

TT19 data protocol

1 Data communication

1. Set TT9 RTC time :

After a connection is established between the device and the server, the device sends a data message to the server. The server sends the following information to the device to change the RTC time. It is recommended that the server set the RTC time each time when the device connects to the server.

Set the RTC time Format: **@UTC,yyyy-MM-dd HH:mm:ss#**

For example: **@UTC,2021-11-24 02:56:43#**

***please note the time setting should be UTC +0 time,the RTC time is set first, and then the ACK reply is set.**

C# code:

```
byte[] utcBytes = System.Text.Encoding.Default.GetBytes(string.Format("@UTC,{0}#",  
System.DateTime.UtcNow.ToString("yyyy-MM-dd HH:mm:ss")));
```

```
_NetStream.Write(utcBytes, 0, utcBytes.Length);
```

2. Set ACK reply:

After a connection is established between the device and the server,each time the machine sends a piece of data to the server, the server must reply with an ACK message to the machine, otherwise the machine will continue to send duplicate data.

Reply ACK Format: **@ACK,Packet index (Hex converted into decimal)#**

For example: **@ACK,0035#**

C# code:

```
byte[] ackBytes = System.Text.Encoding.Default.GetBytes(string.Format("@ACK,{0}#",  
serial));
```

```
_NetStream.Write(ackBytes, 0, ackBytes.Length);
```

2 Upward data parsing

TT19 upward data is in hex format.

The format of hex code:

Start bits(2byte) + Packet length(2byte) + Protocol number(2byte) + Hardware type(2byte) + Firmware version(4byte) + IMEI(8byte) + RTC date time(6byte) + GPS data length (2byte) +Status (1byte) +UTC date time (6byte) + latitude(4byte) +longitude(4byte) + angle(2byte) + speed(2byte) + LBS data length(2byte) + The number of LBS(1byte) + signal LBS information(1byte) + MCC(2byte) + MNC(2byte) + LAC(2byte) + CELLID(4byte) + RxLev(1byte)+ PCI(2byte)+earfcn(3byte)+RSRP(1byte)+RSRQ(1byte)+RSSI(1byte) + State data length(2byte) + Alarm type(1byte) + Terminal information(1byte) + Network signal strength(1byte) + Network state(1byte) +Battery voltage(2byte) + Built-in sensor temperature(2byte) + Built-in sensor humidity(2byte)+External sensor temperature(2byte) +External sensor humidity(2byte)+ External sensor temperature(2byte)+External sensor humidity(2byte)+ Light Sensor(2byte) +Shock sensor(2byte) +WIFI data length(2byte)+single WIFI AP MAC address(6byte)+single WIFI AP RSSI(1byte) packet index(2byte) + CRC(2byte) + Stop bits(2byte)

The data of the device send to the server:

54 5A 00 6C 24 24 04 0A 01 01 00 00 01 90 02 30 00 00 00 02 17 08 01 09 37 09
 00 13 05 17 08 01 09 39 08 01 59 76 CA 06 CB 9E 5A 00 00 00 01 00 14 01 D2
 04 60 00 00 27 9E 3B 4F 4D 6E 00 65 00 05 14 4F 0D 2C 00 0E AA 10 1F 37 00
 64 01 42 02 8B 08 8C 00 00 00 15 88 25 93 44 51 8B 51 00 1F 7A A4 12 11 5A
 D8 D8 66 29 C7 4F 56 00 10 AF D5 0D 0A

Here below is a table which informs more detailed information about the protocol.

Data block	Number of bytes	Data Content	Meaning
Start bits	2	'T' 'Z'	Tzone company identifier. This is the header of every packet
Packet length	2	Variable	The bytes length from the start at protocol number to the end at the CRC.
Protocol number	2	'\$\$'	Normal data
Hardware type	2	0x04 0x0A	The hardware is TT19

