Shenzhen Concox Information Technology Co.,Ltd

GPS Tracker Communication Protocol

(GT06E)

CONTENT

Communication Protocol

Introduction

This document defines instructions about interface protocol on application layer of vehicles GPS tracker and location-based service platform. Related interface protocol only applies in the interaction between the platform and the position terminal.

i. Terms, Definitions

Terms, Abbreviation	Definition in English	Definition in Chinese
CMPP	China Mobile Peer to Peer	中国移动点对点协议
GPS	Global Positioning System	全球卫星定位系统
GSM	Global System for Mobile Communication	全球移动通信系统
GPRS	General Packet Radio Service	通用无线分组业务
TCP	Transport Control Protocol	传输控制协议
LBS	Location Based Services	辅助定位服务
IMEI	International Mobile Equipment Identity	国际移动设备识别码
MCC	Mobile Country Code	移动用户所属国家代号
MNC	Mobile Network Code	移动网号码
LAC	Location Area Code	位置区码
Cell ID	Cell Tower ID	移动基站
UDP	User Datagram Protocol	用户数据报协议
SOS	Save Our Ship/Save Our Souls	遇难求救信号
CRC	Cyclic Redundancy Check	循环冗余校验
NITZ	Network Identity and Time Zone,	时区
GIS	Geographic Information System	地理信息系统

ii. Basic Rules

1. If a GPRS connection is established successfully, the terminal will send a first login message packet to the server and, within five seconds, if the terminal receives a data packet responded by the server, the connection is considered to be a normal connection. The terminal will begin to send location information (i.e., GPS, LBS information package). A status information package will be sent by the terminal after three minutes to regularly confirm the connection.

2. If the GPRS connection is established unsuccessfully, the terminal will not be able to send the login message packet. The terminal will start schedule reboot in twenty minutes if the GPRS connection is failed three times. Within twenty minutes, if the terminal successfully connects to the server and receives the data packet from the server as the server's response to the login message packet sent by the terminal, the schedule reboot will be off and the terminal will not be rebooted; otherwise, the terminal will be rebooted automatically in twenty minutes.

3. After receiving the login message packet, the server will return a response data packet. If the terminal doesn't receive packet from the server within five seconds after sending the login message packet or the status information package, the current connection is regarded as an abnormal connection. The terminal will start a retransmission function for GPS tracking data, which will cause the terminal to disconnect the current GPRS connection, rebuild a new GPRS connection and send a login message packet again.

4. If the connection is regarded to be abnormal, and the data packet as a response from the server is failed to be received three times after a connection is established and a login message packet or status information package is sent, the terminal will start schedule reboot and the scheduled time is ten minutes. Within ten minutes, if the terminal successfully connects to the server and receives the data packet responded by the server, the schedule reboot will be off and the terminal will not be rebooted; otherwise, the terminal will be rebooted automatically in ten minutes.

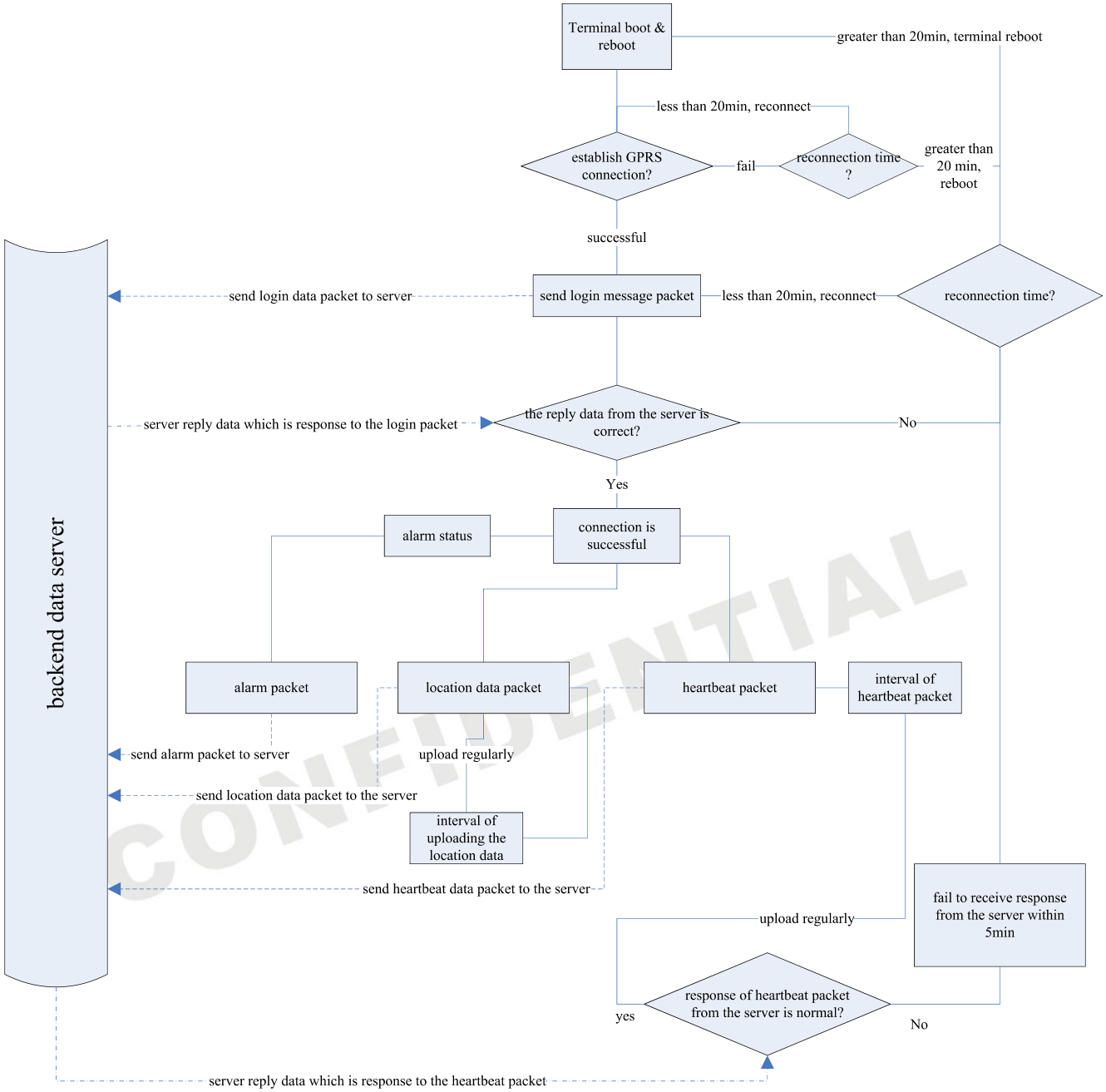
5. In case of the normal connection, the terminal will send a combined information package of GPS and LBS to the server after the GPS information is changed; and the server may set a default protocol for transmission by using commands.

6. To ensure the effectiveness of the connection, the terminal will send status information to the server at regular intervals, and the server will return response data packets to confirm the connection.

7. For the terminal which doesn't register an IMEI number, the server will reply the terminal with a login request response and heartbeat packet response, rather than directly disconnect the connection. (If the connection is directly disconnected or the server doesn't reply to the terminal, it will lead to a continuous reconnected by the terminal and the GPRS traffic will be

consumed heavily.

Data Flow Diagram



iv. Data Packet Format

The communication is transferred asynchronously in bytes.

The total length of packets is (10+N) Bytes.

Format	Length(Byte)
Start Bit	2
Packet Length	1
Protocol Number	1
Information Content	N
Information Serial Number	2
Error Check	2
Stop Bit	2

4.1. Start Bit

Fixed value in HEX 0x78 0x78.

4.2. Packet Length

Length = Protocol Number + Information Content + Information Serial Number + Error Check, totally (5+N)Bytes, because the Information Content is a variable length field.

4.3. Protocol Number

Type	Value
Login Message	0x01
Location Data	0x12
Status information	0x13
String information	0x15
Alarm data	0x16
GPS, query address information by phone number	0x1A
Command information sent by the server to the terminal	0x80
Information Transmission Packet	0x94

4.4. Information Contents

The specific contents are determined by the protocol numbers corresponding to different applications.

4.5. Information Serial Number

The serial number of the first GPRS data (including status packet and data packet such as GPS, LBS) sent after booting is '1', and the serial number of data sent later at each time will be automatically added '1'.

