Communication protocol for ThinkPower device with server

Revision history

Rev	Date	Author	Changes
1.0	2020-07-12	Yasin	Initial version - Basic requirements
1.1	2021-01-11	Andrea	Add Eld
1.2	2021-01-18	Andrea	Add record value for Environmental records Add record value for light records Add configure value of device password Change configure value of GPS report mode Change configure value of Sensor Change configure value of I-Button configure section Add configure value of BLE configure section
1.3	2021-05-08	Andrea	Add configure value of Device configure section
1.4	2021-08-16	Andrea	Add configure value of remaining battary report function Add record value type of remaining battary report
1.5	2021-08-17	Andrea	Modification record value type of remaining battary report
1.6	2021.-09-01	Andrea	Add record value for Engine idling alarm
1.7	2021.-09-03	Jacks	Modify Engine idling alarm definitions

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Protocol for uplink

All data transfer from the device to an upstream server should use an efficient binary protocol. This also includes commands sent from the server to the device for configuration.

Binary message format

Every message, both uplink messages from the device to the server or commands sent back from the server to the device, contain 5 fields. The format of such a message is depicted below:

Message type	**Packet identifier**	**Payload length**	**Payload data**	**CRC-16-CCITT**
1 byte	1 byte	2 bytes	N bytes	2 bytes

Message type

The first byte defines the message type:

Message type	**Message description(direction)**
0x01	Login request(device->platform)
0x02	Login reply(platform ->device)
0x03	Heartbeat request(device->platform)
0x04	Heartbeat response(platform ->device)
0x05	Record report(device->platform)
0x06	Record ack(platform ->device)
0x07	Read request(platform ->device)
0x08	Read response(device->platform)
0x09	Write request(platform ->device)
0x0A	Write response(device->platform)
0x0B	Action request(platform ->device)
0x0C	Action response(device->platform)

Packet identifier

The second byte of a packet is the packet identifier. This field acts as a correlation identifier between the requests and responses. Each reply message should contain a packet identifier matching the unique identifier of the request message. The packet identifier is only 1 byte so there is a wrap around after reaching 255. In normal state, we should add 1 to the identifier each time we send a packet.

Payload length

This field indicates the variable length of the payload in bytes.This field contains two bytes, so the maximum packet length supported theoretically is 65535, but the actual length is related to CPU ram resources.

Payload

The payload depends on the packet type. Please check the documentation of each specific packet type to get the correct encoding.

CRC

The CRC field contains an error-detecting code, used to verify the packet's validity. For calculation we are using CRC-16/IBM. The CRC is calculated over the full packet, which includes the following fields:

