Wialon IPS

The Wialon IPS (v. 2.1) communication protocol was developed by Gurtam for use in personal and automotive GPS and GLONASS trackers which transfer data to a satellite monitoring server using the TCP or the UDP protocol.

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TCP Data Transfer

The TCP connection must be maintained throughout the entire data transfer process. If the device disconnects immediately after sending the message, the server does not have time to send a response to the device, and traffic consumption increases.

While using one TCP connection, you should transfer data from one device. Otherwise, the system registers only the data of the device whose ID is the first in the incoming data list.

To save traffic, you can use the UDP protocol. However, it does not guarantee that the messages will be delivered.

General Structure of TCP Messages

All data is received in text format as a packet which looks as follows:

```
#PT#msgCRC\r\n
```

Field	Description
#	Start byte
PT	Packet type (see the *Packet types* table)
#	Delimiter
Msg	Text of the message
CRC	CRC16 checksum
\r\n	End of the packet (0x0D0A in HEX)

Packet Types

Type	Description	Sender
L	Login packet	Device
AL	Answer to the login packet	Server
SD	Short data packet	Device
ASD	Answer to the short data packet	Server
D	Extended data packet	Device
AD	Answer to the extended data packet	Server
B	Black box packet	Device
AB	Answer to the black box packet	Server
QLV	*Request live stream* command	Server
LV	Live stream packet	Device
QPB	*Request playback* command	Server
PB	Playback packet	Device
QVF	*Request video file* command	Server
VF	Video file packet	Device
QTM	*Request timeline* command	Server
TM	Timeline packet	Device
P	Ping packet	Device
AP	Answer to the ping packet	Server
US	*Upload firmware* command	Server
UC	*Upload configuration* command	Server
M	Message to/from the driver	Server/Device
AM	Answer to the message from the driver	Server
QI	*Query snapshot* command	Server
I	Snapshot packet	Device
AI	Answer to the snapshot packet	Server
QT	*Query DDD file* command	Server

IT	DDD file information packet	Device
AIT	Answer to the DDD file information packet	Server
T	DDD file block packet	Device
AT	Answer to the DDD file block packet	Server

Login Packet

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 package looks as follows:

```
#L#Protocol_version;IMEI;Password;CRC16\r\n
```

Field	Description
L	Packet type: login packet.
Protocol_version	Current protocol version. In this case, 2.0.
;	Delimiter.
IMEI	IMEI, ID or serial number of the controller.
Password	Password to access the device. If there is none, NA is transmitted.
CRC16	Checksum. See the *Checksum* section.

Server Response to the L Packet

Type	Code	Meaning	Example
AL	1	Unit successfully authorized.	#AL#1\r\n
	0	Connection rejected. Possible reasons: • Incorrect protocol version. The current one is 2.0; • The unit is not created on the server; • Incorrect packet structure.	#AL#0\r\n
	01	Password verification error.	#AL#01\r\n

	10	Checksum verification error.	#AL#10\r\n

Short Data Packet

The packet contains only navigation data and looks as follows:

#SD#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats;CRC16\r\n

Field	Description
SD	Packet type: short data packet.
Date	Date in the DDMMYY format, UTC±00:00. If there is no data, NA is transmitted.
Time	Time in the HHMMSS.nnnnnnnnn format, UTC±00:00. If there is no data, NA is transmitted.
LatDeg;LatSign	Latitude. LatDeg denotes degrees, LatSign denotes a cardinal point. If there is no data, NA;NA is transmitted. See Annex.
LonDeg;LonSign	Longitude. LonDeg denotes degrees, LonSign denotes a cardinal point. If there is no data, NA;NA is transmitted. See Annex.
Speed	Speed value, integer (km/h). If there is no data, NA is transmitted.
Course	Direction of movement, integer (from 0 to 359 degrees). If there is no data, NA is transmitted.
Alt	Altitude, integer (metres). If there is no data, NA is transmitted.
Sats	Number of satellites, integer. If there is no data, NA is transmitted.
CRC16	Checksum. See the *Checksum* section.

If the *Date* and *Time* fields contain NA, the message is registered with the current server time.