Firmware version	4	Variable	Each byte represents a first-level version For example, 01H 01H 00H 00H indicates that the version is 1.1.0.0
IMEI	8	Variable	The high four bits of the first byte are ignored, and every other 4 bits represent a character, such as 01H 90H 02H 30H 00H 00H 00H 02H Indicates that the IMEI is 190023000000002.
RCT time date	6	Variable	The time when the piece of data is packaged and ready to be sent is in the order of year, month, day, hour, minute, and second, and 2000 is added to the year. For example, 17H 08H 01H 09H 37H 09H indicates that the time is: 2023/08/01 17:55:09
GPS data length	2	Variable	Indicates the length of GPS information (unit: byte), if it is 0000H, it means that there is no such data
Status	1	Variable	bit0: latitude mark, 1=N north latitude, 0=S south latitude; bit1: longitude mark, 1=W west longitude, 0=E east longitude, other bits are reserved
UTC date time	6	Variable	The format is the same as the RTC date time
latitude	4	Variable	Unit: 0.000001 degree, HEX format, this value/1000000 is the longitude, such as 015976CAH means 22.640330
longitude	4	Variable	Unit: 0.000001 degree, HEX format, this value/1000000 is the latitude, such as 06CB9E5AH means 114.007642
angle	2	Variable	Unit: degree, reserved
speed	2	Variable	Unit: 0.1Knots, reserved,such as 0001H means 0.1Knots, which is 0.1852km/h
LBS data length	2	Variable	GSM LBS's data length excludes LBS data length part. If the value is 0, there is no LBS data.
The number of LBS	1	Variable	The number of LSB base stations included in this package data
Signal LBS information	1	Variable	Single LBS base station information length and base station information indication,bit7-5 means base station type,000H-2G base station, 010H-NB base station , 100H-CATM1 base station , 110H-LTE base station ;bit4-0 ,means Signal LBS information length
MCC	2	Variable	Mobile Country Code, ignore the first digital, only 3 digital, 04 60 means that MCC is 460.
MNC	2	Variable	Mobile Network Code, 2 or 3 digital, if the first digital is 8 , MNC is 3 digital. If the first digital is 0, MNC is 2 digital. 87 56 means that MNC is 756. 00 56 means 56.
LAC	2	Variable	location area code, hex code 0x27 0x56 means LAC is 10070

CELL ID	4	Variable	<p>Cell identification code, 4 byte, hex code, i.e. 01H23H45H67H means CELL ID is 19088743;</p> <p>In the data example: LBS length:00H 22H, means 34byte;</p> <p>The number of LBS: 03H, means 3;</p> <p>The first LBS information: Signal LBS information :0AH, 2G base station, Contains 10 bytes of data; MCC :04H 60H,460; MNC:00H 00H,00; ; LAC:27H 93H,10131; CELL ID:00H 00H 0FH A1H,4001;</p> <p>The second LBS information: Signal LBS information:0AH,2G base station,Contains 10 bytes of data; MCC:04H 60H,460; MNC:00H 00H,00; LAC:27H B6H,10166; CELL ID:00H 00H 15H BBH,5563;</p> <p>The Third LBS information: Signal LBS information:0AH, 2G base station, Contains 10 bytes of data; MCC:04H 60H,460; MNC:00H 00H,00; LAC:27H B6H,10166; CELL ID:00H 00H 12H A3H,4771;</p>
RxLev	1	Variable	Received Signal power, 1 byte, hex format, unit: -dbm, supported by 2G base stations, this data does not appear for unsupported base stations; for example, 52H means -82dbm
PCI	2	Variable	Physical Cell Identity, 2 bytes, hex format, supported by LTE base stations, this data does not appear for unsupported base stations
earfcn	3	Variable	Evolved Absolute Radio Frequency Channel, 3 bytes, hex format, supported by LTE base stations, this data will not appear for unsupported base stations

RSRP	1	Variable	Reference Signal Received Power (RSRP) in dBm.1 byte, hex format, unit: -dbm, supported by LTE base stations, this data does not appear for unsupported base stations, such as 52H means -82dbm
RSRQ	1	Variable	Reference Signal Received Quality (RSRQ) in dB.1 byte, hex format, unit: -db, supported by LTE base stations, this data does not appear for unsupported base stations, such as 12H means -18db
RSSI	1	Variable	Received signal strength indicator value, 1 byte, hex format, unit: -dbm, supported by LTE base stations, this data does not appear for unsupported base stations, such as 52H means -82dbm
Status data length	2	Variable	The status data length excluding “Status data length” itself. If this part is 0, there is no status data.
Alarm type	1	Variable	The value of this part has four possibilities, Temperature/humidity included in all the data. 0xAA Interval GPRS data 0x10 Low battery Alarm 0xA0 Temperature/Humidity over threshold alarm 0xA1 Temperature/Humidity sensor abnormal alarm 0xA2 Light sensor bright and dark changes 0xA3 Shock alarm 0xB0 Turn on the device 0xB1 Turn off the device
Terminal information	1	Variable	Bit 7-6 work mode 00= Normal work mode, 01= Flight mode, bit 5 are reserved for future use. Bit4: 1 press the button 0 Have not press the button Bit3: 1 The temperature/Humidity sensor is abnormal 0 The temperature/Humidity sensor is normal Bit2: 1 The temperature/Humidity is over threshold 0 The temperature/Humidity is normal Bit1: 1 The battery low voltage 0 The battery is normal Bit0: 1 The machine is charging 0 The machine is not charging
GMS signal strength	1	Variable	CSQ value , Hex code

