JT

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Satellite positioning system for road transport vehicles

Terminal communication protocol and data format

GNSS system for operational vehicles
General specifications for vehicle terminal communication protocol and data format

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Preface

This standard was drafted according to the rules given in GB/T 1.1-2009 .

This standard is proposed and coordinated by the National Technical Committee for Road Transport Standardization (in preparation) .

This standard was drafted by : Fujian Provincial Department of Transportation, China Communications and Information Center, and the Highway Research Institute of the Ministry of Transport.

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Satellite positioning system for road transport vehicles

Terminal communication protocol and data format

1. Scope

This standard specifies the vehicle-mounted terminal (hereinafter referred to as the terminal) and the supervision / monitoring platform of the road transport vehicle satellite positioning system (hereinafter referred to as the platform) communication protocol and data format, including protocol basis, communication connection, message processing, protocol
Classification and description and data format.

This standard applies to the communication between the on-board terminal and platform of the satellite positioning system of road transport vehicles.

2 Normative references

The following documents are essential for the application of this document. For dated references, only the version with the date is applicable.
Applicable to this document. For any undated referenced documents, the latest version (including all amendments) shall apply to this document.
GB/T 2260 Administrative division codes of the People's Republic of China
GB/T 19056 Vehicle driving recorder
JT/T 415-2006 Coding rules for road transport e-government platform
JT/T794 Technical requirements for vehicle-mounted terminals of satellite positioning systems for road transport vehicles
3. Terms, definitions and abbreviations

3.1 Terms and definitions

The following terms and definitions apply to this document.
3. 1
Abnormal data communication link
The wireless communication link is disconnected or temporarily suspended (such as during a call) .
3.1.2
Register
The terminal sends a message to the platform to inform it that it is installed on a certain vehicle.
3.1.3
unregister
The terminal sends a message to the platform to inform it to be removed from the vehicle on which it is installed.
3.1.4
Authentication
When the terminal is connected to the platform, it sends a message to the platform to verify its identity.
3.1.5
Location reporting strategy
Report at fixed times, fixed intervals, or a combination of both.
3.1.6
Location reporting program
Rules for determining the intervals for periodic reporting based on relevant conditions.
3.1.7
additional points report while turning
The terminal sends a position information report message when it determines that the vehicle is turning. The sampling frequency is not less than 1Hz , and the vehicle azimuth
The rate of change is not less than 15°/s and lasts for at least 3 seconds .
3.1.8

answering strategy
Rules for the terminal to automatically or manually answer incoming calls.
3.1.9
SMS text alarm
When the terminal alarms, a text message is sent via SMS .
3.1.10
event item
The event item is set from the platform to the terminal, consisting of an event code and an event name. The driver operates when encountering a corresponding event.
Terminal, trigger event report is sent to the platform.
3.2 Abbreviations
The following abbreviations apply to this document.
APN— Access Point Name
GZIP — a GNU Free Software file compression program (GNUzip)
LCD— Liquid crystal display
RSA - an asymmetric cryptographic algorithm (developed by Ron Rivest , Adi Shamirh , and Len Adleman , and named after them)
SMS— Short Message Service (short message protocol)
TCP— transmission control protocol
TTS— text to speech
UDP— User Datagram Protocol
VSS— Vehicle Speed Sensor

4 Protocol Basics

4.1 Communication method

The communication method adopted by the protocol should comply with the relevant provisions of JT/T 794. The communication protocol adopts TCP or UDP .
The terminal acts as the server and the terminal acts as the client. When the data communication link is abnormal, the terminal can use SMS message to
line of communication.

4.2 Data Types

The data types used in the protocol messages are shown in Table 1:
Table 1 Data types

Data Types	Description and requirements
BYTE	Unsigned single-byte integer (byte, 8 bits)
WORD	Unsigned double-byte integer (word, 16 bits)
DWORD	Unsigned four-byte integer (double word, 32 bits)
BYTE[n]	n bytes
BCD[n]	8421 code, n bytes
STRING	GBK encoding uses a 0 terminator. If there is no data, a 0 terminator is placed.

4.3 Transmission rules

The protocol uses big -endian network byte order to transfer words and double words.
The agreement is as follows :
——Byte transmission convention : transmission in the form of byte stream ;
——Word (WORD) transmission convention : first transmit the high eight bits , then transmit the low eight bits;
——DWORD transmission convention : first transfer the high 24 bits , then transfer the high 16 bits, and then transfer the high eight bits.
The lower eight bits are passed last.