Server Response to the SD Packet

Type	Code	Meaning	Example
ASD	-1	Incorrect packet structure.	#ASD#-1\r\n
	0	Incorrect time.	#ASD#0\r\n
	1	Packet successfully registered.	#ASD#1\r\n
	10	Error receiving coordinates.	#ASD#10\r\n
	11	Error receiving speed, course, or altitude.	#ASD#11\r\n
	12	Error receiving the number of satellites.	#ASD#12\r\n
	13	Checksum verification error.	#ASD#13\r\n

Extended Data Packet

The packet contains additional data structures and looks as follows:

#D#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats;HDOP;Inputs; Outputs;ADC;Ibutton;Params;CRC16\r\n

Field	Description
D	Packet type: extended data packet.
Date	Date in the DDMMYY format, UTC±00:00. If there is no data, NA is transmitted.
Time	Time in the HHMMSS.nnnnnnnnn format, UTC±00:00. If there is no data, NA is transmitted.
LatDeg;LatSign	Latitude. LatDeg denotes degrees, LatSign denotes a

	cardinal point. If there is no data, NA;NA is transmitted. See Annex.
LonDeg;LonSign	Longitude. LonDeg denotes degrees, LonSign denotes a cardinal point. If there is no data, NA;NA is transmitted. See Annex.
Speed	Speed value, integer (km/h). If there is no data, NA is transmitted.
Course	Direction of movement, integer (from 0 to 359 degrees). If there is no data, NA is transmitted.
Alt	Altitude, integer (metres). If there is no data, NA is transmitted.
Sats	Number of satellites, integer. If there is no data, NA is transmitted.
HDOP	Horizontal Dilution of Precision. It shows the accuracy of the coordinates transmitted by the device. The smaller this value is, the more accurate the coordinates are. If there is no data, NA is transmitted.
Inputs	Digital inputs. Every bit of the number (beginning from the low-order one) corresponds to one input. Integer. If there are none, NA is transmitted.
Outputs	Digital outputs. Every bit of the number (beginning from the low-order one) corresponds to one output. Integer. If there are none, NA is transmitted.
ADC	Analog inputs. Fractional numbers separated by commas. The sensors are numbered from 1. If there are no analog inputs, an empty string is transmitted. Example: 14.77,0.02,3.6
Ibutton	Driver key code. A string of arbitrary length. If there is none, NA is transmitted.
Params	Additional parameters. Separated by commas. See

	Additional Parameters.
CRC16	Checksum. See the *Checksum* section.

If the *Date* and *Time* fields contain NA, the message is registered with the current server time.

Additional Parameters (Params)

Each parameter has the following structure:

Name:Type:Value

Examples of additional parameters: count1:1:564, fuel:2:45.8, hw:3:V4.5, SOS:1:1

Field	Description
Name	Parameter name in Latin. In lowercase. The maximum number of characters is 38. Invalid characters: space, comma, colon, number sign, line feed and carriage return (\r\n).
Type	Parameter type: 1 — Integer / Long; 2 — Double; 3 — String (the maximum number of characters: 1344).
Value	Parameter value. Depends on the parameter type.

If the value does not correspond to the parameter type, the parameter will

not be registered.

The maximum number of parameters that can be registered in Wialon is 200. The protocol does not limit the number of the transmitted parameters.

Fixed parameters

- **Alarm messages**. To transmit an alarm message highlighted in red, a parameter of the first (Integer) type is used. The parameter name is SOS, in uppercase. A value of 1 means the alarm is triggered.
- **Chat with drivers**. To display a message in the *Chat with drivers* pop-up window, a parameter of the third (String) type is used. The parameter name is *text*.
- **Positioning by LBS**. To determine the location by base stations (LBS), it is required to register the following parameters:

Name	Type	Value
mcc#	Integer	Mobile country code
mnc#		Mobile network code
lac#		Local area code
cell_id#		Cell identification

is a parameter index. It is used if it is necessary to transmit several LBS structures. In this case, the parameter names should be numbered. Examples: mcc1=12, mnc1=12, lac1=12, cell_id1=12, mcc2=13, mnc2=13, lac2=13, cell_id2=13.

- **Positioning by Wi-Fi**. To determine the location by Wi-Fi points, it is required to register the following parameters:

Name	Type	Value

wifi_mac_#	String	MAC address. Every byte is separated by the minus sign (-). Example: 74-D8-3E-40-B8-7A
wifi_rssi_#	Integer	Indicator of the signal level

is a parameter index. It is used if it is necessary to transmit several parameter pairs. In this case, the parameter names should be numbered. The parameter registered in Wialon will look like 74:d8:3e:40:b8:7a, that is, separated by colons and in lower case, even if it was sent in upper case. The initial value sent by the device can't be like this, because the colons are not allowed. Example: wifi_mac_1=74:d8:3e:40:b8:7a, wifi_rssi_1 = 74, wifi_mac_2=34:a2:5e:30:b8:4a, wifi_rssi_2 = 72.