- Message type
- Packet identifier
- Payload length
- Payload data

Example code and lookup table for CRC16-CCITT can be found below:

```
static unsigned short crc_table [256] = {

0x0000, 0x1021, 0x2042, 0x3063, 0x4084, 0x50a5,
0x60c6, 0x70e7, 0x8108, 0x9129, 0xa14a, 0xb16b,
0xc18c, 0xd1ad, 0xe1ce, 0xf1ef, 0x1231, 0x0210,
0x3273, 0x2252, 0x52b5, 0x4294, 0x72f7, 0x62d6,
0x9339, 0x8318, 0xb37b, 0xa35a, 0xd3bd, 0xc39c,
0xf3ff, 0xe3de, 0x2462, 0x3443, 0x0420, 0x1401,
0x64e6, 0x74c7, 0x44a4, 0x5485, 0xa56a, 0xb54b,
0x8528, 0x9509, 0xe5ee, 0xf5cf, 0xc5ac, 0xd58d,
0x3653, 0x2672, 0x1611, 0x0630, 0x76d7, 0x66f6,
0x5695, 0x46b4, 0xb75b, 0xa77a, 0x9719, 0x8738,
0xf7df, 0xe7fe, 0xd79d, 0xc7bc, 0x48c4, 0x58e5,
0x6886, 0x78a7, 0x0840, 0x1861, 0x2802, 0x3823,
0xc9cc, 0xd9ed, 0xe98e, 0xf9af, 0x8948, 0x9969,
0xa90a, 0xb92b, 0x5af5, 0x4ad4, 0x7ab7, 0x6a96,
0x1a71, 0x0a50, 0x3a33, 0x2a12, 0xdbfd, 0xcbdc,
0xfbbf, 0xeb9e, 0x9b79, 0x8b58, 0xbb3b, 0xab1a,
0x6ca6, 0x7c87, 0x4ce4, 0x5cc5, 0x2c22, 0x3c03,
0x0c60, 0x1c41, 0xedae, 0xfd8f, 0xcdec, 0xddcd,
0xad2a, 0xbd0b, 0x8d68, 0x9d49, 0x7e97, 0x6eb6,
0x5ed5, 0x4ef4, 0x3e13, 0x2e32, 0x1e51, 0x0e70,
0xff9f, 0xefbe, 0xdfdd, 0xcffc, 0xbf1b, 0xaf3a,
0x9f59, 0x8f78, 0x9188, 0x81a9, 0xb1ca, 0xa1eb,
0xd10c, 0xc12d, 0xf14e, 0xe16f, 0x1080, 0x00a1,
0x30c2, 0x20e3, 0x5004, 0x4025, 0x7046, 0x6067,
0x83b9, 0x9398, 0xa3fb, 0xb3da, 0xc33d, 0xd31c,
0xe37f, 0xf35e, 0x02b1, 0x1290, 0x22f3, 0x32d2,
0x4235, 0x5214, 0x6277, 0x7256, 0xb5ea, 0xa5cb,
0x95a8, 0x8589, 0xf56e, 0xe54f, 0xd52c, 0xc50d,
0x34e2, 0x24c3, 0x14a0, 0x0481, 0x7466, 0x6447,
0x5424, 0x4405, 0xa7db, 0xb7fa, 0x8799, 0x97b8,
0xe75f, 0xf77e, 0xc71d, 0xd73c, 0x26d3, 0x36f2,
0x0691, 0x16b0, 0x6657, 0x7676, 0x4615, 0x5634,
0xd94c, 0xc96d, 0xf90e, 0xe92f, 0x99c8, 0x89e9,
0xb98a, 0xa9ab, 0x5844, 0x4865, 0x7806, 0x6827,
0x18c0, 0x08e1, 0x3882, 0x28a3, 0xcb7d, 0xdb5c,
0xeb3f, 0xfb1e, 0x8bf9, 0x9bd8, 0xabbb, 0xbb9a,
0x4a75, 0x5a54, 0x6a37, 0x7a16, 0x0af1, 0x1ad0,
0x2ab3, 0x3a92, 0xfd2e, 0xed0f, 0xdd6c, 0xcd4d,
0xbdaa, 0xad8b, 0x9de8, 0x8dc9, 0x7c26, 0x6c07,
0x5c64, 0x4c45, 0x3ca2, 0x2c83, 0x1ce0, 0x0cc1,
0xef1f, 0xff3e, 0xcf5d, 0xdf7c, 0xaf9b, 0xbfba,
0x8fd9, 0x9ff8, 0x6e17, 0x7e36, 0x4e55, 0x5e74,
0x2e93, 0x3eb2, 0x0ed1, 0x1ef0
};

unsigned short CRCCCITT(unsigned char *data, size_t length)
{

   size_t count;
   unsigned int crc = 0xffff;
   unsigned int temp;

   for (count = 0; count < length; ++count)
   {
     temp = (*data++ ^ (crc >> 8)) & 0xff;
     crc = crc_table[temp] ^ (crc << 8);
   }

   return (unsigned short) crc;

}
```

Login request

The packet is used for the device authorization on the server. Every TCP connection starts with sending this packet from the device to the server. Other data should be transferred only after the server confirms the successful authorization of the device. The login payload looks as follows:

