



“T MESSAGE” PROTOCOL USER GUIDE

MT2000



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CONFIDENTIAL

MT2000S "T MESSAGE"

PROTOCOL OVER THE AIR

Revision	Description	Date	Author
1.0	First Release	2020.11.23	Ricardo Franco
1.1	Include "release notes"	2020.12.01	Ricardo Franco
1.1.1	Bit 0 (output flag) of "terminal status" is inverted	2020.12.04	Ricardo Franco
1.2	<p>1- Addition of information to the "T" protocol: internal battery voltage and partial Odometer;</p> <p>2- Page 31/Protocol T6/PARAM_VAL: "=" modification by ",";</p> <p>3- In the field PRT_VER (Protocol Version) the information was updated to: V1.2.5;</p> <p>4- Note: All new information was inserted at the end of the protocol datagram</p>	2021.01.28	Gustavo Pardiniho
1.3	<p>1-Total compilation of the revision history of this document;</p> <p>2- Reconfiguration of the air protocol document layout;</p> <p>3- addition of information in the "T" protocol that will be developed and implemented in the future. These are: a) ODOMETER_TOTAL; b) HORIMETER; c) HDOP; d) MCC; e) MNC; f) LAC; g) CELL_ID; h) RX_LEVEL; i) SERIAL_COUNTER;</p> <p>4-Change of nomenclature: Event Message chance to Report Message;</p> <p>5-Creation of the LOGIN MESSAGE section;</p> <p>6-Creation of the HEARTBEAT MESSAGE section;</p> <p>7-Creation of the REPORT MESSAGE section;</p> <p>8-Summary update;</p> <p>9-Added the preview of REPORT MESSAGE that will be implemented in the future. These are: a) TURN; b) IGN OFF; c) MILEAGE REPORT;</p> <p>10-Added the preview of ALERT MESSAGE that will be implemented in the future. These are: a) INPUT ACTIVATION; b) INPUT DISABLING; c) BATTERY RECONNECTION; d) BATTERY LEVEL RESTORATION; e) JAMMER DETECTION; f) TOPPLE DETECTION; g) OVERTUR DETECTION;</p> <p>11- Note: red messages in this document (V1.3.0) will be implemented in the future;</p> <p>12- T8= Low Internal Battery Voltage Alert addition;</p> <p>13-Added a description of the buffer offload mode. p.14;</p> <p>14- Payload order item added to document;</p>	2021.03.03	Gustavo Pardiniho

1.3.1	<p>1- Added examples of real packages to the end of each table;</p> <p>2- Added explanation of bit 5 of the TERM_STATUS parameter;</p> <p>3- Added examples of strings of the parameters referring to the content of the payload from itens 13 to 21;</p> <p>4- Standardization of table T4;</p> <p>5- Inclusion of responses from SMS commands, page 29.</p> <p>6- Addition of example of memory message blocks downloaded on the server;</p> <p>7- Addition of space allocation table for protocol Fields, in page Appendix;</p> <p>8- Addition of query table for the value "GSM_Signal_strength", in page Appendix;</p> <p>9- Added response "S1" with status "0" of connection rejection.</p> <p>10- In all protocols, in the TERM_STATUS field, the term "TRIP" is replaced by "Ignition" in Bit2.</p> <p>11- Added Appendix;</p>	30.04.21	Gustavo Pardi- nho
1.3.2	<p>1- Change Value from NET_MOBI TO ICCID; PAGE 10;</p> <p>2- Insert description of ICCID – PAGE 10;</p> <p>3 – Correction LAT/LONG, inserted dot before decimals – PAGE 16;</p> <p>4 – Text correction : From Overturn to Rollover – PAGE 18;</p> <p>5 – Text Correction : MILAGE to MILEAGE – Pages 3, 10, 14, 16, 21, 30;</p> <p>6 – Text correction : INGESTION – PAGE 11;</p> <p>7 – Image swap on Page 33 to better explain how UPDATE VIA FOTA works;</p> <p>8 – Correction of the T3 command to match the new add protocols.;</p> <p>9 – Correction of the Tx Alarm messages to match the new protocols.;</p>	22/06/2021	Henrique Mar- condes
1.3.3	<p>1- Correction of command GET INFO to GET ALL(it will change in future releases)</p> <p>2- Insertion of two alerts that wasn't previously added (High Voltage alert and high battery level restauration)</p> <p>3 – Insertion of two SMS commands GET INFO and GET PROG(prior to 1.3.3v)</p>	16/07/2021	Henrique Mar- condes
1.3.4	<p>1- Insertion of NEW SMS commands after protocol version 1.3.3</p>	21/07/2021	Henrique Mar- condes
1.3.5	<p>1- Insertion of Incoming new Commands for S6(SET) and S5(GET)</p>	23/07/2021	Henrique Mar- condes