Server Response to the D Packet

Type	Code	Meaning	Example
AD	-1	Incorrect packet structure.	#AD#-1\r\n
	0	Incorrect time.	#AD#0\r\n
	1	Packet successfully registered.	#AD#1\r\n
	10	Error receiving coordinates.	#AD#10\r\n
	11	Error receiving speed, course, or altitude.	#AD#11\r\n
	12	Error receiving the number of satellites or HDOP.	#AD#12\r\n
	13	Error receiving Inputs or Outputs.	#AD#13\r\n
	14	Error receiving ADC.	#AD#14\r\n
	15	Error receiving additional parameters.	#AD#15\r\n

	15.1	Error receiving additional parameters. The parameter name is more than 40 characters long. The parameter will not be registered.	#AD#15.1\r\n
	15.2	Error receiving additional parameters. The parameter name contains a space, which is not allowed. The parameter will not be registered.	#AD#15.2\r\n
	16	Checksum verification error.	#AD#16\r\n

Black Box Packet

The black box packet is used to transmit messages for the past period. The maximum number of messages that can be transmitted in one packet is 5000. The packet looks as follows:

```
#B#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats|
Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats|
Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats|CRC16\r\n
```

Field	Description
B	Packet type: black box packet.
Data	A set of short (SD) or extended (D) data packets without the packet type field. The packets are separated by the vertical bar (|).
CRC16	Checksum. See the *Checksum* section.

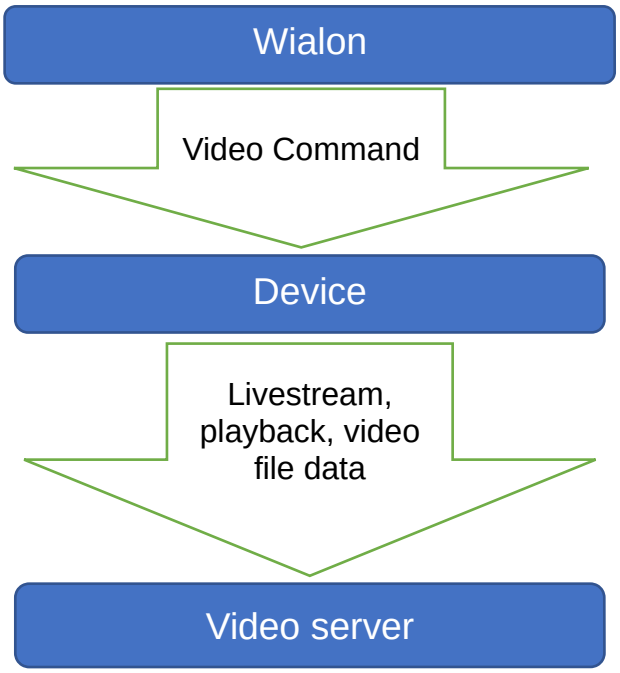
Server Response to the B Packet

Type	Value	Meaning	Example
AB	Number	Number of packets successfully	#AB#3\r\n

		registered.	
	Empty string	Checksum verification error.	#AB#\r\n

Video

This part of the protocol describes the operation of the device and the server as far as getting and watching video is concerned. After sending the *Request live stream*, *Request playback*, *Request video file* commands, the device is connected to the remote server specified in the command. To authorize on the server, the device should first send the login packet and then data packets to the server.



Request Live Stream Command

The command is used for requesting live streams.

The packet looks as follows:

#QLV#hwsIP;chNum;streamType\r\n

Field	Description
QLV	Packet type: *Request live stream* command.
hwsIP	IP address of the media server.
chNum	Channel number. Only one channel can be specified in a packet.
streamType	Video stream type. 0 is the main video stream. Ensures the highest video quality. 1 is a secondary video stream. Ensures a low video quality.
\r\n	End of the packet.

Live Stream Packet

Before sending a live stream packet, it is required to send a login packet to authorize on the server. The login packet looks as follows:

#L#Protocol_version;IMEI;Password;CRC16\r\n

After a positive server answer, the device can send a live stream packet:

#LV#date;time;chNum;encode;dataLen\r\ndata

Field	Description
LV	Packet type: *Request live stream* command.
date	Date in the DDMMYY format, UTC±00:00.
time	Time in the HHMMSS format, UTC±00:00
chNum	Channel number. Only one channel can be specified in a packet.
encode	Encoding: • 0-10 is video encoding;

	0 – h264; • 11-20 is sound encoding; 11 – apdcm.
dataLen	Video data size.
\r\n	Indicator of the packet end.
data	Binary video data. Formed according to the specified encoding.

Request Playback Command

The command is used for requesting a video playback.