Field name	Length	Field description
Protocol major version	1 byte	The major protocol version, as an unsigned byte (0 - 255)
Protocol minor version	1 byte	The minor protocol version, as an unsigned byte (0 - 255)
IMEI length	1 byte	The length of the IMEI field, in bytes as an unsigned byte (0-255)
IMEI	variable	IMEI, ID or serial number of the controller
Model length	1 byte	The length of the next make / model field, in bytes as an unsigned byte (0-255)
Model	variable	The make / model of the tracker (eg. TE304)
Firmware version length	1 byte	The length of the next firmware version field, in bytes as an unsigned byte (0-255)
Firmware version	variable	The firmware version of the tracker (eg. V3.12.0.18.2004171625-b0)
Password length	1 byte	The length of the password field, in bytes as an unsigned byte (0-255). Can be ‘0’ if no password is configured.

Login reply

After sending the login request, the device waits for the login reply from the server. The login replay payload looks like this:

Field name	Length	Field description
login_result	1 byte	The login result code: Success = 0 Failure codes: • 1 = Unsupported protocol • 2 = Authentication required • 3 = Invalid password • 4 = Unknown device • 5 = Server busy

Heartbeat request

Heartbeats are used to test GPRS connection status and maintain GPRS connectivity. If a GPRS connection is established successfully, the terminal will send heartbeat information to the platform when no data is received for a configurable time using the following parameters:

- heartbeat_idle_time = minimum period of communication silence before the tracker can send a heartbeat packet, in milliseconds, the length is 4 bytes.
- heartbeat_timeout = timeout in milliseconds before the tracker can assume that the link is closed.the length is 4 bytes.

After receiving the heartbeat information, the platform should send a heartbeat reply. If no heartbeat reply is received after 'heartbeat_timeout' milliseconds, the tracker closes the connection and only reconnects again when data has to be sent. When the platform closes the connection, the tracker also only reconnects when data has to be sent.

Heartbeat response

After receiving the heartbeat information, the platform should send a heartbeat reply. If no response is sent within this period, the tracker will close the connection. As with any other response, a heartbeat response is only valid if the packet identifier matches with the request.

Record report

Field name	Length	Field description
Record count	1 byte	The number of records in this report. The maximum number or records in a single report is limited to 255 entries.
List of records	Variable size	The list of appended records. A record is described in the table below.

Record format

Record field name	Length	Record field description
Record timestamp	4 bytes	The exact timestamp when the data in this record was captured, as an epoch time in seconds (UTC,from 1970 to 2099)
List of values	Variable size	The list of appended values. A value is described in the table below.

Value format

Value field name	Length	Value field description
Value type	1byte	The type id of the value (see type id’s below). Encoded as a variable type field.
Value	Variable size	The captured value. Size and encoding depends on the value type.

Coordinates encoding (lat / lon)

Longitude and latitude are 4-byte integer values built from degrees, minutes, seconds and milliseconds by the following formula:

$$\left(d + \frac{m}{60} + \frac{s}{3600} + \frac{ms}{3600000}\right) * p$$

Where:

- d – Degrees
- m – Minutes
- s – Seconds
- ms – Milliseconds
- p – Precision (10000000)

Coordinates in the western hemisphere multiply the longitude by -1, coordinates on the southern hemisphere multiply the latitude by -1. Multiplying the coordinates by minus one is done following the two’s complement.

Example:

A 4-byte integer latitude value of 1E 61 47 2B. First bit is ‘0’ which means a positive coordinate. Converting this integer to decimal gives: 509691691. Applying the precision again to get a decimal coordinate gives you 50.9691691° and in north hemisphere.

A 4-byte integer longitude value of E8 73 42 65. First bit is '1' which means a negative coordinate. Converting this integer to decimal gives: 1752384101. Applying the precision again to get a decimal coordinate gives you 175.2384101° and in western hemisphere.

Value type encoding

All common value types have a value less than 256, which allows you to encode this type as a single unsigned byte, ranging from 0-255.