1.3.6	<ul style="list-style-type: none"> 1-Adjust size of many tables inside the document 2-Information about the payload inserted into T4, T6, T7 3- changed SMS commands from “prior to V1.3.3” to “V1.3.4+” 4- Inserted information about GET ALL, GET INFO AND GET PROG commands 5- ENGINEV value now corrected (Mv instead of V) 6- Changed the size of SMS messages 7- Changed the payloads after V1.3.4 so now the user many know what will come in new T-MESSAGES 8 - Added upcoming alerts(T32,T33,T34) 9- Fixed some strings regarding the T-messages. 	18/08/2021	Henrique Marcondes
1.3.7	<ul style="list-style-type: none"> 1- Added Transmission mode into Commands section 2- Updated tables for new values 	30/08/2021	Henrique Marcondes
1.3.8	<ul style="list-style-type: none"> 1- Added Package Supervisor into Commands section 		

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1 INTRODUCTION

This document provides the communication protocol over the air, and the form of bilateral communication between the MT2000 device and the application server.

Will be analyzed in this document:

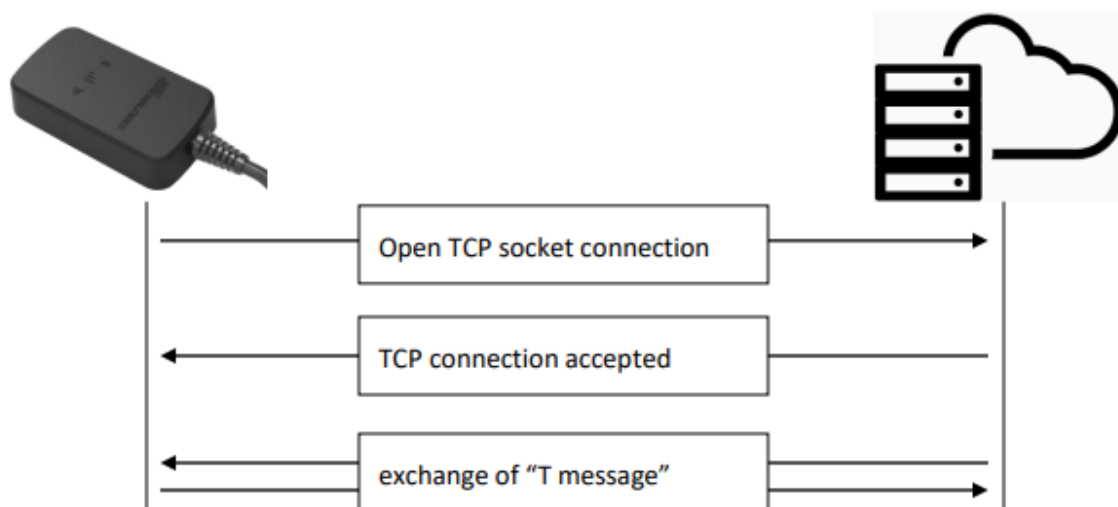
- The connection and login mechanism of the MT2000 with the application server.
- The communication messages and events of the MT2000 and their respective return message.
- The configuration messages of the MT2000, and their respective return messages (to request the current configuration or the configuration return).