4.6. Error Check

A check code may be used by the terminal or the server to distinguish whether the received information is error or not. To prevent errors occur during data transmission, error check is added to

against data misoperation, so as to increase the security and efficiency of the system. The check code is generated by the CRC-ITU checking method.

The check codes of data in the structure of the protocol, from the Packet Length to the Information Serial Number (including "Packet Length" and "Information Serial Number") , are values of CRC-ITU.

CRC error occur when the received information is calculated, the receiver will ignore and discard the data packet.

4.7. Stop Bit

Fixed value in HEX 0x0D 0x0A.

Ⅴ.Details about Data Packet sent by Server to Terminal

The commonly used information packages sent by the terminal and those sent by the server will be interpreted separately.

5.1. Login Message Packet

5.1.1. Terminal Sending Data Packet to Server

The login message packet is used to be sent to the server with the terminal ID so as to confirm the established connection is normal or not.

	Description	Bits	Example
Login Message Packet(18 Byte)	Start Bit	2	0x78 0x78
	Packet Length	1	0x0D
	Protocol Number	1	0x01
	Terminal ID	8	0x01 0x23 0x45 0x67 0x89 0x01 0x23 0x45
	Information Serial Number	2	0x00 0x01
	Error Check	2	0x8C 0xDD
	Stop Bit	2	0x0D 0x0

5.1.1.1. Start Bit

For details see Data Packet Format section 4.1.

5.1.1.2. Packet Length

For details see Data Packet Format section 4.2.

5.1.1.3. Protocol Number

For details see Data Packet Format section 4.3.

5.1.1.4. Terminal ID

The terminal ID applies IMEI number of 15 bits.

Example: if **the** IMEI is 123456789012345,
the terminal ID is 0x01 0x23 0x45 0x67 0x89 0x01 0x23 0x45.

5.1.1.5. Information Serial Number

For details see Data Packet Format section 4.5.

5.1.1.6. Error Check

For details see Data Packet Format section 4.6.

5.1.1.7. Stop Bit

For details see Data Packet Format section 4.7.

5.1.2. Server Responds the Data Packet

	Description	Bits	Example
Login Message Packet (18 Byte)	Start Bit	2	0x78 0x78
	Packet Length	1	0x05
	Protocol Number	1	0x01
	Information Serial Number	2	0x00 0x01
	Error Check	2	0xD9 0xDC
	Stop Bit	2	0x0D 0x0A

The response packet from the server to the terminal: the protocol number in the response packet is identical to the protocol number in the data packet sent by the terminal.

5.1.2.1. Start Bit

For details see Data Packet Format section 4.1.

5.1.2.2. Packet Length

For details see Data Packet Format section 4.2.

5.1.2.3. Protocol Number

For details see Data Packet Format section 4.3.

5.1.2.4. Information Serial Number

For details see Data Packet Format section 4.5.

5.1.2.5. Error Check

For details see Data Packet Format section 4.6.

5.1.2.6. Stop Bit

For details see Data Packet Format section 4.7.

5.1.3. Examples

Examples of the login message packet sent by the terminal to the server and the response packet sent by the server to the terminal are as follows: (in the examples the terminal ID is 123456789012345.

Example of data packet sent by the terminal 78 78 0D 01 01 23 45 67 89 01 23 45 00 01 8C DD 0D 0A						
Explain						
0x78 0x78	0x0D	0x01	0x01 0x23 0x45 0x67 0x89 0x01 0x23 0x45	0x00 0x01	0x8C 0xDD	0x0D 0x0A

Start Bit	Length	Protocol No.	Terminal ID	Serial No.	Error Check	Stop Bit
Example of response packet returned by the server						
78 78 05 01 00 01 D9 DC 0D 0A						
Explain						
0x78 0x78	0x05	0x01	0x00 0x01	0xD9 0xDC	0x0D 0x0A	
Start Bit	Length	Protocol No.	Serial No.	Error Check	Stop Bit	

5.2. Location Data Packet

5.2.1. Terminal Sending Location Data Packet to Server

a) Format of location data packet sent Server by default (mileage turned off).

Format			Length(Byte)	Example
Information Content	Start Bit		2	0x78 0x78
	Packet Length		1	0x1F
	Protocol Number		1	0x12
	GPS Information	Date Time	6	0x0B 0x08 0x1D 0x11 0x2E 0x10
		Quantity of GPS information satellites	1	0xCF
		Latitude	4	0x02 0x7A 0xC7 0xEB
		Longitude	4	0x0C 0x46 0x58 0x49
		Speed	1	0x00
		Course, Status	2	0x14 0x8F
	LBS Information	MCC	2	0x01 0xCC
		MNC	1	0x00
		LAC	2	0x28 0x7D
		Cell ID	3	0x00 0x1F 0xB8
	Serial Number		2	0x00 0x03
	Error Check		2	0x80 0x81
	Stop Bit		2	0x0D 0x0A

5.2.1.1. Start Bit

For details see Data Packet Format section 4.1.

5.2.1.2. Packet Length

For details see Data Packet Format section 4.2.

5.2.1.3. Protocol Number

For details see Data Packet Format section 4.3.

5.2.1.4. Date Time

Format	Length(Byte)	Example
Year	1	0x0A
Month	1	0x03
Day	1	0x17
Hour	1	0x0F
Minute	1	0x32

Second	1	0x17

Example: 2010-03-23 15:30:23

Calculated as follows: 10(Decimal)=0A(Hexadecimal)

3 (Decimal)=03(Hexadecimal)

23(Decimal)=17(Hexadecimal)

15(Decimal)=0F(Hexadecimal)

50(Decimal)=32(Hexadecimal)

23(Decimal)=17(Hexadecimal)

Then the value is: 0x0A 0x03 0x17 0x0F 0x32 0x17

5.2.1.5. Length of GPS information, quantity of positioning satellites

The field is 1 Byte displayed by two hex digits, wherein the first one is for the length of GPS information and the second one for the number of the satellites join in positioning.

Example: if the value is 0xCB, it means the length of GPS information is 12 and the number of the positioning satellites is 11.

(C = 12Bit Lenght ， B = 11 satellites)

5.2.1.6. Latitude

Four bytes are consumed, defining the latitude value of location data. The range of the value is 0-162000000, indicating a range of 0º90°.The conversion method thereof is as follow:

Converting the value of latitude and longitude output by GPS module into a decimal based on minute; multiplying the converted decimal by 30000; and converting the multiplied result into hexadecimal

Example: 22º32.7658'=(22X60+32.7658)X30000=40582974, then converted into a hexadecimal number

40582974(Decimal)= 26B3F3E(Hexadecimal)

at last the value is 0x02 0x6B 0x3F 0x3E.

5.2.1.7. Longitude

Four bytes are consumed, defining the longitude value of location data. The range of the value is 0-324000000, indicating a range of 0º180°.

The conversion method herein is same to the method mentioned in Latitude (see section 5.2.1.6).

5.2.1.8. Speed

One byte is consumed, defining the running Speed of GPS. The value ranges from 0x00 to 0xFF indicating a range from 0 to 225km/h.

e.g. 0x00 represents 0 km/h.

0x10 represents 16km/h.

0xFF represents 255 km/h.

5.2.1.9. Course & Status

Two bytes are consumed, defining the running direction of GPS. The value ranges from 0°to 360° measured clockwise from north of 0°.

BYTE_1	Bit7	0	0: ACC OFF
			1: ACC ON

	Bit6	0	1
	Bit5	GPS real-time/differential positioning	
	Bit4	GPS having been positioning or not	
	Bit3	East Longitude, West Longitude	
	Bit2	South Latitude, North Latitude	
	Bit1	Course	
	Bit0		
BYTE_2	Bit7		
	Bit6		
	Bit5		
	Bit4		
	Bit3		
	Bit2		
	Bit1		
	Bit0		

Note:

1. If the Bit6 in BYTE_1 is 1, then the Bit7 is valid. In this case, if Bit7 is 1, means ACC ON; if it is 0, means ACC OFF.