The packet looks as follows:

```
#QPB#hwsIP;date;time;chNum;streamType\r\n
```

Field	Description
QPB	Packet type: *Request playback* command.
hwsIP	IP address of the media server.
date	Start date of the playback request in the DDMMYY format, UTC±00:0000.
time	Start time of the playback request in the HHMMSS format, UTC±00:0000.
chNum	Channel number. Only one channel can be specified in a packet.
streamType	Video stream type. 0 is the main video stream. Ensures the highest video quality. 1 is a secondary video stream. Ensures a low video quality.
\r\n	End of the packet.

Playback Packet

Before sending a playback packet, it is required to send a login packet to authorize on the server. The login packet looks as follows:

#L#Protocol_version;IMEI;Password;CRC16\r\n

After a positive server answer, the device can send a playback packet:

#PB#date;time;chNum;encode;dataLen\r\nData

Field	Description
PB	Packet type: *Request playback* command.
date	Frame date in the DDMMYY format, UTC±00:00.
time	Frame time in the HHMMSS format, UTC±00:00
chNum	Channel number. Only one channel can be specified in a packet.
encode	Encoding: • 0-10 is video encoding; 0 – h264; • 11-20 is sound encoding; 11 – apdcm.
dataLen	Video data size.
\r\n	Indicator of the packet end.
Data	Binary video data. Formed according to the specified encoding.

Request Video File Command

The command is used for downloading a video file from the device.

The packet looks as follows:

#QVF#hwsIP;date;time;dur;chNum;streamType\r\n

File	Description

QVF	Packet type: *Request video file* command.
hwsIP	IP address of the HWS server.
Date	Video start date in the DDMMYY format, UTC±00:00.
Time	Video start time in the HHMMSS format, UTC±00:00.
Dur	Video duration in seconds.
chNum	Channel number. Only one channel can be specified in a packet.
streamType	Video stream type. 0 is the main video stream. Ensures the highest video quality. 1 is a secondary video stream. Ensures a low video quality.
\r\n	End of the packet.

Video File Packet

Before sending a video file packet, it is required to send a login packet to authorize on the server. The login packet looks as follows:

#L#Protocol_version;IMEI;Password;CRC16\r\n

After a positive server answer, the device can send a video file packet:

#VF#date;time;dur;chNum;container;encode;dataLen\r\ndata

Поле	Описание
VF	Packet type: *Request video file* command.
date	Date in the DDMMYY format, UTC±00:00.
time	Time in the HHMMSS format, UTC±00:00
dur	Video duration in seconds.
chNum	Channel number. Only one channel can be specified in a packet.
container	Media container:

	• 0 – mp4.
encode	Encoding: • 0-10 – video encoding; 0 – h264; • 11-20 – sound encoding; 11 – apdcm.
dataLen	Video data size.
\r\n	Indicator of the packet end.
Data	Binary video data. Formed according to the specified encoding.

If the start time of a file from the device memory is later than the start time requested by the QVF command, the device sends the actual start time of the video file.

Example:

The start time 12:00:00 and a duration of 60 seconds have been requested by the QVF command. However, the device only has files starting from 12:00:30. In response to the VF command, the device will send the parameter **time=12:00:30**, and a shorter duration **dur=30**, respectively. In this case, the response to the command will be as follows:

#VF#date;120030;30;chNum;container;encode;dataLen\r\ndata

Request Timeline Command

The command is used for requesting a list of the video files stored in the device.

The packet looks as follows:

#QTM#sDate;sTime;eDate;eTime;chNum\r\n

Field	Description

QTM	Packet type: *Request timeline* command
sDate	Start date of the time interval in the DDMMYY format, UTC±00:00.
sTime	Start time of the interval in the HHMMSS format, UTC±00:00.
eDate	End date of the time interval in the DDMMYY format, UTC±00:00.
eTime	End time of the interval in the HHMMSS format, UTC±00:00.
chNum	Channel number. Several channels can be specified in a packet (separated by commas). Example: 1, 2, 3
\r\n	End of the packet.

Timeline Packet

A packet with a list of video files is received in the same connection from which the command was sent. The packet looks as follows:

#TM#seqNum;count;list\r\n

Field	Description
TM	Packet type: *Request timeline* command
seqNum	The number of files in the packet at the moment.
count	The total number of files to be transferred.
list	List of file names (separated by commas). A file name should be transferred in the format specified below. Otherwise, it will be ignored. **File name format:** {video start time DDMMYYHHMMSS utc 0}_{duration in seconds}_{channel number}.{file format} Example: 010521102256_15_1.mp4, 010521112341_12_1.mp4
\r\n	End of the packet.