Record value types

Type name	**Identifier**	**Length**	**Content**
GPS record type section			
GPS Location	0x01	12bytes	Latitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Speed: 2 byte calculated from satellites, in 1/10th of a km/h, encoded as a 2-byte unsigned integer. Directon: 2 byte Degrees from the North pole, as an angle ranging from 0 up to 36000, in 1/100th of a degree, as a 2 byte unsigned value.
GPS State	0x02	1 byte	GPS location alarm state: 0x00 = lost location 0x01 = location success
GPS Geo-fence	0x03	3 byte	Geo-fence shape attribute: 1 byte 0x01 = circle 0x02 = rectangle 0x03 = polygon Geo-fence ID number: 1 byte Value from 0 - 255 Geo-fence event: 1 byte 0x01 = inside 0x02 = outside
G-sensor record type section			
G-sensor X acceleration	0x06	2 bytes	Accelerometer X-axis value in mG, signed 2-byte value.
G-sensor Y	0x07	2 bytes	Accelerometer Y-axis value in mG, signed

acceleration			2-byte value.
G-sensor Z acceleration	0x08	2 bytes	Accelerometer Z-axis value in mG, signed 2-byte value.
G-sensor Collision alarm	0x09	1 byte	Collision alarm state: 0x00 = Not active 0x01 = Active
G-sensor drop alarm	0x0A	1 byte	Drop alarm state: 0x00 = Not active 0x01 = Active
G-sensor towed alarm	0x0B	1 byte	Towed away alarm state: 0x00 = Not active 0x01 = Active
SOS record type section			
SOS	0x10	1 byte	SOS state: 0x00 = Not active 0x01 = Active
Battery record type section			
Battery voltage	0x12	2 byte	Battery voltage in 1/10th V as an unsigned 2-byte value.
Battery low voltage alarm	0x13	1 byte	Battery low battery alarm state: 0x00 = Not active 0x01 = Active
Percentage of remaining battery	0x14	1 byte	Percentage of remaining battery in %
Environment record type section			
Temperature	0x16	2 bytes	Temperature in centigrade, as an signed 2-byte value.
Humidity	0x17	1 bytes	Humidity in %, ranging between 0-100 as an unsigned byte.
High temperature	0x18	2 bytes	Temperature in centigrade, as an signed 2-byte value.
High humidity	0x19	1 bytes	Humidity in %, ranging between 0-100 as an unsigned byte.
IO record type section			
INP	0x1A	1 byte	Digital inputs where each bit represents a digital input 0x00 = Not active 0x01 = Active
OUP	0x1B	1 byte	Digital outputs where each bit represents a digital input 0x00 = Not active 0x01 = Active
Car general record type section			
Car B+ cut alarm	0x20	1 byte	Car B+ cut alarm state: 0x00 = Not active 0x01 = Active

Car ACC status	0x21	1 byte	Ignition input state: 0x00 = Not active 0x01 = Active
Speeding	0x22	1 byte	Speeding alarm state: 0x00 = Not active 0x01 = Active
Car Short drive mileage	0x23	2 bytes	Car Short mileage value in 1/10th of a km, calculated from GPS location
Car Short drive time	0x24	2 bytes	Short drive time value in minutes, calculated from car ACC status
Fuel level	0x25	1 bytes	Fuel level in %, ranging between 0-100 as an unsigned byte, get from fuel sensor.
I-button	0x26	8 byte	Driver identifier
Car special record type section based CAN Bus			
Car drive mileage	0x30	8 byte	Car short mileage: 4 byte value in 1/10th of a km, encoded as a 4-byte unsigned integer Car total mileage: 4 byte value in 1/10th of a km, encoded as a 4-byte unsigned integer
Car speed	0x31	5 byte	Car speed: 2 byte in 1/10th of a km/h, encoded as a 2-byte unsigned integer Engine speed: 2 byte In prm, encoded as a 2-byte unsigned integer Engine load: 1 byte Engine load encoded as a 1-byte signed integer(range from -125 to 125)
Car oil	0x32	9 byte	Car short oil consumption: 4 byte value in L, encoded as a 4-byte unsigned integer Car total oil consumption: 4 byte value in L, encoded as a 4-byte unsigned integer Oil level: 1 bye value in %, ranging between 0-100 as an unsigned byte,
Car Engine time	0x33	8 byte	Car idle work time: 4 byte value in 1/10th of hour, encoded as a 4-byte unsigned integer Car total work time: 4 byte value in 1/10th of hour, encoded as a 4-byte unsigned integer
Car Device info	0x34	9 byte	Car battery voltage: 2 byte value in 1/10th V, encoded as an unsigned 2-byte value. Car air temperature: 2 byte value in centigrade, encoded as an signed 2-