2. The status information in the data packet is the status corresponding to the time bit recorded in the data packet.

For example: the value is 0x15 0x4C, the corresponding binary is 00010101 01001100,

BYTE_1 Bit7 0

BYTE_1 Bit6 0

BYTE_1 Bit5 0 (real time GPS)

BYTE_1 Bit4 1 (GPS has been positioned)

BYTE_1 Bit3 0 (East Longitude)

BYTE_1 Bit2 1 (North Latitude)

BYTE_1 Bit1 0

BYTE_1 Bit0 1

BYTE_2 Bit7 0

BYTE_2 Bit6 1

BYTE_2 Bit5 0 → Course 332°(0101001100 in Binary, or 332 in decimal)

BYTE_2 Bit4 0

BYTE_2 Bit3 1

BYTE_2 Bit2 1

BYTE_2 Bit1 0

BYTE_2 Bit0 0

which means GPS tracking is on, real time GPS, location at north latitude, east longitude and the course is 332°

5.2.1.10. MCC

The country code to which a mobile user belongs, i.e., Mobile Country Code(MCC).

Example: Chinese MCC is 460 in decimal, or 0x01 0xCC in Hex (that is, a decimal value of 460 converting into a hexadecimal value, and 0 is added at the left side because the converted hexadecimal value is less than four digits).

Herein the range is 0x0000 ~ 0x03E7.

5.2.1.11. MNC

Mobile Network Code(MNC)

Example: Chinese MNC is 0x00.

5.2.1.12. LAC

Location Area Code (LAC) included in LAI consists of two bytes and is encoded in hexadecimal. The available range is 0x0001-0xFFFE, and the code group 0x0000 and 0xFFFF cannot be used. (See GSM specification 03.03, 04.08 and 11.11).

5.2.1.13. Cell ID

Cell Tower ID (Cell ID), which values ranges from 0x000000 to 0xFFFFFF.

5.2.1.14. Information Serial Number

For details see Data Packet Format section 4.5.

5.2.1.15. Error Check

For details see Data Packet Format section 4.6.

5.2.1.16. Stop Bit

For details see Data Packet Format section 4.7.

Format of location data packet sent Server by default (mileage turned on).

Format			Length(Byte)	Example
Information Content	Start Bit		2	0x78 0x78
	Packet Length		1	0x23
	Protocol Number		1	0x12
	GPS Information	Date Time	6	0x0B 0x08 0x1D 0x11 0x2E 0x10
		Quantity of GPS information satellites	1	0xCF
		Latitude	4	0x02 0x7A 0xC7 0xEB
		Longitude	4	0x0C 0x46 0x58 0x49

		Speed	1	0x00
		Course, Status	2	0x14 0x8F
	LBS Information	MCC	2	0x01 0xCC
		MNC	1	0x00
		LAC	2	0x28 0x7D
		Cell ID	3	0x00 0x1F 0xB8
		Mileage	4	0x00 0x00 0x00 0x00
	Driver ID	Length of driving ID	1	For the first positioning packet when swipe card:0x8f; The rest:0x4B
		Driving ID	75~N	24 2 0004552 00100
		Alarm status	1	1:alarm 0:no alarm
		Swipe flag	1	1:just swipe 0:no swipe
	Serial Number		2	0x00 0x03
	Error Check		2	0x61 0x90
	Stop Bit		2	0x0D 0x0A

5.2.1.17 Upload driver ID

1.No card been swiped: upload 75 blank spaces
2. When swipe magnetic card: for the first positioning packet, upload all 3 track data
3. When swipe magnetic card: after the first positioning packet upload all 3 track data , for the rest positioning packet, only upload track 3 data

Example:

Upload all 3 track :
7878B5121105170E0C13CA027AC9C20C465AB600D40201CC00287D001F71000000008F2520205E53554B534157414444454524534149544841524E244D4953535E5E3F3B363030373634333130303530303135373839313D31353036313938303930393D3F2B20202020202020202020202020202032342020202020202020202020202020203220202020202020202020202020202020303030343535322020303031303020202020202020202020202020202020202020202030310002247 20D0A

Only upload track 3:
787871121105170E0E34CA027AC9C20C465AB600D40201CC00287D001F40000000004B202020202020202020202020202020323420202020202020202020202020202032202020202020202020202020202020203030303435353220203030313030202020202020202020202020202020202020202020203030000327410D0A

Mileage Statistics (after turned on)
Mileage statistics do mileage calculation and showed by hex.

b) Server doesn't need to reply location data packet.

5.3. Alarm Packet (Combined information packet of GPS, LBS and Status)

5.3.1. Server Sending Alarm Data Packet to Server

Format			Length (Byte)
Information Content	Start Bit		2
	Packet Length		1
	Protocol Number		1
	Date Time		6
	GPS Information	Quantity of GPS information satellites	1
		Latitude	4
		Longitude	4
		Speed	1
		Course, Status	2
	LBS Information	LBS Length	1
		MCC	2
		MNC	1
		LAC	2
		Cell ID	3
	status Information	Terminal Information Content	1
		Voltage Level	1
		GSM Signal Strength	1
		Alarm/Language	2
	Serial Number		2
	Error Check		2
	Stop Bit		2

Alarm packet is consisted by adding status information to location packet, so does the encoding format of the protocol.

5.3.1.1. Start Bit

For details see Data Packet Format section 4.1.

5.3.1.2. Packet Length

For details see Data Packet Format section 4.2.

5.3.1.3. Protocol Number

For details see Data Packet Format section 4.3.

5.3.1.4. Date Time

For details see Location Data Packet Format section 5.2.1.4.

5.3.1.5. Length of GPS information, quantity of positioning satellites

For details see Location Data Packet Format section 5.2.1.5.

5.3.1.6. Latitude

For details see Location Data Packet Format section 5.2.1.6.

5.3.1.7. Longitude

For details see Location Data Packet Format section 5.2.1.7.

5.3.1.8. Speed

For details see Location Data Packet Format section 5.2.1.8.

5.3.1.9. Status and Course

For details see Location Data Packet Format section 5.2.1.9.

5.3.1.10. MCC

For details see Location Data Packet Format section 5.2.1.10.

5.3.1.11. MNC

For details see Location Data Packet Format section 5.2.1.11.

5.3.1.12. LAC

For details see Location Data Packet Format section 5.2.1.12.

5.3.1.13. Cell ID

For details see Location Data Packet Format section 5.2.1.13.

5.3.1.14. Terminal Information

One byte is consumed, defining various status information of the mobile phone.

Bit		Code Meaning
BYTE	Bit7	1: oil and electricity disconnected
		0: gas oil and electricity connected
	Bit6	1: GPS tracking is on
		0: GPS tracking is off
	Bit3~ Bit5	100: SOS
		011: Low Battery Alarm
		010: Power Cut Alarm
		001: Shock Alarm
		000: Normal
	Bit2	1: Charge On
		0: Charge Off
	Bit1	1: ACC high
		0: ACC Low
	Bit0	1: Defense Activated
		0: Defense Deactivated

Example: 0x44, corresponding binary value is 01000100,
indicates that the status of the terminal is: oil and electricity connected, GPS tracking is on, normal without any alarm, charge on, ACC is low, and defense deactivated.

5.3.1.15. Voltage Level

The range is 0~6 defining the voltage is from low to high.

0: No Power (shutdown)

1: Extremely Low Battery (not enough for calling or sending text messages, etc.)

2: Very Low Battery (Low Battery Alarm)

3: Low Battery (can be used normally)

4: Medium

5: High

6: Very High

Example: 0x02 indicates very low battery and a Low Battery Alarm is sending.

5.3.1.16. GSM Signal Strength Levels

0x00: no signal;

0x01: extremely weak signal;

0x02: very weak signal;

0x03: good signal;

0x04: strong signal.

Example: 0x03 indicates the GSM signal is good.

5.3.1.17. Alarm/Language

0x00 (former bit) 0x01 (latter bit)

former bit: terminal alarm status (suitable for alarm packet and electronic fence project)

latter bit: the current language used in the terminal

former bit	0x00: normal
	0x01: SOS
	0x02: Power Cut Alarm
	0x03: Shock Alarm
	0x04: Fence In Alarm
	0x05: Fence Out Alarm
	0x06 Over Speed Alarm
	0x09 Moving Alarm
	0x29 Harsh acceletation alarm
	0x30 Harsh braking alarm
	0x2A Sharp Left Turn Alarm
	0x2B Sharp Right Turn Alarm
latter bit	0x01: Chinese
	0x02: English

Examples:

No Alarm and Language is Chinese: 0x00 0x01

No Alarm and Language is English: 0x00 0x02

To increase the reliability of alarm information, labeling the alarm information repeatedly; in most cases, the alarm information keeps consistent with information of former terminal, while the inconsistencies are as follows:

- **A. Low Battery Alarm occurred in the information of the terminal**
- **B. Fence in and out Alarm in the Alarm/Language information**

5.3.1.18. Information Serial Number

For details see Data Packet Format section 4.5.