2 SPECIFICATIONS

The MT2000 device uses a message-based protocol called "Protocol T message". The MT2000 device will always be a client on a Socket over TCP connection.

Below are the main characteristics of the connection between the MT2000 and the application server.

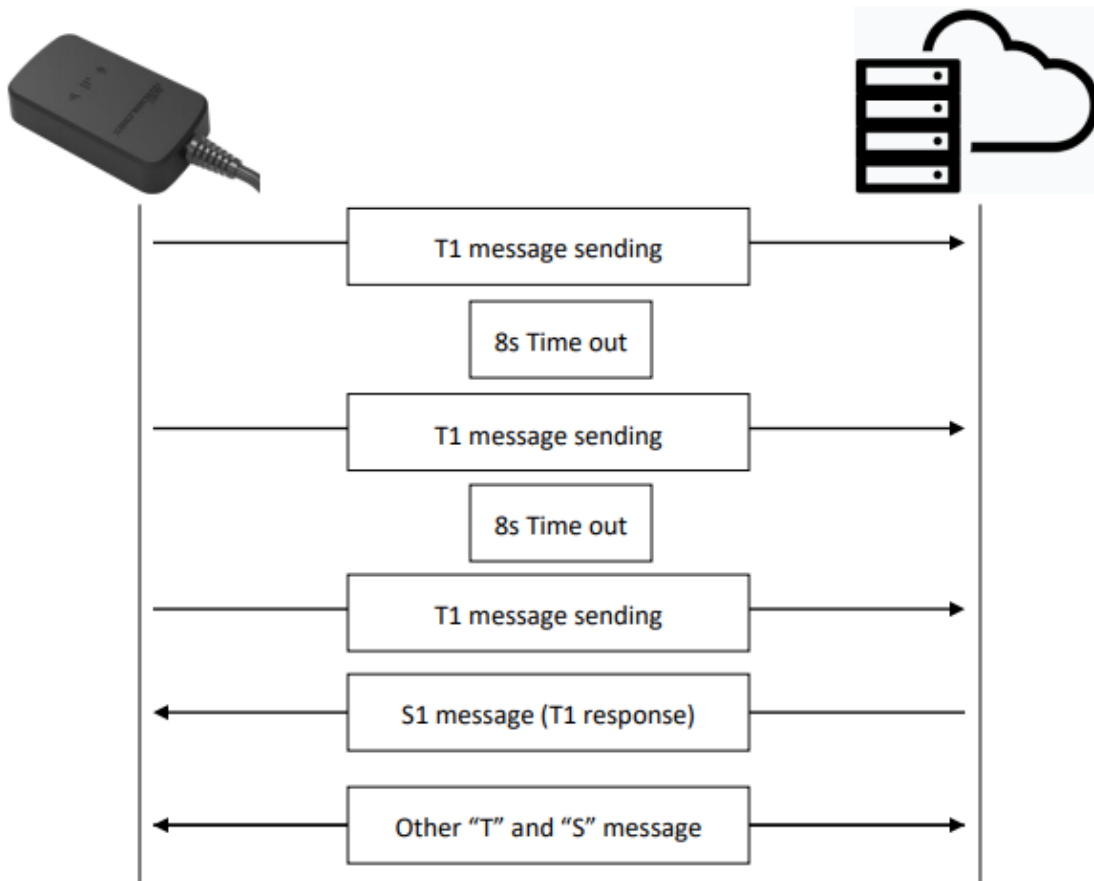
- Connection: TCP/IP (only).
- Message encoding: ASCII plain text;
- Type of communication: Bilateral on the same connection (always initiated by the MT2000, but can be closed by either side).
- Connection duration: Persistent, keeps the connection active as long as possible (auto-reconnection).



The initial settings of the MT2000 must be done by SMS, only two items are required: APN settings (APN, username and password), and the IP and Port settings for the server, the rest of the settings can all be done by T message.