4.4 Message composition

4.4.1 Message Structure

Each message consists of an identification bit, a message header, a message body, and a checksum. The message structure diagram is shown in Figure 1 :

Identification bit	Message Header	Message body	Check code	Identification bit

Figure 1 Message structure

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4.4.2 Identification bit

Ox7e is used to indicate that if 0x7e appears in the checksum, message header, or message body , it must be escaped.
The rules are defined as follows :
0x7e<——>0x7d followed by 0x02 ;
0x7d<——>0x7d is followed by 0x01 .
The escape process is as follows :
When sending a message : message encapsulation -> calculate and fill in the checksum -> escape ;
When receiving a message : escape and restore -> verify the check code -> parse the message.
Example : Sending a data packet with the content of 0x30 0x7e 0x08 0x7d 0x55 is encapsulated as follows : 0x7e 0x30 7d 0x02 0x08 0x7d 0x01 0x55 0x7e .

4.4.3 Message Header

The message header content is detailed in Table 2:

Table 2 Message header content

Start Byte	Fields	Data Types	Description and requirements
0	Message ID	WORD	
2	Message body attributes	WORD	The message body attribute format structure diagram is shown in Figure 2
4	Terminal phone number （ ID for	BCD[6]	The mobile phone number of the terminal after installation is converted. If the mobile phone number is less than 12 digits, add

	logging into the platform ）		digits in the front. The supplementary digit 0 for Hong Kong, Macao and Taiwan is supplemented with digits according to their area codes.
10	Message serial number	WORD	0 in the order of sending and accumulate
12	Message Packet Encapsulation Item		If the relevant flag in the message body attribute determines that the message is sub-packetized, then this item has content; otherwise, there is no such item.

The message body attribute format structure diagram is shown in Figure 2 :

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
reserve		Subcontracting	Data encryption method			Message body length									

Figure 2 Message body attribute format structure diagram

Data encryption method :

—— bit10-bit12 is the data encryption identification bit;

——When these three bits are all 0 , it means the message body is not encrypted;

——When the 10th bit is 1 , it means that the message body is encrypted by the RSA algorithm;

——Other reservations.

Subcontracting :

When the 13th bit in the message body attribute is 1 , it indicates that the message body is a long message and is sent in packets.

The message header is determined by the message encapsulation item; if the 13th bit is 0 , there is no message encapsulation item field in the message header.

The contents of the message package encapsulation items are shown in Table 3

Table 3 Message packet encapsulation items

Start Byte	Fields	Data Types	Description and requirements
0	Total number of message packets	WORD	The total number of packets after the message is divided
2	Package number	WORD	Start from 1

4.4.4 Check Code

The checksum refers to the byte starting from the message header, XORed with the next byte, until the byte before the checksum, occupying one byte.

5. Communication Connection

5.1 Connection Establishment

The daily data connection between the terminal and the platform can be TCP or UDP . After the terminal is reset, it should establish a connection with the platform as soon as possible.
After the connection is established, the terminal authentication message is immediately sent to the platform for authentication.

5.2 Maintaining the connection

After the connection is established and the terminal is authenticated successfully, the terminal should periodically send a terminal heartbeat message to the platform.
The terminal sends a platform general response message, and the sending period is specified by the terminal parameters.

5.3 Disconnection

Both the platform and the terminal can actively disconnect according to the TCP protocol, and both parties should actively determine whether the TCP connection is disconnected.
The platform determines the TCP connection is disconnected:
——According to the TCP protocol, the terminal actively disconnects;
——A terminal with the same identity establishes a new connection, indicating that the original connection has been disconnected;
——No message from the terminal, such as terminal heartbeat, is received within a certain period of time.
the terminal determines that the TCP connection is disconnected:
——According to the TCP protocol, the platform actively disconnects;
——the data communication link is disconnected;
——The data communication link is normal and no response is received after reaching the number of retransmissions.

8. Data Format

8.1 Terminal General Response (0x0001)

Message ID: 0x0001 .

The terminal general response message body data format is shown in Table 4.

Table 4 Terminal general response message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Response serial number	WORD	The serial number of the corresponding platform message
2	Response ID	WORD	The ID of the corresponding platform message
4	result	BYTE	0 : Success / confirmation; 1 : Failure; 2 : Error message; 3 : Not supported

8.2 Platform General Response (0x8001)

Message ID : 0x8001 .