5.3.1.19. Error Check

For details see Data Packet Format section 4.6.

5.3.1.20. Stop Bit

For details see Data Packet Format section 4.7.

5.3.1.21. Examples

Examples of terminal transmission

78 78 25 16 0B 0B 0F 0E 24 1D CF 02 7A C8 87 0C 46 57 E6 00 14 02 09 01 CC 00 28 7D 00 1F 72 65 06 04 01 01 00 36 56 A4 0D 0A

Explain

0x78 0x78	0x25	0x16	0x0B 0x0B 0x0F 0x0E 0x24 x01D	0xCF		0x02 0x7A 0xC8 0x87	
Start Bit	Length	Protocol No.	Date Time	Quantity of GPS information satellites		Latitude	
0x0C 0x46 0x57 0xE6	0x00	0x14 0x02	0x09	0x01 0xCC	0x00	0x28 0x7D	0x00 0x1F 0x72
Longitude	Speed	Course Status	LBS Length	MCC	MNC	LAC	Cell ID
0x65	0x06	0x04	0x01 0x01	0x00 0x36	0x56 0xA4		0x0D 0x0A
Terminal Information Content	Voltage Level	GSM Signal Strength	Alarm/Language	Serial No.	Error Check		Stop Bit

Note: The status information in the data packet is the status corresponding to the time bit recorded in the data packet.

5.3.2. Server responding alarm data packet to terminal（terminal do not check enforcedly）

Format		Length(Byte)
Information Content	Start Bit	2
	Packet Length	1
	Protocol Number	1
	Serial Number	2
	Error Check	2
	Stop Bit	2

Alarm packet is consisted by adding status information to location packet, so does the encoding format of the protocol.

5.3.2.1. Start Bit

For details see Data Packet Format section 4.1

5.3.2.2. Packet Length

For details see Data Packet Format section 4.2

5.3.2.3. Protocol Number

For details see Data Packet Format section 4.3

5.3.2.4. Serial Number

For details see Data Packet Format section 4.5

5.3.2.5. Error Check

For details see Data Packet Format section 4.6

5.3.2.6. Stop Bit

For details see Data Packet Format section 4.7

5.3.2.7. Examples

Example of data packet responded by the server

78 78 05 16 00 36 95 70 0D 0A

5.3.3. Server responding alarm data address packet to Terminal

5.3.3.1. Response package in Chinese

The response data packet in Chinese is as follow:

Command packet sent from the server to the terminal (15+M+N Byte)	Start Bit			2
	Length of data bit			1
	Protocol Number			1
	Information Content	Length of Command		1
		Server Flag Bit		4
		Command Content	ALARMSMS	8
			&&	2
			Address Content	M
			&&	2
			Phone Number	21
			##	2
	Information Serial Number			2
	Check Bit			2
	Stop Bit			2

The Protocol Number of request Chinese address response is 0X17.

Command Content: ADDRESS&&Address Content&&Phone Number(All is 0)## (ADDRESS, &&, ## are fixed strings)

Chinese address content is sent in UNICODE.

Example of Chinese address response information:

7878 // Start Bit

85 // Data Length
17 // Response Protocol Number
7E // Length of Command, i.e., length of the information of the transmitted content
00000001 // Server Flag Bit
414C41524D534D53 // ALARMSMS
2626 //&& Separator
624059044F4D7F6E0028 // Chinese address is sent in UNICODE
004C004200530029003A
5E7F4E1C77015E7F5DDE
5E0282B190FD533AFF17
FF15FF144E6190530028
004E00320033002E0033
00390035002C00450031
00310032002E00390038
0038002996448FD1
2626 //&& Separator
00000000000000000000000000000000000000000000 // Phone Number
2323 //## terminator of content
0106 // Serial No.
3825 // Check Bit
0D0A // Stop Bit

5.3.3.2. Response package in English

Considering the address or other foreign address in English is generally longer than that in Chinese, one data bit is not enough, so the data bit is occupied in 2 bytes.
Note: only the length of data bit corresponding to the protocol number of response address information is changed into two bytes.

<table>
<tr><td rowspan="8">Command packet sent from the server to the terminal (15+M+N</td><td colspan="3">Start Bit</td><td>2</td></tr>
<tr><td colspan="3">Length of data bit</td><td>2</td></tr>
<tr><td colspan="3">Protocol Number</td><td>1</td></tr>
<tr><td rowspan="5">Information Content</td><td colspan="2">Length of Command</td><td>2</td></tr>
<tr><td colspan="2">Server Flag Bit</td><td>4</td></tr>
<tr><td rowspan="3">Command Content</td><td>ALARMSMS</td><td>8</td></tr>
<tr><td>&&</td><td>2</td></tr>
<tr><td>Address Content</td><td>M</td></tr>
<tr><td></td><td></td><td>&&</td><td>2</td></tr>
</table>

Byte)			Phone Number	21
			##	2
	Information Serial Number			2
	Check Bit			2
	Stop Bit			2

The Protocol Number of request English address response is 0X97.

Command Content: ADDRESS&&Address Content&&Phone Number(All is 0)##(ADDRESS, &&, ## are fixed strings)

Example of English address response information:

7878 // Start Bit
00D2 // Data Length
97 // Response Protocol Number
00CA // Length of Command, i.e., length of the information of the transmitted content
00000001 // Server Flag Bit
414C41524D534D53 // ALARMSMS
2626 //&& Separator
0053004F00530028004C // English address is sent in UNICODE
0029003A005300680069
006D0069006E00200046
0061006900720079006C
0061006E006400200057
0065007300740020052
0064002C004800750069
006300680065006E0067
002C004800750069007A
0068006F0075002C0047
00750061006E00670064
006F006E00670028004E
00320033002E00310031
0031002C004500310031
0034002E003400310031
0029004E006500610072
00620079
2626 //&& Separator
00000000000000000000000000000000000000000000 // Phone Number
2323 //## terminator of content
0007 //Serial No.
72b5 // Check Bit
0D0A // Stop Bit

5.4. Heartbeat Packet (status information packet)

Heartbeat packet is a data packet to maintain the connection between the terminal and the server.

5.4.1. Terminal Sending Heartbeat Packet to Server

Format			Length (Byte)
Information Content	Start Bit		2
	Packet Length		1
	Protocol Number		1
	Status Information	Terminal Information Content	1
		Voltage Level	1
		GSM Signal Strength	1
		Alarm/Language	2
	Serial Number		2
	Error Check		2
	Stop Bit		2

5.4.1.1. Start Bit

For details see Data Packet Format section 4.1.

5.4.1.2. Packet Length

For details see Data Packet Format section 4.2.

5.4.1.3. Protocol Number

For details see Data Packet Format section 4.3.

5.4.1.4. Terminal Information

One byte is consumed defining for various status information of the mobile phone.

Bit		Code Meaning
BYTE	Bit7	1: oil and electricity disconnected
		0: gas oil and electricity
	Bit6	1: GPS tracking is on
		0: GPS tracking is off
	Bit3~ Bit5	100: SOS
		011: Low Battery Alarm
		010: Power Cut Alarm
		001: Shock Alarm
		000: Normal
	Bit2	1: Charge On
		0: Charge Off
	Bit1	1: ACC high
		0: ACC Low
	Bit0	1: Defense Activated
		0: Defense Deactivated

Example: 0x44, corresponding binary value is 01000100, indicates that the status of the terminal is: oil and electricity connected, GPS tracking is on, normal without any alarm, charge on, ACC is low, and defense deactivated.

5.4.1.5. Voltage Level

The range is 0~6 defining the voltage is from low to high.

0: No Power (shutdown)

1: Extremely Low Battery (not enough for calling or sending text messages, etc.)

2: Very Low Battery (Low Battery Alarm)

3: Low Battery (can be used normally)

4: Medium

5: High

6: Very High

Example: 0x02 indicates very low battery and a Low Battery Alarm is sending.

5.4.1.6. GSM Signal Strength Levels

0x00: no signal;

0x01: extremely weak signal;

0x02: very weak signal;

0x03: good signal;

0x04: strong signal.

Example: 0x03 indicates the GSM signal is good.