3 LOGIN MECHANISM OF THE MT2000

After the connection is established, MT2000 will try to login by sending a message of type "T1" (login message), the device will be continuously trying to log in without sending any other message until the server accepts the login of MT2000.



3.1.1 COMMUNICATION MESSAGE FORMAT

All message data is carried as printable 8-bit ASCII characters. It always starts with a “[” called SOM (Start of message). Each “field” is separated by a comma and ends with a “]” called EOM (end of message).

Header			Payload			Tail
SOM	TM_STAMP	MESS_TYPE	field1	...	field N	EOM
[	Timestamp,	Message Type,	Field 1,	...	Field N]

Different message types contain a different number of fields. In some cases, it is permissible to omit the contents of a field, however the field separators should still be present.

Maximum message length is 1024 bytes.

Note: After sending a "T" message, the device always sends the sequence of: "/ r / n". MT2000 does not accept "/ r / n" back.

4 LOGIN MESSAGE

LOGIN message is sent at the beginning of the communication and is used to establish the connection between the device and the server.

Login Message	MT2000 TO SERVER (MESS_TYPE)	SERVER TO MT2000 (MESS_TYPE)
LOGIN	T1	S1

See below for details.

Report Message	Description (T1)
LOGIN	Sent by the terminal for authentication and login to the server. The Terminal will log in whenever it establishes a connection with the server. After a TCP connection, the MT2000 will only send other messages after the server accepts the login (response packet S1).
ACK Message	Description (S1)
The server needs to authorize the login of the MT2000 for it to start reporting positions.	

Below the structure of the message "T1".

Field	Data Field	Meaning (T)	Example	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2021-08-23:15:03:00,

MESS_TYPE	T1	Type of message "Terminal Location"		T1,
REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	Payload	1,
PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet		V1.3.5,
S/N	12 char.	Terminal serial number		201909000982,
MSISDN	NULL	It is a number that uniquely identifies a subscription in a Global Mobile Communications System. In Brazil it must come in the format "55+DDD+Subscriber Number (9 digits). It is very usual for operators not to provide this information in which case the field will become null.		,
ICCID	NULL	Single Identification Number for physical cards		89551301301001677313,
PASS	8 CHAR	Device access password. For future implementation.		12345678,
IMSI	15 CHAR	The international mobile subscriber identity (IMSI), is a number that uniquely identifies every user of a cellular network (associated with SIM-CARD).		724130100149950,
IMEI	15 CHAR	The International Mobile Equipment Identity (IMEI) is a unique number to identify devices and modems in the GSM network (Associated with the tracker).		359366080039813
EOM	]	End Of Message]
The server will receive a message like the following:				
[2021-08-23:15:03:00,T1,1,V1.3.5,201909000982,, 89551301301001677313,12345678,724130100149950,359366080039813]				

Then, structure of the "S1" protocol.

Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2021-04-07 15:54:15,
MESS_TYPE	S1	Type of message "Terminal Location"		S1,
STATUS	1 char.	0 = Login rejected 1 = Login success	Payload	1,
EOM	]	End Of Message]	
The server's response should look like this:				
[2021-04-07 15:54:15,S1,1]				

* This response must be sent to the device when it requests the connection. Otherwise, it will not send location messages and /or alerts messages.

Important: In case it is necessary for the server to reject the connection with the device, the server must send the message "S1" with the status "0" to the MT-2000.

When [2021-04-07 15: 54: 15, S1,0] is sent, MT-2000 does not connect to the server and does not continue making connection attempts indefinitely, so it goes into sleep mode. Once at rest, he only tries to connect again if an event occurs and he wants to inform the server.

5 HEARTBEAT MESSAGE

HEARTBEAT message (T14) after being configured is sent to the server at the moment the device, with ignition off, wakes up to reestablish the connection and send the message "T31" (Sleep). In the MT2000, the time configured for reporting with ignition off requires these two parameters. Heartbeat controls how long after the physical or virtual ignition has been turned off the device will wake up. And SLEEP controls how long after the ignition was turned off, the device will send a message to the server and after that it goes into economy mode. For example: If we want the device after the ignition turns off to transmit every 1 hour in economy mode, we must set the Heartbeat parameter to 59 minutes and the Sleep parameter to 60 seconds.