The platform general response message body data format is shown in Table 5 .

Table 5 Platform general response message body data format

Start Byte	Fields	Data	Description and requirements

		Types	
0	Response serial number	WORD	The serial number of the corresponding terminal message
2	Response ID	WORD	The ID of the corresponding terminal message
4	result	BYTE	0 : Success / confirmation; 1 : Failure; 2 : Error message; 3 : Not supported

8.3 Terminal Heartbeat (0x0002)

Message ID : 0x0002 .

The terminal heartbeat data message body is as follows:

Heartbeat message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Battery percentage	BYTE	0-100
1	Working status bit	BYTE	Bit2-bit0=000 indicates power saving mode Bit2-bit0=001 indicates balanced mode Bit2-bit0=010 means real-time mode Bit2-bit0=011 indicates vibration upload mode Bit2-bit0=100 means continuous positioning mode

8.4 Terminal Registration (0x0100)

Message ID : 0x0100 .

The data format of the terminal registration message body is shown in Table 6 .

Table 6 Terminal registration message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Provincial ID	WORD	Indicates the province where the terminal is installed. 0 is reserved and the platform takes the default value. The province ID uses the first two digits of the six-digit administrative division code specified in GB/T 2260 .
2	City and County ID	WORD	Indicates the city and county where the terminal is installed. 0 is reserved and the platform takes the default value. The city and county ID uses the last four digits of the sixth administrative division code specified in GB/T 2260 .
4	Manufacturer ID	BYTE[5]	Five bytes, terminal manufacturer code.
9	Terminal Model	BYTE[8]	Eight bytes. This terminal model is defined by the manufacturer. If the number of digits is not eight, fill it with spaces.

17	Terminal ID	BYTE[7]	Seven bytes, consisting of uppercase letters and numbers, this terminal ID is defined by the manufacturer.
twenty one	License plate color	BYTE	License plate color, in accordance with 5.4.12 of JT/T 415-2006
25	License Plate	STRING	Motor vehicle license plate issued by the public security traffic management department

8.5 Terminal Registration Response (0x8100)

Message ID : 0x8100 .

The data format of the terminal registration response message body is shown in Table 7 .

Table 7 Terminal registration response message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Response serial number	WORD	The serial number of the corresponding terminal registration message
2	result	BYTE	0 : Success; 1 : The vehicle has been registered; 2 : The vehicle does not exist in the database; 3 : The terminal has been registered; 4 : The terminal does not exist in the database
3	Authentication code	STRING	This field is only present if successful [maximum 30 characters]

8.6 Terminal Authentication (0x0102)

Message ID : 0x0102.

The data format of the terminal authentication message body is shown in Table 8 .

Table 8 Terminal authentication message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Authentication code	STRING	The terminal reports the authentication code after reconnection

8.7 Location information report (0x0200)

Message ID : 0x0200 .

The location information report message body consists of basic location information and a list of additional location information items. The message structure diagram is shown in Figure 3 :

Location basic information	List of additional location information items

Figure 3 Location report message structure

The location additional information item list is composed of various location additional information items, or may be absent, which is determined by the length field in the message header.

The data format of basic location information is shown in Table 16 .

8.7.1 Basic information format

Table 16 : Location basic information data format

Start Byte	Fields	Data Types	Description and requirements
0	Alarm sign	DWORD	18 for the definition of alarm flags
4	state	DWORD	17 for status bit definitions
8	latitude	DWORD	The latitude value in degrees is multiplied by 10 to the sixth power, accurate to one millionth of a degree
12	longitude	DWORD	The latitude value in degrees is multiplied by 10 to the sixth power, accurate to one millionth of a degree
16	Elevation	WORD	Altitude, in meters (m)
18	speed	WORD	1/10km/h
20	direction	WORD	0-359, due north is 0 , clockwise
twenty one	time	BCD[6]	YY-MM-DD-hh-mm-ss (GMT+ 0 time, all times mentioned in this standard shall be based on this time zone