5.4.1.7. Alarm/Language

0x00 (former bit) 0x01 (latter bit)

former bit: terminal alarm status (suitable for alarm packet and electronic fence project)

latter bit: the current language of the terminal

former bit	
latter bit	0x01: Chinese
	0x02: English

Examples:

No Alarm and Language is Chinese: 0x00 0x01

No Alarm and Language is English: 0x00 0x02

5.4.1.8. Information Serial Number

For details see Data Packet Format section 4.5.

5.4.1.9. Error Check

For details see Data Packet Format section 4.6.

5.4.1.10. Stop Bit

For details see Data Packet Format section 4.7.

5.4.2. Server Responds the Data Packet

	Description	Bits	Example
Login Message Packet (18 Byte)	Start Bit	2	0x78 0x78
	Packet Length	1	0x05
	Protocol Number	1	0x01
	Information Serial Number	2	0x00 0x01
	Error Check	2	0xD9 0xDC
	Stop Bit	2	0x0D 0x0A

The response packet from the server to the terminal: the protocol number in the response packet is identical to the protocol number in the data packet sent by the terminal.

5.4.2.1. Start Bit

For details see Data Packet Format section 4.1.

5.4.2.2. Packet Length

For details see Data Packet Format section 4.2.

5.4.2.3. Protocol Number

For details see Data Packet Format section 4.3.

5.4.2.4. Information Serial Number

For details see Data Packet Format section 4.5.

5.4.2.5. Error Check

For details see Data Packet Format section 4.6.

5.4.2.6. Stop Bit

For details see Data Packet Format section 4.7.

5.4.3. Examples

Example of data packet sent by the terminal

78 78 08 13 4B 04 03 00 01 00 11 06 1F 0D 0A

Explain

0x78 0x78	0x08	0x13	0x4B 0x04 0x03	0x00 0x01	0x00 0x11	0x06 0x1F	0x0D 0x0A
Start Bit	Length	Protocol No.	Information Content	Reserved bit (Language)	Serial No.	Error Check	Stop Bit

Example of response packet returned by the server

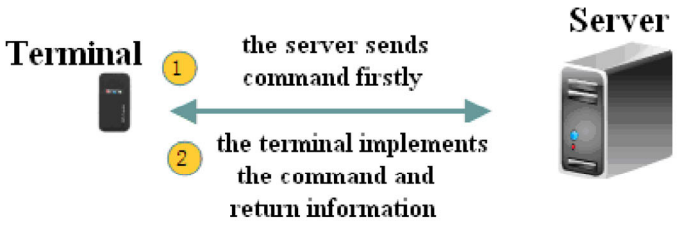
78 78 05 13 00 11 F9 70 0D 0A

Explain

0x78 0x78	0x05	0x13	0x00 0x11	0xF9 0x70	0x0D 0x0A

Start Bit	Length	Protocol No.	Serial No.	Error Check	Stop Bit

Ⅵ. Data Packet Sent From Server to Terminal



6.1. Packet Sent by Server

Format		Length (Byte)
Start Bit		2
Packet length		1
Protocol Number		1
Information Content	Length of Command	1
	Server Flag Bit	4
	Command Content	M
Information Serial Number		2
Error Check		2
Stop Bit		2

6.1.1. Start Bit

For details see Data Packet Format section 4.1.

6.1.2. Packet Length

For details see Data Packet Format section 4.2.

6.1.3. Protocol Number

The Protocol Number of terminal transmission is 0x80.

6.1.4. Length of Command

Server Flag Bit + Length of Command Content

Example: measured in bytes, 0x0A means the content of command occupied ten bytes.

6.1.5. Server Flag Bit

It is reserved to the identification of the server. The binary data received by the terminal is returned without change.

6.1.6. Command Content

It is represented in ASC II of string, and the command content is compatible with text message command.

6.1.7. Information Serial Number

For details see Data Packet Format section 4.5.

6.1.8. Error Check

For details see Data Packet Format section 4.6.

6.1.9. Stop Bit

For details see Data Packet Format section 4.7.

6.2. Packet Replied by Terminal

Format		Length (Byte)
Start Bit		2
Packet Length		1
Protocol Number		1
Information Content	Length of Command	1
	Server Flag Bit	4
	Command Content	M
	Language	2
Information Serial Number		2
Error Check		2
Stop Bit		2

6.2.1. Start Bit

For details see Data Packet Format section 4.1.

6.2.2. Packet Length

For details see Data Packet Format section 4.2.

6.2.3. Protocol Number

The terminal responds to the command sent by the server. The format of data packet is consistent with “the command sent by the server to the terminal”, but the Protocol Number herein is different and is 0x15.

6.2.4. Length of Command

Server Flag Bit + Length of Command Content

Example: measured in bytes, 0x0A means the content of command occupied ten bytes.

6.2.5. Server Flag Bit

It is reserved to the identification of the server. The binary data received by the terminal is returned without change.

6.2.6. Command Content

It is represented in ASC II of string, and the command content is compatible with text message command.

6.2.7. Language

A bit indicates the current language used in the terminal.

Chinese: 0x00 0x01

English: 0x00 0x02

6.2.8. Information Serial Number

For details see Data Packet Format section 4.5.

6.2.9. Error Check

For details see Data Packet Format section 4.6.

6.2.10. Stop Bit

For details see Data Packet Format section 4.7.

6.3. Looking Up Location Information

Function Description: the command to obtain the positioning information. A mobile phone user or a short message server may obtain the positioning information by this command.

In an example, the transmitting and returning strings are converted into ASCII to generate command contents.

Sending by the server
DWXX#
Returned by the terminal
if successful, return
DWXX=Lat:<North/South Latitude>,Lon:<East/West Longitude>,Course:<angle>,Speed:<speed>,DateTime:<time>
if failed, return
DWXX=Command Error!
if tracking unsuccessful, return
DWXX=Lat:,Lon:, Course:,Speed:,DateTime:-:
Example:
DWXX=Lat:N23d5.1708m,Lon: E114d23.6212m,Course:120,Speed:53.02;DateTime:08-09-12 14:52:36
Explain: which means: N23d5.1708m, E114d23.6212m, Course: 120, Speed: 53.02km/h, Date Time: 08-09-12 14:52:36.

6.4. Cutting Oil and Electricity

Function Description: cutting off the vehicle oil-electric control circuit

In an example, the transmitting and returning strings are converted into ASCII to generate command contents.

Sending by the server
RELAY,1 #
Returned by the terminal
if successful, return
reply: Cut off the fule supply:Success!
if failed, return
reply: Already in the state of fuel supply cut off, the command is not running!
Explain: the oil and electricity are not allowed to be disconnect when the GPS tracking is off or the running speed is higher than 20KM/H.

6.5. Connecting Oil and Electricity

Function Description: connecting the vehicle oil-electric control circuit

In an example, the transmitting and returning strings are converted into ASCII to generate command contents.

Sending by the server
RELAY,0#
Returned by the terminal
if successful, return
reply: Restore fule supply: Success!

if failed, return

reply: Already in the state of fuel supply to resume, the command is not running!

6.6. Address Querying Information Sent by the Server

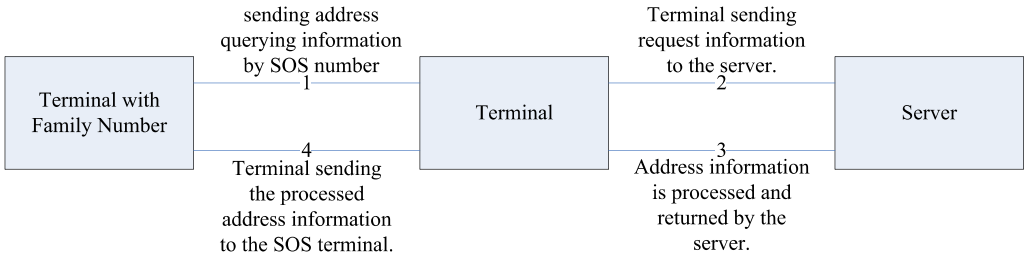
In an example, the transmitting and returning strings are converted into ASCII to generate command contents.

Sending by the server

ADDRESS, Address Content, Phone Number

Note: The address content in Chinese is sent in UNICODE.

6.7. GPS, Phone Number Querying Address Information Package (0X1A)



6.7.1. Information from Terminal to Server

The information is received by the terminal.

The format is basically same to the format mentioned as GPS information content, and the difference is that phone number for querying address is added here.