In this way the device, with the ignition off and without movement, would send a position message to the server every 60 minutes (1 hour).

Heartbeat Message	MT2000 TO SERVER (MESS_TYPE)	SERVER TO MT2000 (MESS_TYPE)
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HEARTBEAT	T14	S14

See below for details.

Heartbeat Message	Description (T14)
HEARTBEAT	Periodically sends (configurable by the user) a package when the ignition is off (similar to a keep alive). This package has no location information, as the satellites are generally not yet fixed, however before sleeping again the terminal will send the T31 package, with all the location information.
ACK Message	Description (S14)
The server needs to send ACK to the MT2000 (from message T14). It is advisable to send the ACK to ensure that no message is buffered unnecessarily, and in the case of the message sent is from the buffer, it is the condition to take that message out of the buffer and clear the memory space. The MT2000 also uses the ACK timestamp to adjust its internal clock when there is no GPS signal.	

Below the structure of the message "T14".

Field	Data Field	Meaning (T)	Example	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2021-08-20 19:27:14,
MESS_TYPE	T14	Type of message "Terminal Location"		T14,
REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	Payload	1,
PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet		V1.3.5,
S/N	12 char.	Terminal serial number		201909000982,
TERM_STATUS	2 char.	Terminal Status is an Ascii coded number (in HEX) representing a set of status bits as follows. Bit0: 1=Output Disabled, 0=Output Enabled;		53,

		Bit1: 0=DisConnected external battery, 1=Connected external battery; Bit2: (0) = Ignition off and (1) = Ignition on (for physical or virtual ignition). The ignition event on the MT-2000 must be collected in this bit. Bit3: 0=Stationary (parked), 1=Moving; Bit4: 0=Outside geofence, 1=Inside geofence; Bit5: 0 = ACC off, 1 = ACC on; In this bit we have the information of the physical input (by wire) of the ignition. When MT-2000 in virtual ignition, this bit can be used as a signal for a general input. Bit6: 0=Undue movement, 1=Allowed movement; Bit7: 0=Operation Mode, 1=Standby Mode.		
BAT_VOLT	String	External battery voltage. i.e. "12.30"		12.18,
EOM	]	End Of Message]
The server will receive a message like the following:				
[2021-08-20 19:27:14,T14,1,V1.3.5,201909000982,53,12.18]				

Then, structure of the "S14" protocol.

Field	Data Field	Meaning (S)	Example	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S14	Type of message "Terminal Location"		S14
EOM	]	End Of Message]	
The server's response should look like this:				
[2020-11-13 23:00:15,S14]				

6 REPORT MESSAGE

Report Message are the position messages, which are sent to the server during the device's work with the ignition on (in motion or stopped) and off and at the moment when the ignition is switched on and off.

Report Message	MT2000 TO SERVER (MESS_TYPE)	SERVER TO MT2000 (MESS_TYPE)
TERMINAL LOCATION	T3	S3
SLEEP	T31	S31
TRIP ON	T21	S21
TRIP OFF	T22	S22
TURN	T17	S17
IGN OFF	T23	S23
MILEAGE REPORT	T20	S20

See below for details.

Report Message	Description (Tx)
TERMINAL LOCATION	Periodically sends (configurable by the user) the location information when a trip is taking place. It is the most common location message.
SLEEP	Always before sleeping the device will send a message of type T31. This can occur: After a heartbeat message (T14), then an ignition off (T22), or any other message. The sleep message is similar to the T3 message.
TRIP ON	Every time the ignition is turned on (either physical or virtual), the terminal will send a message to the server (similar to message T3).
TRIP OFF	Every time the ignition is turned off (either physical or virtual), the terminal will send a message to the server (similar to message T3).
TURN	Each time the vehicle is traveling with ignition turned on (either physical or virtual) and the tracker is configured to report with a change of direction based on an angle greater than "X" (for example 30 degrees) it will send this position message that the user has the exact information of the moment of the conversion.
IGN OFF	When after the ignition status is turned off, the tracker is at rest and configured to send a timed message with ignition off, it will send this message to the application server informing the device's position over time.
MILEAGE REPORT	With the device configured for displacement virtual ignition (wireless ignition connected) being displaced, it will send this timed message to the application server, which will be able to display this message specifically to the user; This message is also sent when the physical ignition enabled tracker is con-