Ping Packet

The packet is used to maintain an active TCP connection with the server and to verify the availability of the channel. The packet looks as follows:

```
#P#\r\n
```

Server Response to the P Packet

Type	Meaning	Example
AP	Positive server response.	#AP#\r\n

Commands

Upload Firmware Command

The command is used to transfer the firmware data from the server to the controller. The packet looks as follows:

```
#US#Sz;CRC16\r\nBIN
```

Field	Description
US	Packet type: firmware packet.
Sz	Size of the binary data of the firmware (bytes).
CRC16	Checksum. See the *Checksum* section.
BIN	Firmware in binary format.

Upload Configuration Command

The command is used to transfer the configuration file from the server to

the controller. The packet looks as follows:

```
#UC#Sz;CRC16\r\nBIN
```

Field	Description
UC	Packet type: configuration packet.
Sz	Size of the configuration file (bytes).
CRC16	Checksum. See the *Checksum* section.
BIN	Contents of the configuration file.

Send Message to Driver Command

The command is used to exchange text messages between the server and the driver. The packet format is the same for the server and for the controller:

```
#M#Msg;CRC16\r\n
```

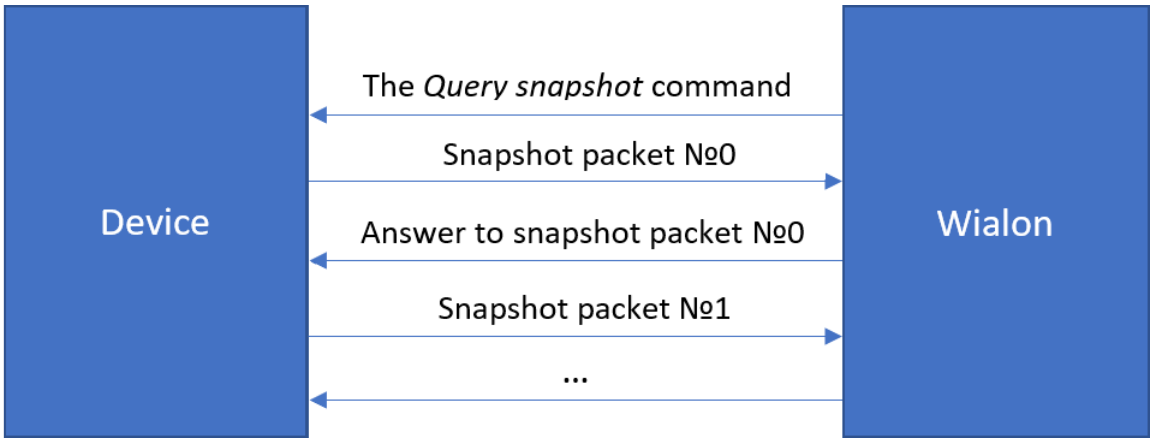
Field	Description
M	Packet type: message to/from the driver.
Msg	Text of the message. If the message is sent from Wialon to the device, there is no size limit. If it is sent from the device to Wialon, the size limit is 4Kbytes.
CRC16	Checksum. See the *Checksum* section.

Server Response to the M Packet

Type	Code	Meaning	Example
AM	1	Message received.	#AM#1\r\n
	0	Error receiving messages.	#AM#0\r\n
	01	Checksum verification error.	#AM#01\r\n

Query Snapshot Command

The command is sent from the server to the controller to request a photograph.



The packet looks as follows:

```
#QI#\r\n
```

Field	Description
QI	Packet type: the *Query snapshot* command.

Snapshot Packet

The packet is used to transfer the image data to the Wialon server. The image is divided into blocks of bytes, each of which is sent to the server as a

separate packet. The recommended block size is up to 50 KB. If the server cannot receive any image block, it disconnects. In this case, it is recommended to reduce the size of the blocks.

The packet looks as follows:

```
#I#Sz;Ind;Count;Date;Time;Name;CRC16\r\nBIN
```

Field	Description
I	Packet type: snapshot packet.
Sz	Size of the binary data of the packet (for example, 51200 bytes).
Ind	Index number of the transmitted block (numbering from zero).
Count	Number of the last block (numbering from 0).
Date	Date in the DDMMYY format, UTC±00:00.
Time	Time in the HHMMSS format, UTC±00:00.
Name	Name of the transmitted image.
CRC16	Checksum. See the *Checksum* section.
BIN	Binary image block of the *Sz* size.