Format			Length (Byte)
Start Bit			2
Packet Length			1
Protocol Number			1
Information Content	Date Time		6
	GPS Information	Length of GPS information, quantity of positioning satellites	1
		Latitude	4
		Longitude	4
		Speed	1
		Course, Status	2
	Phone Number		21
	Language		2
Information Serial Number			2
Error Check			2
Stop Bit			2

6.7.1.1. Start Bit

For details see Data Packet Format section 4.1.

6.7.1.2. Packet Length

For details see Data Packet Format section 4.2.

Example: measured in bytes, 0x2E means the content of command occupied 46 bytes.

6.7.1.3. Protocol Number

0x1A is utilized.

6.7.1.4. Date Time

For details see Location Data Packet Format section 5.2.1.4.

6.7.1.5. Length of GPS information, quantity of positioning satellites

For details see Location Data Packet Format section 5.2.1.5.

6.7.1.6. Latitude

For details see Location Data Packet Format section 5.2.1.6.

6.7.1.7. Longitude

For details see Location Data Packet Format section 5.2.1.7.

6.7.1.8. Speed

For details see Location Data Packet Format section 5.2.1.8.

6.7.1.9. Course

For details see Location Data Packet Format section 5.2.1.9.

6.7.1.10. Phone Number

The SOS phone number used for requesting address query, which is converted by ASCII and 0 is added at the right side if less than 21 bits.

6.7.1.11. Language

A bit indicates the current language used in the terminal.

Chinese: 0x00 0x01

English: 0x00 0x02

6.7.1.12. Information Serial Number

For details see Data Packet Format section 4.5.

6.7.1.13. Error Check

For details see Data Packet Format section 4.6.

6.7.1.14. Stop Bit

For details see Data Packet Format section 4.7.

6.7.2. Response of Server

The server replies Chinese address or English address based on the extended command, and the response data packet is inconsistent

6.7.2.1. Response package in Chinese

The response data packet in Chinese is as follow:

<table>
<tr><td rowspan="11">Command packet sent from the server to the terminal (15+M+N Byte)</td><td colspan="3">Start Bit</td><td>2</td></tr>
<tr><td colspan="3">Length of data bit</td><td>1</td></tr>
<tr><td colspan="3">Protocol Number</td><td>1</td></tr>
<tr><td rowspan="9">Information Content</td><td colspan="2">Length of Command</td><td>1</td></tr>
<tr><td colspan="2">Server Flag Bit</td><td>4</td></tr>
<tr><td rowspan="7">Command Content</td><td>ADDRESS</td><td>7</td></tr>
<tr><td>&&</td><td>2</td></tr>
<tr><td>Address Content</td><td>M</td></tr>
<tr><td>&&</td><td>2</td></tr>
<tr><td>Phone Number</td><td>21</td></tr>
<tr><td>##</td><td>2</td></tr>
<tr><td colspan="3">Information Serial Number</td><td>2</td></tr>
</table>

	Check Bit	2
	Stop Bit	2

The Protocol Number of request Chinese address response is 0X17.

Command Content: ADDRESS&&Address Content&&Phone Number## (ADDRESS, &&, ## are fixed strings)

Chinese address content is sent in UNICODE.

Example of Chinese address response information:

7878 //Start Bit
84 //Data Length
17 //Response Protocol Number
7E //Length of Command, i.e., length of the information of the transmitted content
00000001 //Server Flag Bit
41444452455353 //ADDRESS
2626 //&& Separator
624059044F4D7F6E0028 //Chinese address is sent in UNICODE
004C004200530029003A
5E7F4E1C77015E7F5DDE
5E0282B190FD533AFF17
FF15FF144E6190530028
004E00320033002E0033
00390035002C00450031
00310032002E00390038
0038002996448FD1
2626 //&&Separator
3133373130383139313335000000000000000000 //Phone Number
2323 //## terminator of content
0106 //Serial No.
3825 //Check Bit
0D0A //Stop Bit

6.7.2.2. Response package in English

Considering the address or other foreign address in English is generally longer than that in Chinese, one data bit is not enough, so the data bit is occupied in 2 bytes.

Note: only the length of data bit corresponding to the protocol number of response address information is changed into two bytes.

Command packet sent	Start Bit	2
	Length of data bit	2

from the server to the terminal (15+M+N Byte)	Protocol Number			1
	Information Content	Length of Command		2
		Server Flag Bit		4
		Command Content	ADDRESS	7
			&&	2
			Address Content	M
			&&	2
			Phone Number	21
			##	2
	Information Serial Number			2
	Check Bit			2
	Stop Bit			2

The Protocol Number of request English address response is 0X97.

Command Content: ADDRESS&&Address Content&&Phone Number##(ADDRESS, &&, ## are fixed strings)

Example of English address response information:

7878 //Start Bit
00D1 //Data Length
97 //Response Protocol Number
00CA //Length of Command, i.e., length of the information of the transmitted content
00000001 //Server Flag Bit
41444452455353 //ADDRESS
2626 //&& Separator
0053004F00530028004C //English address is sent in UNICODE
0029003A005300680069
006D0069006E00200046
0061006900720079006C
0061006E006400200057
0065007300740200052
0064002C004800750069
006300680065006E0067
002C004800750069007A
0068006F0075002C0047
00750061006E00670064
006F006E00670028004E
00320033002E00310031
0031002C004500310031
0034002E003400310031
0029004E006500610072

00620079
2626 //&& Separator
313235323031333739303737343035310000000000 //Phone Number
2323 //## terminator of content
0007 // Serial No.
72b5 //Check Bit
0D0A //Stop Bit

7. Information transmission packet

Description：

- Terminal transmits all types of non-position data.

7.1. Information transmission packet sent by terminal

		Length	Description
Start Bit		2	0x79 0x79
Length of data bit		2	Length = Protocol Number + Information Content + Information Serial Number + Error Check
Protocol Number		1	0x94
Information Content	Information Type（Sub-protocol Number）	1	00 External power voltage 01~03（defined by customer） 04 terminal status synchronization 05door status 07Oil flow sensor ……to add
	Data Content	N	Different information type results in different transmission content. See the following for details.
Information Serial Number		2	Serial number of data sent later at each time will be automatically added ‘1’.
Error Check		2	Error check (From “Packet Length” to “Information Serial Number”) , are values of CRC-ITU. CRC error occur when the received information is calculated, the receiver will ignore and discard the data packet. (See Appendix 1)
Stop Bit		2	Fixed value:0x0D0x0A

Example：

7979007F9404414C4D313D43343B414C4D323D43433B414C4D333D34433B535441313D43303B4459443D30313B534F533D2C2C3B43454E5445523D3B46454E43453D46656E63652C4F4E2C302C32332E3131313830392C3131342E3430393236342C3430302C494E206F72204F55542C303B4D4946493D4D4946492C4F4646000A061E0D0A

Transmitted information content

When type is 00，the bit transmit external battery. This bit is two-digit hexadecimal value. Hexadecimal value converted to decimal value and divide 100

Example：0X04,0X9F, 049F converted to decimal is 101183，then divide 100 is 11.83, which means external voltage is 11.83V

When type is 04, the bit transmits information of terminal status synchronization. The bit length extended. Transmission is ASCII code.