	figured to transmit messages to the server based on the distance traveled (for example, sending a position message every 1 km);
ACK Message	Description (Sx)
<p>The server needs to send ACK to the MT2000 (of every "Tx" message). It is advisable to send the ACK to ensure that no message is buffered unnecessarily, and in the case of the message sent is from the buffer, it is the condition to take that message out of the buffer and clear the memory space. The MT2000 also uses the ACK timestamp to adjust its internal clock when there is no GPS signal.</p>	

Below the structure of the message "Tx" (T3, T31, T21, T22, T17, T23 AND T20);

Field		Data Field	Meaning (T)	Example
payload order	SOM	[	Start Of Message	[
	TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	2021-04-13 06:36:59,
	MESS_TYPE	Tx	Type of message "Terminal Location"	T3,
01	REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	1,
02	PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet	V1.3.5,
03	S/N	12 char.	Terminal serial number	201950130047,
04	TERM_STATUS	2 char.	Terminal Status is an Ascii coded number (in HEX) representing a set of status bits as follows. Bit0: 1=Output Disabled, 0=Output Enabled; Bit1: 0=DisConnected external battery, 1=Connected external battery;	23,

			<p>Bit2: (0) = Ignition off and (1) = Ignition on (for physical or virtual ignition). The ignition event on the MT-2000 must be collected in this bit.</p> <p>Bit3: 0=Stationary (parked), 1=Moving;</p> <p>Bit3: 0=Stationary (parked), 1=Moving;</p> <p>Bit4: 0=Outside geofence, 1=Inside geofence;</p> <p>Bit5: 0 = ACC off, 1 = ACC on; In this bit we have the information of the physical input (by wire) of the ignition. When MT-2000 in virtual ignition, this bit can be used as a signal for a general input.</p> <p>Bit6: 0=Undue movement, 1=Allowed movement;</p> <p>Bit7: 0=Operation Mode, 1=Standby Mode.</p>	
05	BAT_VOLT	String	External battery voltage. i.e. "12.30"	12.18,
06	LOC_STATUS	3 char.	<p>Number_GPS_Sat + GSM_Signal_strength + GPS_fix.</p> <p>N0: GPS_fix</p> <p>0=No fix, lat and long fields are empty;</p> <p>1=Current GPS fix, lat and long fields are Current GPS fix;</p> <p>2=Last good fix, lat and long fields are last GPS fix.</p> <p>N1: GSM_Signal_strength = 0~9</p> <p>N2: Number_GPS_Sat = 0~9</p>	731,
07	LAT	String	Latitude (+/-xx.xxxxxx)	33.697881,
08	LONT	String	Longitude (+/- xx.xxxxxx)	-117.764332,
09	SPEED	String	Speed in km/h	0,

10	DIR	String	Course on the ground in degree	291,
11	INT_BATT_VOLT	String	Internal battery voltage. i.e. "3.7"	4.15,
12	ODOMETER_TRIP	String	Partial mileage accumulator (in meters)	9555,
13	ODOMETER_TOTAL	String	Total mileage accumulator (in meters)	200035,
14	HORIMETER	String	Total Horimeter (in minuts)	5648,
15	HDOP	String	Precision Of GPS	1.59,
16	MCC	String	Mobile Country Code	724,
17	MNC	String	Mobile Network Code	18,
18	LAC	String	Location Area Code	00919,
19	CELL_ID	String	Cell Identification	050462,
20	RX_LEVEL	String	Signal strength lbs (in dbm)	20,
21	SERIAL_COUNTER	String	Serial message counter	9999
	EOM	]	End Of Message]
The server will receive a message like the following:				
[2021-04-13 06:36:59,T3,1,V1.3.5,201950130047,23,12.18,731,33.697881,-117.764332,0,291,4.15,9555,200035,5648,1.59,724,18,00919,05462,20,9999]				