			byte value. Car coolant temperature: 2 byte value in centigrade, encoded as an signed 2-byte value. Car coolant level: 1 byte value in %, ranging between 0-100 as an unsigned byte, Car engine oil pressure level: 2 byte value in kpa, encoded as an unsigned 2-byte value.
Engine idling alarm	0x35	5 byte	Car ACC status:1 byte 0x00 = Not active 0x01 = Active Hold time: 1 byte (minute) Car speed: 1 byte in 1/10th of a km/h, encoded as a 2-byte unsigned integer Engine speed: 2 byte In prm, encoded as a 2-byte unsigned integer
ELD event record type section			
Change in Driver’ s Duty Status	0x40	14 byte	Car short mileage: 2 byte value in miles, encoded as a 2-byte unsigned integer Elapsed Engine Hours: 1 byte value in hour, encoded as a 1-byte unsigned integer Latitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Distance Since Last Valid Coordinates:1 byte Range 0-6, value in miles,encoded as a 1-byte unsigned integer Malfunction Indicator Status: 1 byte encoded as a 1-byte Boolean Data Diagnostic Event Indicator Status:1 byte encoded as a 1-byte Boolean
Event: Intermediate Logs	0x41	14 byte	Car short mileage: 2 byte value in miles, encoded as a 2-byte unsigned integer

			Elapsed Engine Hours: 1 byte value in hour, encoded as a 1-byte unsigned integer Latitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Distance Since Last Valid Coordinates:1 byte Range 0-6, value in miles,encoded as a 1-byte unsigned integer Malfunction Indicator Status: 1 byte encoded as a 1-byte Boolean Data Diagnostic Event Indicator Status:1 byte encoded as a 1-byte Boolean
Event: Change in Driver's Indication of Allowed Conditions That Impact Driving Time Recording	0x42	14 byte	Car short mileage: 2 byte value in miles, encoded as a 2-byte unsigned integer Elapsed Engine Hours: 1 byte value in hour, encoded as a 1-byte unsigned integer Latitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Distance Since Last Valid Coordinates:1 byte Range 0-6, value in miles,encoded as a 1-byte unsigned integer Malfunction Indicator Status: 1 byte encoded as a 1-byte Boolean Data Diagnostic Event Indicator Status:1 byte encoded as a 1-byte Boolean
Event: Driver's Certification of Own Records	0x43	1 byte	Time Zone Offset from UTC: 1 byte encoded as a 1-byte unsigned interger
Event: Driver's Login/Logout Activity	0x44	8 byte	Car total mileage: 4 byte value in miles, encoded as a 4-byte unsigned integer

			Car total work time: 4 byte value in hour, encoded as a 4-byte unsigned integer
Event: CMV’s Engine Power Up and Shut Down Activity	0x45	17 byte	Car total mileage: 4 byte value in miles, encoded as a 4-byte unsigned integer Car total work time: 4 byte value in hour, encoded as a 4-byte unsigned integer Latitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Distance Since Last Valid Coordinates:1 byte Range 0-6, value in miles,encoded as a 1-byte unsigned integer
Event: ELD Malfunction and Data Diagnostics Occurrence	0x46	9 byte	Malfunction/Diagnostic Code: 1 byte encoded as a 1-byte character(ASCII code) Car total mileage: 4 byte value in miles, encoded as a 4-byte unsigned integer Car total work time: 4 byte value in hour, encoded as a 4-byte unsigned integer
Light record type section			
Theft alarm	0x50	1 byte	Theft alarm state: 0x00 = Not active 0x01 = Active
Light alarm	0x51	1 byte	Light alarm state: 0x00 = Not active 0x01 = Active
LBS record type section			
Lbs state	0x56	1 byte	LBS location state: 0x00 = lost location 0x01 = location success