Server Response to the I Packet

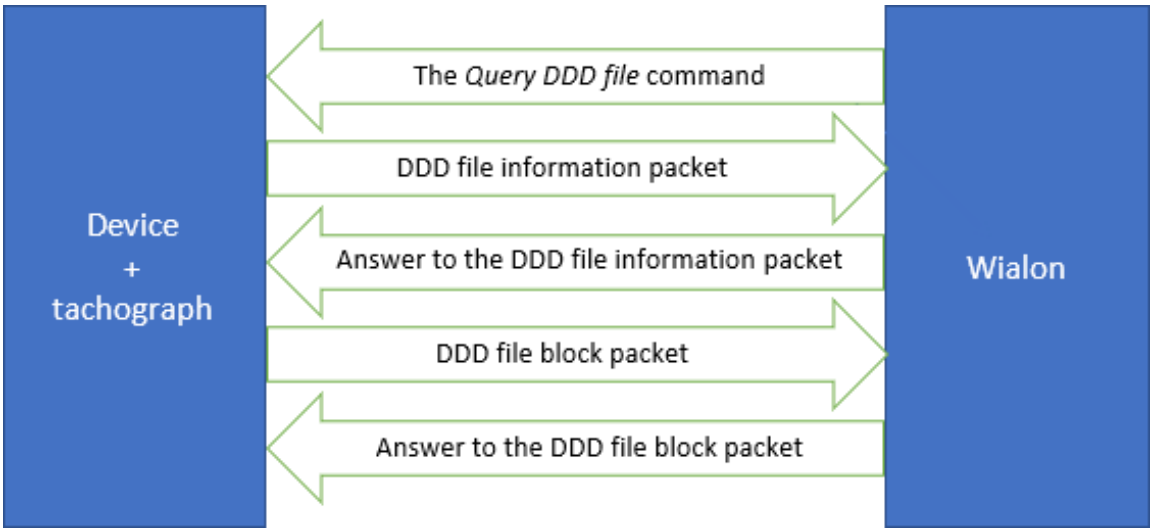
Type	Block number	Code	Meaning	Example
AI	Ind	1	Packet received.	#AI#Ind;1\r\n
AI	Ind	0	Error receiving packet.	#AI#Ind;0\r\n
AI	Ind	01	Checksum verification error.	#AI#Ind;01\r\n
AI	NA	0	Incorrect packet structure.	#AI#NA;0\r\n
AI	None	1	Image fully received and saved in Wialon.	#AI#1\r\n

Ind. The index number of the transmitted image block. Integer.

When the image is fully received and saved in Wialon, the server response contains only one parameter: code (#AI#1\r\n).

Query DDD File Command

The command is sent from the server to the device to request a tachograph file.



The packet looks as follows:

```
#QT#DriverID\r\n
```

Field	Description
QT	Packet type: the *Query DDD file* command.
DriverID	Driver identification.

DDD File Information Packet

The packet contains information about the tachograph file transmitted to the server. All fields are required. This information is necessary to save the file

correctly and bind it to the appropriate driver in Wialon. The saved file is named as follows: *driverid_yyyymmdd_hhmmss.ddd*. You should transfer this packet before transmitting the DDD file.

The packet looks as follows:

```
#IT#Date;Time;DriverID;Code;Count;CRC16\r\n
```

Field	Description
IT	Packet type: DDD file information packet.
Date	Date in the DDMMYY format, UTC±00:00.
Time	Time in the HHMMSS format, UTC±00:00.
DriverID	Driver identification.
Code	Error code. If there are no errors, an empty string is transmitted.
Count	Total amount of the DDD file blocks.
CRC16	Checksum. See the *Checksum* section.

Server Response to the IT Packet

Type	Code	Meaning	Example
AIT	1	Packet received.	#AIT#1\r\n
	0	Error receiving packet.	#AIT#0\r\n
	01	Checksum verification error.	#AIT#01\r\n

DDD File Block Packet

The packet is used to transfer DDD file data blocks and looks as follows:

```
#T#Code;Sz;Ind;CRC16\r\nBIN
```

Field	Description
T	Packet type: DDD file block packet.
Code	Error code. If there are no errors, an empty string is transmitted.
Sz	Size of the binary data of the packet (bytes).
Ind	Index number of the transmitted block (numbering from zero).
CRC16	Checksum. See the *Checksum* section.
BIN	Binary file block of the *Sz* size.

Server Response to the T Packet

Type	Block number	Code	Meaning	Example
AT	Ind	1	Packet received.	#AT#Ind;1\r\n
	Ind	0	Error receiving packet.	#AT#Ind;0\r\n
	Ind	01	Checksum verification error.	#AT#Ind;01\r\n
	None	1	DDD file fully received and saved in Wialon.	#AT#1\r\n

Ind. The index number of the transmitted DDD file block. Integer.

When the image is fully received and saved in Wialon, the server response contains only one parameter: code (#AT#1\r\n).

All DDD file block packets should be transmitted using the same TCP connection as the DDD file information packet.