****The information in red (Reserved) shall be implemented in the future.**

Note:

- Payload Order = 1 to 10 Protocol FW Version V1.2.3;
- Payload Order = 1 to 12 Protocol FW Version V1.2.5;
- Payload Order = 1 to 21 FW Version V1.3.3 or higher.

Then, structure of the "Sx" protocol.

Field	Data Field	Meaning (S)	Example	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	Sx	Type of message "Terminal Location"		S3
EOM	]	End Of Message]	
The server's response should look like this:				
[2020-11-25 13:15:02,S3]				

6.1.1 Important: About Buffer

During the unloading of messages stored in memory, the tracker sends all localization packets in block and concatenated. All packages will have the complete information structure and header including "\r

(character 0x0d) and \n (character 0x0a)" between them, however they will be sent in the same transmission.

```
Example: When unloading the memory, the server will receive a message like the following:
\r\n[2021-07-14 19:49:00,T3,0,V1.3.5,202050783891,37,12.55,971, 33.697881,-
117.764332,0,306,4.16,0,,,0.72,724,13,00119,03642,21,500] \r\n[2021-07-14
19:50:00,T3,0,V1.3.5,202050783891,37,12.55,971,33.697881,-
117.764332,0,306,4.16,0,,,0.72,724,13,00119,03642,21,501] \r\n [2021-07-14
19:51:00,T3,0,V1.3.5,202050783891,37,12.55,971, 33.697881,-
117.764332,0,306,4.16,0,,,0.72,724,13,00119,03642,21,502] \r\n [2021-07-14
19:52:00,T3,0,V1.3.5,202050783891,37,12.55,971,33.697881,-
117.764332,0,306,4.16,0,,,0.72,724,13,00119,03642,21,503] \r\n [2021-07-14
19:53:00,T3,0,V1.3.5,202050783891,37,12.55,971,33.697881,-
117.764332,0,306,4.16,0,,,0.72,724,13,00119,03642,21,504]
```

7 ALERT MESSAGE

Alert Message are alert messages, which are sent to the server when alert events occur. These messages are sent when the device has been previously configured to send such notifications. The exception is the TOW ALERT which is sent to the server every 5 minutes in a fixed manner and is not configurable if the tracker is in motion and with the ignition off. This TOW ALERT behavior also applies if the tracker is configured to work with virtual ignition, because in the MT2000 the virtual ignition, once configured, works by raising the supply voltage in VCC.

Alert Message	MT2000 TO SERVER (MESS_TYPE)	SERVER TO MT2000 (MESS_TYPE)
SHAKE ALERT	T9	S9
LOW INTERNAL BATTERY VOLTAGE ALERT	T8	S8
MAIN BATTERY REMOVAL	T10	S10
LOW BATTERY VOLTAGE ALERT	T11	S11
OUTSIDE GEOFENCE ALERT	T12	S12
OVERSPEED ALERT	T13	S13
TOWING ALERT	T15	S15
GENERAL PURPOSE INPUT ACTIVATION*	T18	S18
GENERAL PURPOSE INPUT DISABLING*	T19	S19
MAIN BATTERY RECONNECTION	T24	S24

LOW BATTERY VOLTAGE LEVEL RESTORATION	T25	S25
JAMMER DETECTION*	T26	S26
TOPPLE DETECTION*	T27	S27
ROLLOVER DETECTION*	T28	S28
HIGH BATTERY VOLTAGE ALERT	T29	S29
HIGH BATTERY VOLTAGE LEVEL RESTORATION	T30	S30
LOW INTERNAL BATTERY VOLTAGE LEVEL RESTORATION	T32	S32
HIGH INTERNAL BATTERY VOLTAGE ALERT	T33	S33
HIGH INTERNAL BATTERY VOLTAGE LEVEL RESTAURATION	T34	S34

*The information in red will be implemented in the future in new releases with these features.