GSM status	1	Variable	<p>Bit 7 to bit 6 are reserved for future use.</p> <p>Bit 5: 1 Internet connection is established 0 Internet connection is not established</p> <p>Bit4: 1 GPRS is registered successfully 0 GPRS is not registered</p> <p>Bit3: 1 The GSM is in roaming mode 0 The GSM is in home network mode</p> <p>Bit2: 1 GSM is registered successfully 0 GSM is not registered yet</p> <p>Bit1: 1 Detected SIM card 0 Not detected SIM card</p> <p>Bit0: 1 The GSM module is started 0 The GSM module is not started yet</p>
Battery voltage	2	Variable	<p>Unit:10mv, for example: 0175H=373(DEC), 375*10mV=3.73V.</p>
Built-in sensor temperature	2	Variable	<p>unit 0.1°C,2byte, need convert to binary; bit15 means if the built-in sensor is normal,0 means normal, 1 means abnormal; bit14 means temperature is positive or negative , 0 means positive, 1 means negative; bit 0 to bit13 means temperature value, need convert to decimal. For example, 0142H means temperature 32.2°C , 412E means temperature -30.2°C , 8000 means temperature sensor abnormal ; different devices type please refer to different data description.</p>
Built-in sensor humidity	2	Variable	<p>unit 0.1%, 2byte, need covert to binary,; bit15 means if the built-in sensor is normal, 0 means normal, 1 meams abnormal; bit0 to 14 means RH value, need covert to decimal. For example, 028BH means humidity 65.1%, 8000 means built-in sensor abnormal; different devices type please refer to different data description.</p>
external sensor temperature(only temp version)	2	Variable	<p>unit 0.1°C,2byte, need convert to binary; bit15 means if the built-in sensor is normal,0 means normal, 1 means abnormal; bit14 means temperature is positive or negative , 0 means positive, 1 means negative; bit0to bit13 means temperature value, need convert to decimal. different devices type please refer to different data description.</p>

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external sensor humidity	2	Variable	unit 0.1%, 2byte, need convert to binary; bit15 means if the built-in sensor is normal, 0 means normal, 1 means abnormal; bit0 to 14 means RH value, need convert to decimal. different devices type please refer to different data description.
Light Sensor	2	Variable	2byte, unit: lux, need convert to decimal
Shock Sensor	2	Variable	2byte, unit: mg, need convert to decimal
WIFI data length	2	Variable	2 bytes, need convert to decimal, if it is 0000 means without WIFI data;
single WIFI AP MAC address	6	Variable	6 bytes, for example, 36 C2 E4 E2 6E 63 means the WIFI AP mac address is 36:C2:E4:E2:6E:63
single WIFI AP RSSI	1	Variable	1byte, need convert to decimal, unit: -dbm
Packet index	2	Variable	The value range of this part is between 1 and 9999
CRC	2	Variable	The checked content is from the "protocol number" to the end at "CRC", including "protocol number", excluding "CRC".
Stop bits	2	0x0D 0x0A	Indicate that this packet is finished

3 Downward data parsing

Format of server downward commands:

Start bits (1byte) + Type of data (X1) + Delimiter (1byte) + Command (X2) + Delimiter (1byte) + Stop bits (1byte) + End mark (2byte)

1. Start bits: @;
2. Type of data: CMD;
3. Delimiter: ,;
4. Command: refer the commands list below;
5. Delimiter: ,;

6. Stop bits: #;
7. End: \r\n(0x0D,0x0A);

For example: @CMD,*000000,018,30#,#
Set the data upload/ storage interval

Format of TT19 reply:

190023000000001

Start bits (2byte) + Packet length (2byte) + Protocols number (2byte) + Hardware type (2byte) + Firmware version (4byte) + IMEI (8byte) + RTC time date (6byte) + Type of downward command (1byte) + downward command (2byte) + Result (1byte) + Command information (X byte) + Packet index (2byte) + CRC (2byte) + Stop bits (2byte)

1. Start bits: (TZ:545A)
2. Packet length: The bytes length from the start at protocol number to the end at the CRC.
3. Protocol number: \$D
- 4 Hardware type: 04H 0AH
1. Firmware version: 4byte,for example 01H 01H 00H 00H means the firmware is 1.01
2. IMEI: 8byte,ignore the upper four bits of the first byte. For the rest, every 4bit means a number. For example 01H 90H 02H 30H 00H 00H 00H 01H means the IMEI is 190023000000001.
3. RTC time date: 6byte,the data upload/storage RTC time and date,each byte means year/month/day/hour/min/sec
4. Type of downward command: 00H means write command,01H means read command
5. Downward command: command information
6. Result: the result of read or write command,1bit,00H means read or write successful ,05H means do not support this command,08H means read or write failed
7. Command information: If it is write command, the command information will be null. If it is read command,it will show different commands, the format is ASCII, different command is separated by “,” . For details, please refer the command list
For example. If its is read command of IP/Domain, the command information will be 1,g.cloud.tzonedigital.cn,18801
8. Packet index: Accumulate from 1 to 9999
9. CRC: The checked content is from the “protocol number” to the end at “CRC” , including “protocol number” , excluding “CRC” ,MSB first;
10. Stop bits:0DH 0AH;