Definition of content identifier

Definition	Identifier
Alarm Bit1	ALM1
Alarm Bit 2	ALM2
Alarm Bit 3	ALM3
Status Bit 1	STA1
SOS Number	SOS
Centre Number	CENTER
Fence	FENCE
Fuel/Electricity Cutoff Status	DYD
Mode	MODE

✧ **ALM1 Definition (Status）**

Bit	Definition	Mark
bit7	Vibration Alarm	1 ON 0 OFF
bit6	Network Alarm	1 ON 0 OFF
bit5	Phone Alarm	1 ON 0 OFF
bit4	SMS Alarm	1 ON 0 OFF
bit3	Displacement Alarm	1 ON 0 OFF
bit2	Network Alarm	1 ON 0 OFF
bit1	Phone Alarm	1 ON 0 OFF
bit0	SMS Alarm	1 ON 0 OFF

✧ ALM2 Definition (Status）

Bit	Definition	Mark
bit7	Low Battery Alarm	1 ON 0 OFF
bit6	Network Alarm	1 ON 0 OFF
bit5	Phone Alarm	1 ON 0 OFF
bit4	SMS Alarm	1 ON 0 OFF
bit3	Low Battery Alarm	1 ON 0 OFF
bit2	Network Alarm	1 ON 0 OFF
bit1	Phone Alarm	1 ON 0 OFF
bit0	SMS Alarm	1 ON 0 OFF

✧ **ALM3 Definition (Status）**

Bit	Definition	Mark
bit7	Overspeed Alarm	1 ON 0 OFF
bit6	Network Alarm	1 ON 0 OFF
bit5	Phone Alarm	1 ON 0 OFF
bit4	SMS Alarm	1 ON 0 OFF
bit3	Power Off Alarm	1 ON 0 OFF
bit2	Network Alarm	1 ON 0 OFF

bit1	Phone Alarm	1 ON 0 OFF
bit0	SMS Alarm	1 ON 0 OFF

✧ **STA1 Definition (Status）**

Bit	**Definition**	Mark
bit7	Arm Status	1 Arm0 Disarm
bit6	Automatically Arm	1 ON 0 OFF
bit5	Manually Arm	1 ON 0 OFF
bit4	Remotely Disarm	1 ON 0 OFF
bit3	To Be Defined	
bit2	To Be Defined	
bit1	Disassembly OFF	1 ON 0 OFF
bit0	Disassembly Alarm Status	1 ON 0 OFF

✧ **Fuel/Electricity Status Definition**

Bit	**Definition**	Mark
bit7	Undefined	
bit6	Undefined	
bit5	Undefined	
bit4	Undefined	
bit3	Deferred execution caused by overspeed	1Valid bit 0 Invalid bit
bit2	Deferred execution caused by GPS un located	1Valid bit 0 Invalid bit
bit1	Oil/Electricity cutoff	1Valid bit 0 Invalid bit
bit0	Oil/Electricity connection	1Valid bit 0 Invalid bit

✧ SOS definition：adopt ASCII to transmit（use “,” to separate if multiple SOS numbers）

✧ Center number definition：adopt ASCII to transmit

✧ Fence definition：adopt ASCII to transmit

✧ Mode：adopt ASCII to transmit(separate parameters by “，”)

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

Notice：Not all contents are transmitted and please parse based on bits. Different products upload different contents.

When type is 05，this bit transmit external IO detection(door checking). Transmission is hexadecimal.

Bit	**Definition**	Mark
bit7	To Be Defined	
bit6	To Be Defined	
bit5	To Be Defined	
bit4	To Be Defined	
bit3	To Be Defined	
bit2	IO Status	1 High 0 Low
bit1	Triggering Status	1High triggering 0 Low triggering
bit0	Door Status	1ON0OFF

For type 07, this bit transmit fuel sensor passthrough value by ASCII.

!AIOIL	**!AIOIL**	Special beginning of protocol
02	**02**	Device address
021.800	**021.800**	Output value of liquid level (unit: cm)
000.000	**000.000**	Temperature
412z	**4**	Standard protocol version
	12	Software version
	z	Hardware version
0200	**02**	Number of echoes
	0	Software status code
	0	Hardware status code
2	**2**	Installation status code
06	**06**	Excited wave multiplier
BF	**BF**	Error check

7.2. Server Response Information Transmission Packet

Server no Response

Ⅶ. Appendix A: code fragment of the CRC-ITU lookup table algorithm implemented based on C language

Code fragment of the CRC-ITU lookup table algorithm implemented based on C language is as follow:

```
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, 0XDFC5, 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 the 16-bit CRC of data with predetermined length.
U16 GetCrc16(const U8* pData, int nLength)
{
    U16  fcs  =  0xffff;            //  initialization
    while(nLength>0){
        fcs = (fcs >> 8) ^ crctab16[(fcs ^ *pData) & 0xff];
        nLength--;
        pData++;
    }
    return  ~fcs;           //  negated
}
```

Ⅷ. Appendix B: a fragment of example of data packet of communication protocol

The following data displayed in hexadecimal are intercepted from the communication between a terminal and a server, wherein transmission means sending by the terminal and reception means returned from the server:

Login packet:

transmission: 78 78 0D 01 03 53 41 35 32 15 03 62 00 02 2D 06 0D 0A

reception: 78 78 05 01 00 02 EB 47 0D 0A

GPS data packet (06 adopts combined information package of GPS and LBS):

transmission: 78 78 1F 12 0B 08 1D 11 2E 10 CF 02 7A C7 EB 0C 46 58 49 00 14 8F 01 CC 00 28 7D 00 1F B8 00 03 80 81 0D 0A

Status packet:

transmission: 78 78 0A 13 44 01 04 00 01 00 05 08 45 0D 0A

reception: 78 78 05 13 00 05 AF D5 0D 0A

disconnect oil and electricity online:

reception: 78 78 12 80 0C 00 11 42 78 52 45 4C 41 59 2C 31 23 00 00 D2 02 0D 0A

transmission: 78 78 2D 15 25 00 11 42 78 43 75 74 20 6F 66 66 20 74 68 65 20 66 75 65 6C 20 73 75 70 70 6C 79 3A 20 53 75 63 63 65 73 73 21 00 02 00 15 90 3B 0D 0A

the server sending： RELAY,1#

reply: Cut off the fule supply:Success!

Command sent during disconnection of oil and electricity:

reception: 78 78 12 80 0C 00 11 42 79 52 45 4C 41 59 2C 31 23 00 00 87 93 0D 0A

transmission: 78 78 54 15 4C 00 11 42 79 41 6C 72 65 61 64 79 20 69 6E 20 74 68 65 20 73 74 61 74 65 20 6F 66 20 66 75 65 6C 20 73 75 70 70 6C 79 20 63 75 74 20 6F 66 66 2C 20 74 68 65 20 63 6F 6D 6D 61 6E 64 20 69 73 20 6E 6F 74 20 72 75 6E 6E 69 6E 67 21 00 02 00 1A 05 54 0D 0A

the server sending :RELAY,1#

reply: Already in the state of fuel supply cut off, the command is not running!

Connect oil and electricity online:

reception: 78 78 12 80 0C 00 11 42 80 52 45 4C 41 59 2C 30 23 00 00 BE C2 0D 0A

transmission: 78 78 29 15 21 00 11 42 80 52 65 73 74 6F 72 65 20 66 75 65 6C 20 73 75 70 70 6C 79 3A 20 53 75 63 63 65 73 73 21 00 02 00 1C 26 D2 0D 0A

the server sending: RELAY,0#

reply: Restore fule supply: Success!

Command sent during connection of oil and electricity:

reception: 78 78 12 80 0C 00 11 42 81 52 45 4C 41 59 2C 30 23 00 00 EB 53 0D 0A

transmission: 78 78 56 15 4E 00 11 42 81 41 6C 72 65 61 64 79 20 69 6E 20 74 68 65 20 73 74 61 74 65 20 6F 66 20 66 75 65 6C 20 73 75 70 70 6C 79 20 74 6F 20 72 65 73 75 6D 65 2C 20 74 68 65 20 63 6F 6D 6D 61 6E 64 20 69 73 20 6E 6F 74 20 72 75 6E 6E 69 6E 67 21 00 02 00 20 06 74 0D 0A

the server sending: RELAY,0#

reply: Already in the state of fuel supply to resume, the command is not running!

Querying address information online:

reception: 78 78 16 80 10 00 01 A9 67 44 57 58 58 2C 30 30 30 30 30 30 23 00 A0 06 2D 0D 0A

transmission: 78 78 64 15 5C 00 01 A9 67 44 57 58 58 3D 4C 61 74 3A 4E 32 33 2E 31 31 31 36 38 32

2C 4C 6F 6E 3A 45 31 31 34 2E 34 30 39 32 31 37 2C 43 6F 75 72 73 65 3A 30 2E 30 30 2C 53 70 65 65 64 3A 30 2E 33 35 31 38 2C 44 61 74 65 54 69 6D 65 3A 31 31 2D 31 31 2D 31 35 20 20 31 31 3A 35 33 3A 34 33 00 02 00 23 07 AE 0D 0A

Content sent by the terminal: DWXX=Lat:N23.111682,Lon:E114.409217,Course:0.00,Speed:0.3518,DateTime:11-11-15 11:53:43

The terminal obtains address information from the server:

Chinese:

transmission: 78 78 2E 1A 0B 0B 0F 0E 21 17 CF 02 7A C8 87 0C 46 57 E3 00 14 02 36 36 33 36 36 00 03 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 34 AD E9 0D 0A

reception: 78 78 94 17 8E 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 60 E0 5D DE 5E 02 4E 91 5C 71 89 7F 8D EF 00 2E 65 87 53 4E 4E 00 8D EF 00 2E 79 BB 60 E0 5D DE 5B 89 4F 17 4F 1A 8B A1 5E 08 4E 8B 52 A1 62 40 7E A6 00 33 00 32 7C 73 00 2E 79 BB 60 E0 5D DE 5E 02 59 16 55 46 62 95 8D 44 67 0D 52 A1 4E 2D 5F C3 7E A6 00 33 00 32 7C 73 00 2E 26 26 36 36 33 36 36 00 03 00 04 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 01 E4 2A 0D 0A

The content sent by the server is: Locating: Wenhua Rd. 1, Huizhou, Guangdong, about 32 meters from Huizhou Anzhong Accounting Firm, about 32 meters from Huizhou Foreign Investment Service Center.