Table 17 Status bit definition

Bit	state
0	Reserve
1	0: Not positioned ; 1: Positioned
2	0: North Latitude : 1: South Latitude
3	0: East longitude ; 1: West longitude
4 -6	Bit6-bit4=000 indicates power saving mode Bit6-bit4=001 indicates balanced mode Bit6-bit4=010 means real-time mode Bit6-bit4=011 indicates vibration upload mode Bit6-bit4=100 means continuous positioning mode
7 -17	reserve
18	0: Not used GPS Satellite positioning; 1: Use GPS Satellite positioning
19	0: Beidou satellites are not used for positioning; 1: Beidou satellites are used for positioning
20	0: Not used GLONASS Satellite positioning; 1: Use GLONASS Satellite positioning
twenty one	0: Not used Galileo Satellite positioning; 1: Use Galileo Satellite positioning
22- 31	reserve

Table 18 Alarm flag bit definition

Bit	definition	Processing instructions
0	1: Emergency alarm is triggered after the alarm switch is touched	

1	Reserve	
2	1: Alarm at work	
3	1: Call the police after get off work	
4	1 : GNSS module failure	
5	Reserve	
6	Reserve	
7	Reserve	
8	Reserve	
9	Reserve	
10	Reserve	
11	Reserve	
12	Reserve	
1 3	Reserve	
1 4	Reserve	
15	Reserve	
16- 21	Reserve	
17	Reserve	
twenty three	Reserve	
twenty four	Reserve	
25	Reserve	
26	Reserve	
27	Reserve	
30	Reserve	
31	Reserve	

The format of the location additional information item is shown in Table 19 .

8.7.2 Additional Information

Table 19 : Position additional information item format

Fields	Data Types	Description and requirements
Additional information ID	BYTE	1-255
Additional information length	BYTE	
Additional Information		20 for additional information definitions

Table 20 Additional information definition

Additional information ID	Additional information length	Description and requirements
0x 3 0	1	Network signal strength
0x3 1	1	Number of GNSS positioning satellites
0x5d	1+n*10	Base station data, the first byte is the number of

		base stations, followed by 0-1 for MCC, 2 for MNC, 3-4 for LAC, 5-8 for CID, and 9 for signal strength
0x57	8	8 bytes for extended status, 0-1 for alarm status, 2-7 for spare Alarm status WORD byte: bit4 = low battery alarm, bit7 = low battery shutdown alarm
0x62	1	Battery level (%) 0-100
0x63	1+n*7	WIFI data, the first byte is the number of wifi, followed by 0-5 is MAC [0~5], 6 is the signed signal strength, and the maximum value of n is 3
0xF3		Bluetooth beacon protocol, see Table 22
0xF5		Bluetooth beacon MAC report, see Table 23
0xE1	1 3	High-precision positioning status information (only available when positioning with high-precision version hardware, RTK account is set and enabled , the ordinary version does not have this extension) High-precision positioning status items, see Table 21

8.7.3 0xE1 High Precision Extended Information

Table 21 Extended message 0x E1 - High-precision positioning status information reporting

Start Byte	Length (bytes)	Description and requirements
0	1	0XNN Additional message length
1	1	Fixed value 0x08
2	1	0x00~0x09 ; 0=fix not available status is not available (invalid solution) 1=GNSS fix single point solution 2=Differential GNSS fix RTD pseudo-range differential 3=PPS fix PPS 4=Real Time Kinematic RTK fixed solution 5=Float RTK RTK floating point solution 6 = estimated (dead reckoning) 7=Manual input mode 8=Simulation mode 9 = Reserved
3	1	High 4 bits : 7th decimal place of longitude (converted to decimal 0-9)

		Low 4 bits : The 8th decimal place of longitude (converted to decimal 0-9)
4	1	High 4 bits : the seventh decimal place of latitude (converted to decimal 0-9) Low 4 bits : The eighth decimal place after the latitude decimal point (converted to decimal 0-9)
5	2	fhdop horizontal precision factor (0.5~99.9 units 0.1)
7	2	fvdop vertical precision factor (0.5~99.9 units 0.1)
9	2	fpdop position precision factor (0.5~99.9 units 0.1)
11	2	High decimal places, Every two digits take up 1 byte. For example, 31.1200 is encoded as 0x1200

Table 2 2 Extended Bluetooth beacon scan additional information status bit definition

byte	state
0	0XF3 Message ID
1	0XNN Additional message length
2	0XE6 Specific flag
3	0 X0C Specific identification
4	of Bluetooth data groups scanned , up to 4 groups
5 - 12	The Bluetooth beacon data starts, consisting of a 6-byte MAC address + 1- byte signal strength . Example : **EC26CA8464B0AC corresponds**
13-N	0x 00 03 0B 64 C5 14 0000 AD , custom data, data content is subject to beacon broadcast data