Configure value types

Configure name	Identifier	Length	Description
Device section			
SN	0x70	Variable size	Device IMEI number as a zero (0x00) terminated string, just Read and can’t be write
SW	0x71	Variable size	Device software version as a zero (0x00) terminated string, just Read and can’t be write
Password	0x72	Variable size	Device password as a zero(0x00)terminated string
Server configure section			
IP address	0x73	Variable size	Platform IP address or host name as a zero (0x00) terminated string
Port	0x74	2 bytes	Platform port number as a 2 byte unsigned value
Heartbeat_idletime	0x75	2 bytes	The heartbeat idle time in seconds , as a 2 byte unsigned value.
Response_timeout	0x76	2 bytes	The response timeout in seconds, as a 2 byte unsigned value.
FTP configure section			
FTP address	0x78	Variable size	Firmware update ftp server IP address or host name as a zero (0x00) terminated string
FTP URL	0x79	Variable size	Firmware update ftp server URL/ path as a zero (0x00) terminated string
FTP user name	0x7A	Variable size	Firmware update ftp server username as a zero (0x00) terminated string
FTP password	0x7B	Variable size	Firmware update ftp server password as a zero (0x00) terminated string
APN configure section			
APN name	0x7D	Variable size	The name of Mobile APN as a zero (0x00) terminated string
APN username	0x7E	Variable size	The username of Mobile APN as a zero (0x00) terminated string
APN password	0x7F	Variable size	The password of Mobile APN as a zero (0x00) terminated string
SOS configure section			
SOS number 1	0x80	Variable size	SOS number 1 as a zero (0x00) terminated string
SOS number 2	0x81	Variable size	SOS number 2 as a zero (0x00) terminated string

SOS number 3	0x82	Variable size	SOS number 3 as a zero (0x00) terminated string
SOS number 4	0x83	Variable size	SOS number 4 as a zero (0x00) terminated string
SOS Alarm	0x84	1 byte	SOS alarm switch 0x00 = disabled 0x01 = enabled
Dial configure section			
Dial username	0x88	Variable size	Mobile username as a zero (0x00) terminated string
Dial password	0x89	Variable size	Mobile password as a zero (0x00) terminated string
Call mode	0x8A	1 byte	Call mode 0x00 = 2-way talk 0x01 = listen
Call volume	0x8B	1 byte	Volume ranging from 0-100 as single unsigned byte. Values above 100 are clipped to 100.
Ring volume	0x8C	1 byte	Volume ranging from 0-100 as single unsigned byte. Values above 100 are clipped to 100.
SMS switch	0x8D	1 byte	SMS function switch 0x00 = disabled 0x01 = enabled
G-sensor configure section			
Impact_threshold_x	0x90	2 bytes	The impact X axis threshold in milli G, as a 2 byte unsigned value.
Impact_threshold_y	0x91	2 bytes	The impact Y axis threshold in milli G, as a 2 byte unsigned value.
Impact_threshold_z	0x92	2 bytes	The impact Z axis threshold in milli G, as a 2 byte unsigned value.
Collision sensitivity	0x93	1 byte	The Sensitivity of collision, the level is from 0 to 10(0 is most high sensitivity)
Collision Alarm	0x94	1 byte	Collision alarm switch 0x00 = disabled 0x01 = enabled
GPS configure section			
Offline Mode	0x98	1 byte	Offline mode switch 0x00 = disabled 0x01 = enabled
GPS report mode	0x99	1 byte	GPS location report rule: Report mode where every bit indicates whether a certain report rule is disabled