Mobile Phone Number is 66366.

English:

transmission: 78 78 2E 1A 0B 0B 0F 0E 1E 08 CF 02 7A C8 A2 0C 46 57 D7 00 14 02 36 36 33 36 36 00 03 00 04 00 00 00 00 00 00 00 00 00 00 00 00 00 02 00 32 04 3A 0D 0A

reception: 78 78 00 E9 97 00 E2 00 00 00 01 41 44 44 52 45 53 53 26 26 00 50 00 72 00 65 00 63 00 69 00 73 00 65 00 6C 00 79 00 20 00 4C 00 6F 00 63 00 61 00 74 00 69 00 6E 00 67 00 3A 00 31 00 30 53 F7 00 20 00 59 00 75 00 6E 00 73 00 68 00 61 00 6E 00 20 00 57 00 65 00 73 00 74 00 20 00 52 00 64 00 2C 00 48 00 75 00 69 00 63 00 68 00 65 00 6E 00 67 00 2C 00 48 00 75 00 69 00 7A 00 68 00 6F 00 75 00 2C 00 47 00 75 00 61 00 6E 00 67 00 64 00 6F 00 6E 00 67 00 2C 00 35 00 31 00 36 00 30 00 30 00 33 00 28 00 4E 00 32 00 33 00 2E 00 31 00 31 00 31 00 37 00 37 00 2C 00 45 00 31 00 31 00 34 00 2E 00 34 00 30 00 39 00 32 00 32 00 29 26 26 36 36 33 36 36 00 03 00 04 00 00 00 00 00 00 00 00 00 00 00 00 23 23 00 01 AF 4D 0D 0A

The content sent by the server is: Precisely Locating: No.10 Yunshan West Rd, Huicheng, Huizhou, Guangdong, 516003(N23.11177,E114.40922)

Mobile Phone Number is 66366.

Process of Alarm packet:

Short message in Chinese:

transmission: 78 78 25 16 0B 0B 0F 0E 24 1D CF 02 7A C8 87 0C 46 57 E6 00 14 02 09 01 CC 00 28 7D 00 1F 72 65 06 04 01 01 00 36 56 A4 0D 0A

reception: 78 78 05 16 00 36 95 70 0D 0A

reception: 78 78 BE 17 B8 00 00 00 01 41 4C 41 52 4D 53 4D 53 26 26 7D 27 60 25 54 7C 53 EB 00 3A 5E 7F 4E 1C 77 01 60 E0 5D DE 5E 02 4E 91 5C 71 89 7F 8D EF 00 2E 65 87 53 4E 4E 00 8D EF 00 2E 79 BB 4E 2D 88 4C 00 41 00 54 00 4D 7E A6 00 33 00 31 7C 73 00 2E 79 BB 4E 2D 88 4C 6C 5F 53 17 65 2F 88 4C 7E A6 00 33 00 31 7C 73 00 2E 00 2C 00 31 00 31 00 2D 00 31 00 31 00 2D 00 31 00 35 00

20 00 31 00 34 00 3A 00 33 00 36 00 3A 00 32 00 39 26 26 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 30 23 23 00 01 B6 D8 0D 0A

Content of Short message is: Emergency Call: Wenhua Rd. 1, Huizhou, Guangdong, about 31 meters away from ATM machine of Bank of China, about 31 meters away from Jiangbei branch of of Bank of China, 11-11-15 14:36:29.

The specific meanings of the above commands can be looked up in the protocol document.

Ⅸ. Appendix C: Complete Format of the Information Package

A. data packet sent by the terminal to the server

Login Message Packet (18 Byte)						
Start Bit	Packet length	Protocol Number	Terminal ID	Information Serial Number	Check Bit	Stop Bit
2	1	1	8	2	2	2

GPS Information Package (26+N Byte)												
Start Bit	Packet length	Protocol Number	Information Content						Information serial number	check bit	stop bit
			Date Time	GPS Information								
				Length of GPS information, quantity of positioning satellites	Latitude	Longitude	Speed	Course, Status	Reserved extended bit			
2	1	1	6	1	4	4	1	2	N	2	2	2

LBS information package (23+N Byte)											
Start Bit	Packet length	Protocol Number	Information Content					Reserved extended bit	Information serial number	check bit	stop bit
			Date Time	LBS Information							
				MCC	MNC	LAC	Cell ID				
2	1	1	6	2	1	2	3	N	2	2	2

LBS complete information package (42+N Byte)																								
Start Bit	Packet length	Protocol Number	Information Content																			Information serial number	check bit	stop bit
			Date Time	LBS Information																	Reserved extended bit			
				MCC	MNC	LAC	MCI	MCISS	NCI1	NCISS1	NCI2	NCISS2	NCI3	NCISS3	NCI4	NCISS4	NCI5	NCISS5	NCI6	NCISS6				
2	1	1	6	2	1	2	2	1	2	1	2	1	2	1	2	1	2	1	2	1	N	2	2	2

GPS、LBS information package (34+M+N Byte)																	
Start Bit	Packet length	Protocol Number	Information Content											Reserved and extended	Information serial number	check bit	stop bit
			Date Time	GPS Information						LBS Information							
				Length of GPS information, quantity of positioning satellites	Latitude	Longitude	Speed	Course, Status	Reserved extended bit	MCC	MNC	LAC	Cell ID				
2	1	1	6	1	4	4	1	2	M	2	1	2	3	M	2	2	2

Status Packet(13+N Byte)

Start Bit	Packet Length	Protocol Number	Information Content				Information Serial Number	Check Bit	Stop Bit
			Terminal Information Content	Voltage Level	GSM Signal Strength Level	Reserved and Extended Bit (language)			
2	1	1	1	1	1	2	2	2	2

SNR information of satellite (11+M+N Byte)								
Start Bit	Packet Length	Protocol Number	Information Content			Information Serial Number	Check Bit	Stop Bit
			Quantity of positioning satellites	SNR of Satellite 1 2 3 …… n	Reserved and Extended Bit			
2	1	1	1	M	N	2	2	2

terminal responds to the command sent by server (15+M+N Byte)									
Start Bit	Packet Length	Protocol Number	String Content				Information Serial Number	Check Bit	Stop Bit
			Length of Command	Server Flag Bit	Command Content	Reserved and Extended Bit (language)			
2	1	1	1	4	M	2	2	2	2

GPS, LBS, Status Information Package (40+M+N+L Byte)																						
Start Bit	Packet Length	Protocol Number	Information Content																Reserved and Extended Bit (language)	Information Serial Number	Check Bit	Stop Bit
			Date Time	GPS Information						LBS Information						Status Information						
				Length of GPS information, quantity of positioning satellites	Latitude	Longitude	Speed	Course, Status	Reserved and Extended Bit	LBS Length	MCC	MNC	LAC	Cell ID	Reserved and Extended Bit	Terminal Information Content	Voltage Level	GSM Signal Strength Level				
2	1	1	6	1	4	4	1	2	M	1	2	1	2	3	N	1	1	1	2	2	2	2

B. Data Packet Sent by Server to Terminal

Response of Server after receiving Status Packet from Terminal (10 Bytes)					
Start Bit	Packet Length	Protocol Number	Information Serial Number	Check Bit	Stop Bit
2	1	1	2	2	2

Command Packet Sent by Server to Terminal (15+M+N Byte)									
Start Bit	Packet Length	Protocol Number	Information Content				Information Serial Number	Check Bit	Stop Bit
			Length of Command	Server Flag Bit	Command Content	Reserved extended bit			
2	1	1	1	4	M	N	2	2	2

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