For example :

XR-LY302 model, Bluetooth beacon custom data analysis:

0001030B64C5140000AD

00: Status code

01: Version number

03: Transmit power, signed single byte

0B: broadcast frequency, unit 100ms

64: Battery percentage

C5: RSSI@1M, signed single byte

14: Random Seed

0000: running time, high byte first

AD: Reserve

Table 2 3 Bluetooth beacon MAC additional information definition

byte	state
0	0XF5 Message ID
1	0X NN Additional message length

2-7	Bluetooth beacon MAC starts, consisting of a 6-byte MAC address . Example : **EC26CA8464B0 corresponds to EC : 26:CA:84:64:B0**

8.8 Batch upload of positioning data (0x0704)

Message ID: 0x0704 (reserved)

The data format for batch uploading positioning data is shown in Table 22 .

Table 22 Data format for bulk upload of positioning data

Start Byte	Fields	Data Types	illustrate
0	Number of data items	WORD	The number of location report data items included, > 0
1	Position data type	BYTE	0: normal position batch report, 1: blind area supplementary report
2	Location reporting data items		23 for definitions

Table 23 Position report data item data format

Start Byte	Fields	Data Types	illustrate
0	Location report data length	WORD	Position report data length, n
2	Position report data body	BYTE[n]	See 8.7 Location Information Report for definition

8.9 Text message sent (0x8300)

Message ID: 0x8300 .

The data format of the text message body is shown in Table 26 .

Table 26 Text message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Logo	BYTE	The meaning of the text information flag is shown in Table 27
1	Text information	STRING	ascii or GBK encoding

Table 27 Text information, flag bit meaning

bit	Logo
0	1: The transparent transmission setting command is sent, and the device will reply with 0x0300. 0: Non-setting command, the device replies with a general response
1	Not used
2	Not used
3	1 : “You have a new text message” notification tone
4	Not used
5	Not used

6-7	Not used

8. 10 Set command to send reply (0x0300)

Message ID: 0x0300

Message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Terminal phone number	STRING	
8	Reply content	STRING	

8.11 ICCID reporting (0x0120)

Message ID: 0x0120

Message body data format

Start Byte	Fields	Data Types	Description and requirements
0	ICCID	STRING	20-character ICCID

8.12 Terminal requests synchronization time (0x0121)

Message ID : 0x0121

The terminal data message body is empty.

8.13 Service synchronization time (0x8 121) [UTC 0 time zone]

Message ID: 0x8121

Message body data format

Start Byte	Fields	Data Types	Description and requirements
0	time	BYTE[6]	For example, BYTE[0-5]={0x15,0x0b,0x11,0x08,0x32,0x2e} indicates the time 2021-11-17 08:50:46

8.14 Terminal request group number (0x0304)

Message ID : 0x0304

Message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Request Grouping	STRING	Fixed 01

Example: 7E030400010580790348560000C 01 EA7E

8.15 Server sends group number (0x8304)

Message ID: 0x8304

Message body data format

Start Byte	Fields	Data Types	Description and requirements
0	Group Information	STRING	GBK encoding

Routine:

7E8304002405807903485600000

61646D696E2FB9A4B3CCB2E2CAD42FDAF9C1D6D0F92F50393031B6D4BDB2B7D6D7E9322F 747E

The Chinese characters in red are: admin/engineering test/Wu Linxuan/P901 intercom group 2/

1. Group information supplement

1. Device requests group information

7E030400010680749242590005017 97E

2. The server sends group information

7E8304002706807492425900000

61646D696E2F43616E747261636B2044656D6F2028444F4E542045444954292F546573745F412F 9F7E

The red part corresponds to: admin/PICTOR Demo (DONT EDIT)/Test_A/

3. If foreign customers experience significant delays when using the intercom function, please contact us.

Revision History:

1. Chapter 24.9.23: "8.9 Text Information Delivery", modify " Table 27 Text Information, Flag Bit Meaning", and send TTS voice with bit 3 set to 1.

2、Modify 8.10. Set the command to send a reply of 0x0300. The starting byte has 8 bytes, which is the terminal phone number (device ID). In fact, it has always been there, but it is not written in the protocol. It is supplemented.

3、Added 8.14 and 8.15 grouping information acquisition.

4、Added Bluetooth F3 extended information