			(0)/enabled (1): 1st bit: reportoninterval 2nd bit: reportoffinterval 3rd bit: reportangle 4th bit: reportdistance
Report interval power on	0x9A	2 bytes	Time interval for GPS position report while ignition is on, in seconds. Encoded as a 2 byte unsigned value.
Report interval power off	0x9B	2 bytes	Time interval for GPS position report while ignition is off, in seconds. Encoded as a 2 byte unsigned value.
Report distance	0x9C	2 bytes	Distance for GPS position report, in meters. Encoded as a 2 byte unsigned value.
Speeding report	0x9D	1 byte	Speeding alarm switch 0x00 = disabled 0x01 = enabled
Speeding threshold	0x9E	1 byte	The threshold of speeding,Encoded as a 1 byte unsigned value.
Heading angle threshold	0x9F	2 byte	Heading angle change threshold for GPS position report, in degree(0-360). Encoded as a 2 byte unsigned value
GPS location state report	0xA0	1 byte	GPS location state change report switch 0x00 = disabled 0x01 = enabled
Geo-fence report	0xA1	1 byte	Geo-fence function switch 0x00 = disabled 0x01 = enabled
Geo-fence circle set	0xA2	11 byte	Geo-fence ID number: 1 byte Value from 0-255 Latitude Center point of circle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude Center point of circle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Radius size of circle:2 byte value in meters

Geo-fence rectangle set	0xA3	13 bytes	Geo-fence ID number: 1 byte Value from 0-255 Latitude top-left of rectangle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude top-left of rectangle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Latitude right-bottom of rectangle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude right-bottom of rectangle: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon)
Geo-fence polygon set	0xA4	2+(byte 2)*8 bytes	Geo-fence ID number: 1 byte Value from 0-255 The number of polygon vertices : 1 byte Value from 0-8 Latitude of point number 1: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon) Longitude of point number 1: 4 byte This coordinate is encoded as a 4 byte signed integer value. See coordinate type definition Coordinates encoding (lat / lon)
Device configure section			
Sensor	0xA8	1 byte	Sensor device type 0x00 = none 0x01 = temperature 0x02 = temperature humidity
Tailrs232	0xA9	1 byte	Tailrs232 device type 0x00 = none and used as print 0x01 = BLE lock 0x02 = Capacitive fuel sensor 0x03 = Ultrasonic fuel sensor
ACC state report	0xAA	1 byte	ACC state change report alarm switch 0x00 = disabled 0x01 = enabled
Low power report	0xAB	1 byte	Low battery alarm switch 0x00 = disabled 0x01 = enabled

Power safe mode	0xAC	1 byte	Power safe mode switch 0x00 = disabled 0x01 = enabled
Serianet mode	0xAD	1 byte	Serianet mode switch 0x00 = disabled 0x01 = enabled
High temperature value	0xAE	1 byte	High temperature alarm value Value from 0-60
High humidity value	0xAF	1 byte	High humidity alarm value Value from 0-100
Percentage of remaining battary report function	0xB0	1 byte	Percentage of remaining battary report function switch 0x00 = disabled 0x01 = enabled
I-Button configure section			
Ibutton function	0xC0	1 byte	Ibutton function swith 0x00 = disabled 0x01 = enabled
Driver_id_valid_time	0xC1	2 byte	Specifies time in seconds to remain unlocked after authorized ID check, in seconds. Value can range from 0-14400 seconds, as a 2-byte unsigned.
Driver_id_ignition_off_timeout	0xC2	1 byte	Specifies the grace time in seconds after ignition off before re-authentication is required again. Value can range from 0-30 seconds, as a single unsigned byte.
Driver_id_check_authorization_list	0xC3	1 byte	Ibutton check authorization list switch 0x00 = disabled 0x01 = enabled
Driver_id_relay_type	0xC4	1 byte	The type of relay used: 0x00 = Normal closed relay 0x01 = Normal open relay
I-Button ID Set	0xC5	10 bytes	I-Button ID index : 2 byte I-Button ID index from 1-512 I-Button ID number: 8 byte The authorized i-Button ID on position given by first byte.Encode as a 8 byte id value
I-Button ID Delete	0xC6	2 byte	I-Button ID index : 2 byte The delete I-Button ID index, value from 1-512
BLE configure section			
BLE static password	0xC8	6 byte	BT static password as a zero (0x00) terminated string
BLE transmit power	0xC9	1 byte	BT transmit power level as a 1 byte unsigned value. Value can range form 0-7 level.

