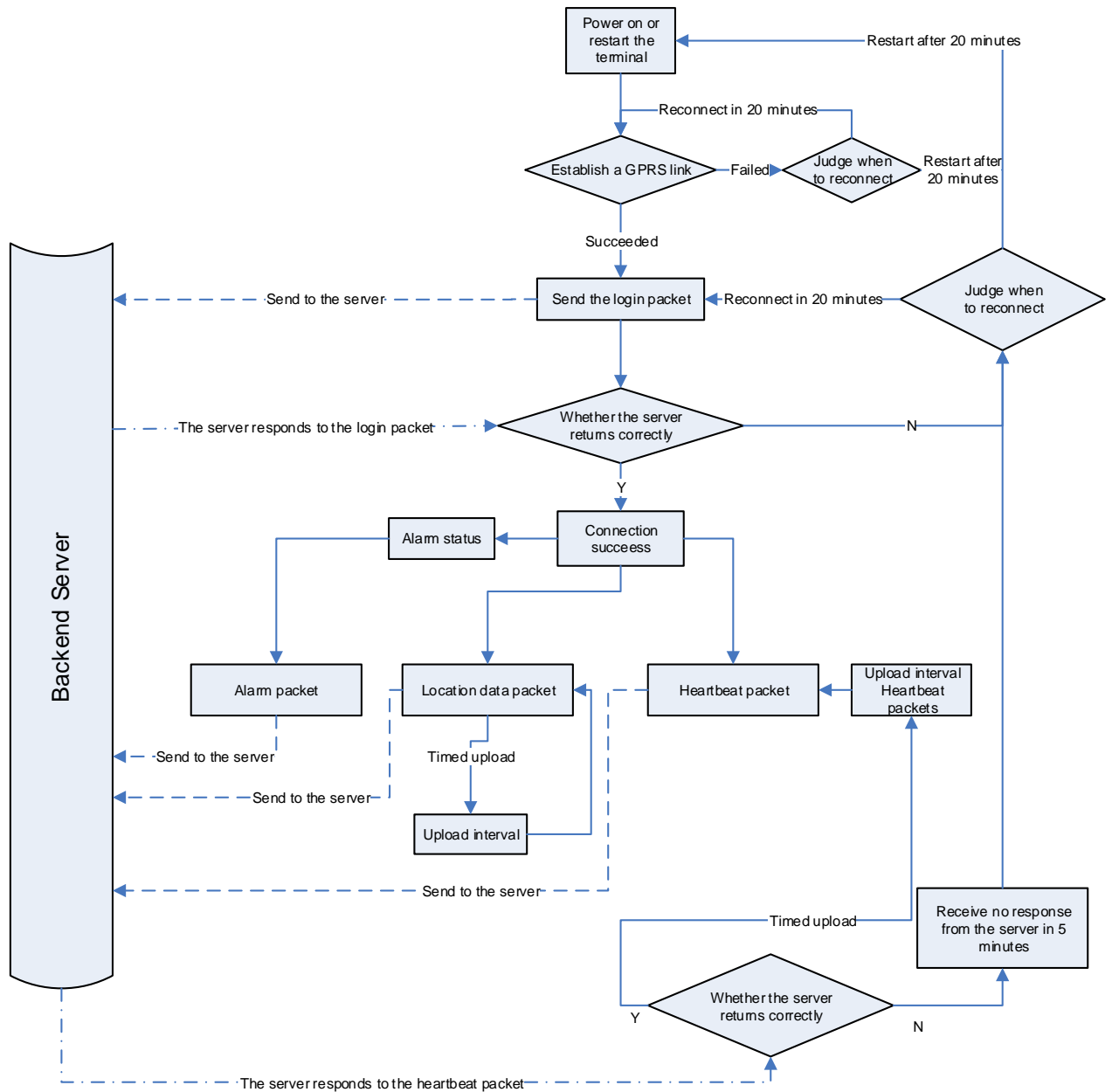
```
};
```

```
// Calculate 16-bit CRC of the given-length data.
```

```
U16 GetCrc16(const U8* pData, int nLength)
```

```
{
    U16 fcs = 0xffff;           // Initialize
    while(nLength>0){
        fcs = (fcs >> 8) ^ crctab16[(fcs ^ *pData) & 0xff];
        nLength--;
        pData++;
    }
    return ~fcs;                // Negate
}
```

3.2 Attachment 2 Services Flowchart



3.3 Attachment 3 Mapping Relationship Between Battery Voltage and Strength in Heartbeat Packet (AM01)

Strength	Voltage
100%	4.2
95%	4.113
90%	4.072
85%	4.033
80%	3.993
75%	3.955
70%	3.922
65%	3.89
60%	3.858
55%	3.829
50%	3.807
45%	3.788
40%	3.771
35%	3.757
30%	3.744
25%	3.732
20%	3.721
15%	3.709
10%	3.696
5%	3.675
0%	3.65