Send Custom Message Command

The command is used to send custom messages to the device. It allows

to implement additional features necessary for the controller.

In response to the command, you can send a *Message to/from the driver* packet. If you need to transfer the position data and other parameters, you can transmit an extended data packet.

The custom command sent to the device looks as follows:

```
Msg\r\n
```

Field	Description
Msg	Text of the message.

UDP Data Transfer

The UDP protocol is used only to transfer data from the controller to the server. It is not possible to send commands from the server to the device using this protocol.

General Structure of UDP Messages

A UDP packet has the same structure as a TCP packet with the only difference that the prefix *Protocol_version;IMEI* is added at the beginning. The packet transferred using UDP looks as follows:

Protocol_version;IMEI#PT#MsgCRC\r\n

Field	Description
Protocol_version	Current protocol version. 2.0 is used now.
;	Delimiter.
IMEI	IMEI of the device.
#	Start byte.
PT	Packet type. See the *Packet types* table.
#	Delimiter.
Msg	Text of the message.
CRC	CRC16 checksum.
\r\n	End of the packet (0x0D0A in HEX).

The SD packet structure (UDP transfer):

2.0;IMEI#SD#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats;CRC16\r\n

Data Compression

To save traffic, it is appropriate to use data compression while transferring packets which contain a large amount of data. The DEFLATE algorithm of the cross-platform «zlib» library is used for compression. Both TCP and UDP transport protocols are supported. The container should consist of only one packet in text format.

Compressed Packet Container Structure

Size (bytes)	1	2	
Field	Head	Len	Data

Head — 0xFF.

Len. The *Data* field length (little-endian, 16-bit integer).

Data. The compressed binary data block of the specified size. Transmitted as it is.

You can transfer the compressed and regular packets of the Wialon IPS protocol simultaneously. The packets sent from the server are always regular (not compressed) because of their small size.

When implementing the library, the identifiers Z_DEFAULT_COMPRESSION, Z_DEFLATED, Z_DEFAULT_STRATEGY affect the result, but the message is valid in any case.

Compressed L Packet Example

HEX:

```
FF1B00780153F65136D233B0CECC4DCDB4F673B476B4343602002FF404E6
```

Text:

```
#L#2.0;imei;NA;A932
```

Compressed D Packet Example

HEX:

```
FFF2007801258C4B0AC24010052F340EFDFA93CC74AF4C701B1739414091805
109DE1F1343ADEA413D1610386052AD662D0D172AC261629AB57243310471
2BC8AAB5525C82368428DA40C6DF9068278673CC8F97C3916E9F699D166797
0C856D4796BEC726FE7CAFF725CD87C24F6669BC8E7B17DAF5F203C7042474
```

Text:

```
231012;153959.486280832;5354.49260;N;02731.44990;E;0;0;300;7;1.1;0;
0;1,0,0,0;NA;ign:1:1,dparam:2:3.14159265,tparam:3:lorem,iparam:1:-
55,SOS:1:1;4BC3
```

Checksum

The CRC16 checksum should be added to the message as a hexadecimal number in ASCII characters. The byte order is big-endian.

Example: 0xFC45 => 0x46433435

Checksum Calculation

Packet type	Explanation
SD	Message example: #SD#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats; CRC16\r\n The checksum is calculated for the following part of the packet: Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats;
B	Message example: #B#Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats| Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats| CRC16\r\n The checksum is calculated for the following part of the packet: Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats| Date;Time;LatDeg;LatSign;LonDeg;LonSign;Speed;Course;Alt;Sats|
I US UC	Message example: #I#51200;0;1;070512;124010;sample.jpg;CRC16\r\nBIN

T	The checksum is calculated for the *BIN* field only.
L SD D B M IT	The checksum is calculated for the part of the packet between the packet type and the *CRC16* field.