BLE scan timeout	0xCA	1 byte	BT scan timeout as a 1 byte unsigned value. Value can range from 5-60 seconds.
BLE slave MAC1	0xCB	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC2	0xCC	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC3	0xCD	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC4	0xCE	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC5	0xCF	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC6	0xD0	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC7	0xD1	9 byte	BT slave Mac as a 9 byte string value
BLE slave MAC8	0xD2	9 byte	BT slave Mac as a 9 byte string value

Note: for variable size configure item, the max size should not large than 50 bytes

Record acknowledgement

Every record report needs to be acknowledged to make sure that the platform has successfully received and stored the records. The platform can confirm this by sending a Record acknowledgement packet. A tracker can only mark records as delivered or ‘acked’ once this message is received, with the correct packet identifier.

Read request

A read request allows the platform to read out configuration parameters and values ad-hoc.

Field name	Length	Field description
Number of requested value types	1 byte	The number of requested value types, as an unsigned byte ranging from 0-255
List of requested value type	Variable size	A list of requested type ids where each type id is encoded as a variable type id. These types can both be record value types as config value types

Read response

After a read request, the tracker responds with a read response containing the values.

Field name	Length	Field description
Number of response value types	1 byte	The number of response value types, which should match with the number of requested value types
List of response values	Variable size	A list of response values, which contain the value type id, result code and value (see below)

Response value

A response value contains a readout result for a single value. It can indicate a success (with data) or a failure.

Response value field name	Length	Response value field description
Value type id	1 byte	The type id, encoded as a variable type id in 1 byte.
Result code	1 byte	A value of ‘0’ means success, any other value is an error code.
Value	Variable size	This field is available in case of a success result code and is encoded according to the value type.

Write request

A read request allows the platform to write configuration parameters.

Field name	Length	Field description
Number of parameters in request	1 byte	The number of parameters written in this request
List of new write parameter values	Variable size	A list of new parameter values to write. Each item to write is encoded as defined in the table below

Write parameter field name	Length	Write parameter field description
Write parameter id	1 byte	The type id, encoded as a variable type id in 1 byte.
Write parameter value	Variable size	The new parameter value, encoded according to the value type.

Write response

The device reports the results of a write request back to the platform using a write response.

Field name	Length	Field description
Number of parameters in response	1 byte	The number of write results in the response
List of write results	Variable size	A list of write results, containing the written parameter id and a result code (success / error). See below

Write result field name	Length	Write result field description
Value type id	1 byte	The type id, encoded as a variable type id in 1 byte.
Result code	1 byte	A value of '0' means success, any other value is an error code.

Action request

An action request is used to execute a certain procedure on the device.

Field name	Length	Field description
Action type	1 byte	The action that should be executed on the device. A list of different action types can be found below.
Action payload	Variable length	The optional payload or parameters required for the given command. This value depends on the action type

Action types

Action name	Identifier	Length	Description
Reset	1	0 bytes	Resets the unit (reboot). This action has no payload.
Factory	2	0 bytes	Reverts the units settings back to factory defaults and does a reboot. This action has no payload.
Update firmware	3	Variable length	Requests the unit to initiate a firmware update. The payload is a 0x00 terminated string, containing the download url. Or just 0x00 to use the default location.
Output control	4	2 bytes	First byte contains the output: 0x01 = Digital output 1 0x02 = Digital output 2 Second byte contains the new state: 0x00 = off 0x01 = on

Action response

Each action has a result, which is reported from the device back to the platform using an action response.

Field name	Length	Field description
Action type	1 byte	The action type that was triggered on the device.
Result code	1 byte	The result of the action, where ‘0’ means success and any other value is an error code.
Action response	Variable size	The optional response of the action, depending on the action type.