C Code Example for CRC16 Calculation

```
static const unsigned short crc16_table[256] =
{

0x0000,0xC0C1,0xC181,0x0140,0xC301,0x03C0,0x0280,0xC241,0xC601,0x06C0
,0x0780,0xC741,0x0500,

0xC5C1,0xC481,0x0440,0xCC01,0x0CC0,0x0D80,0xCD41,0x0F00,0xCFC1,0xCE8
1,0x0E40,0x0A00,0xCAC1,

0xCB81,0x0B40,0xC901,0x09C0,0x0880,0xC841,0xD801,0x18C0,0x1980,0xD941
,0x1B00,0xDBC1,0xDA81,

0x1A40,0x1E00,0xDEC1,0xDF81,0x1F40,0xDD01,0x1DC0,0x1C80,0xDC41,0x140
0,0xD4C1,0xD581,0x1540,

0xD701,0x17C0,0x1680,0xD641,0xD201,0x12C0,0x1380,0xD341,0x1100,0xD1C
1,0xD081,0x1040,0xF001,

0x30C0,0x3180,0xF141,0x3300,0xF3C1,0xF281,0x3240,0x3600,0xF6C1,0xF781,
0x3740,0xF501,0x35C0,

0x3480,0xF441,0x3C00,0xFCC1,0xFD81,0x3D40,0xFF01,0x3FC0,0x3E80,0xFE41,
0xFA01,0x3AC0,0x3B80,

0xFB41,0x3900,0xF9C1,0xF881,0x3840,0x2800,0xE8C1,0xE981,0x2940,0xEB01,
0x2BC0,0x2A80,0xEA41,

0xEE01,0x2EC0,0x2F80,0xEF41,0x2D00,0xEDC1,0xEC81,0x2C40,0xE401,0x24C0,
0x2580,0xE541,0x2700,

0xE7C1,0xE681,0x2640,0x2200,0xE2C1,0xE381,0x2340,0xE101,0x21C0,0x2080,
0xE041,0xA001,0x60C0,

0x6180,0xA141,0x6300,0xA3C1,0xA281,0x6240,0x6600,0xA6C1,0xA781,0x6740,
```

```
0xA501,0x65C0,0x6480,

0xA441,0x6C00,0xACC1,0xAD81,0x6D40,0xAF01,0x6FC0,0x6E80,0xAE41,0xAA01
,0x6AC0,0x6B80,0xAB41,

0x6900,0xA9C1,0xA881,0x6840,0x7800,0xB8C1,0xB981,0x7940,0xBB01,0x7BC0
,0x7A80,0xBA41,0xBE01,

0x7EC0,0x7F80,0xBF41,0x7D00,0xBDC1,0xBC81,0x7C40,0xB401,0x74C0,0x7580
,0xB541,0x7700,0xB7C1,

0xB681,0x7640,0x7200,0xB2C1,0xB381,0x7340,0xB101,0x71C0,0x7080,0xB041,
0x5000,0x90C1,0x9181,

0x5140,0x9301,0x53C0,0x5280,0x9241,0x9601,0x56C0,0x5780,0x9741,0x5500,
0x95C1,0x9481,0x5440,

0x9C01,0x5CC0,0x5D80,0x9D41,0x5F00,0x9FC1,0x9E81,0x5E40,0x5A00,0x9AC1
,0x9B81,0x5B40,0x9901,

0x59C0,0x5880,0x9841,0x8801,0x48C0,0x4980,0x8941,0x4B00,0x8BC1,0x8A81,
0x4A40,0x4E00,0x8EC1,

0x8F81,0x4F40,0x8D01,0x4DC0,0x4C80,0x8C41,0x4400,0x84C1,0x8581,0x4540,
0x8701,0x47C0,0x4680,
   0x8641,0x8201,0x42C0,0x4380,0x8341,0x4100,0x81C1,0x8081,0x4040
};

unsigned short crc16 (const void *data, unsigned data_size)
{
   if (!data || !data_size)
      return 0;

   unsigned short crc = 0;
   unsigned char* buf = (unsigned char*)data;

   while (data_size--)
      crc = (crc >> 8) ^ crc16_table[(unsigned char)crc ^ *buf++];

   return crc;
}
```

Annex

The coordinates are compliant with the NMEA 0183 standard.

DDMM.MM is the format of latitude. Two digits of degrees (DD). If the degree value consists of one digit, the degree field still contains two digits. That is, the field is filled with zeros, for example, 01. The degrees are followed by two

digits of integer minutes, a point, and a fractional part of minutes of variable length. The leading zeros are not omitted. N denotes north (positive) latitude, S denotes south (negative) latitude.

Example: 5544.6025;N (LatDeg - 5544.6025, LatSign - N)

55 is a degree value.

44.6025 / 60 = 0,743375 is a minute value.

N is north latitude (positive sign).

55 + 0,743375 = +55,743375

DDDMM.MM is the format of longitude. Three digits of degrees (DDD). If the degree value consists of one digit, the degree field still contains three digits. That is, the field is filled with zeros, for example, 001. The degrees are followed by two digits of integer minutes, a point, and a fractional part of minutes of variable length. The leading zeros are not omitted. E denotes east (positive) longitude, W denotes west (negative) longitude.

Example: 03739.6834;E (LonDeg - 03739.6834, LonSign - E)

037 is a degree value.

39.6834 is a minute value.

E is east longitude (positive sign).

037 + 39.6834 = +37,66139