See below for details.

Alert Message	Description (T)
SHAKE ALERT	When the ignition is off (ACC off), and the MT2000 detects vibration, it must wake up, register with the server and send a shake alert message. This message will be sent every 5 min (as long as the tracker detects the shake).
LOW INTERNAL BATTERY VOLTAGE ALERT	Message sent when the MT2000 internal battery has low voltage
MAIN BATTERY REMOVAL	When external power is breached (power signals removed), the MT2000 will generate alert messages.
LOW BATTERY VOLTAGE ALERT	When the main (external) battery has a voltage below the threshold (configured by the user in the LBV register). After this message, the MT2000 disconnects from the main battery in order not to exhaust the vehicle's battery.
OUTSIDE GEOFENCE ALERT	When the MT2000 leaves the electronic fence area, the device sends an alert message.
OVERSPEED ALERT	When the MT2000 detects a speed above the threshold (defined by the user in the SPD register), the device sends an alert message.

TOWING ALERT	When the MT2000 moves 100 meters from the place of origin with the ignition off. It sends a T15 message every 5 min three times.
GENERAL PURPOSE INPUT ACTIVATION*	When the tracker is configured to operate in virtual ignition and ACC wire is used as a general-purpose input. When this general-purpose input is previously configured, the device will send this message to the server if it is triggered during its operation. This message then informs the server that it hears a trigger at the tracker's input.
GENERAL PURPOSE INPUT DISABLING*	When the tracker is configured to operate in virtual ignition and ACC wire is used as a general-purpose input. When this general-purpose input is previously configured, the device will send this message to the server if it is triggered during its operation. This message then informs the server when the trigger at the tracker input has been disabled after it has been activated.
MAIN BATTERY RECONNECTION	Whenever the tracker has its external power connection reconnected to the external power supply it will send this message informing the server that the external power source has been reconnected.
LOW BATTERY VOLTAGE LEVEL RESTORATION	When the internal battery is recharged to a previously configured charge level (for example 50%) the device will send a message to the server informing that the charge level in the internal battery has been restored.
JAMMER DETECTION*	When in ambient conditions of jammer detection, the device will store this message and send it to the server as soon as the connection is reestablished.
TOPPLE DETECTION*	When the tracker, through its accelerometer, identifies a transverse dimensional rotation of 90 degrees on its axis, it will send this message to the server informing the condition.
ROLLOVER DETECTION*	When the tracker, through its accelerometer, identifies a transverse dimensional rotation of 180 degrees on its axis, it will send this message to the server informing the condition.
HIGH BATTERY VOLTAGE ALERT	When the tension of the external battery goes above the "high" limit. It will send this message to the server informing the condition
HIGH BATTERY VOLTAGE LEVEL RESTORATION	After sending the High-Tension alert, when the battery goes back to configured voltage range, it sends this message to the server informing the condition is back to stable conditions.
LOW INTERNAL BATTERY VOLTAGE LEVEL RESTORATION	After sending the Low Internal Battery alert, when the battery goes back to configured voltage range, it sends this message to the server informing the condition is back to stable conditions
HIGH INTERNAL BATTERY VOLTAGE ALERT	When the tension of the internal battery goes above the high limit. It will send this message to the server informing the condition
HIGH INTERNAL BATTERY VOLTAGE LEVEL RESTAURATION	After sending the High Internal Battery alert, when the battery goes back to configured voltage range, it sends this message to the server informing the condition is back to stable conditions.
Message	Description (S)

The server needs to send ACK to the MT2000 (of every "Tx" message). It is advisable to send the ACK to ensure that no message is buffered unnecessarily, and in the case of the message sent is from the buffer, it is the condition to take that message out of the buffer and clear the memory space. The MT2000 also uses the ACK timestamp to adjust its internal clock when there is no GPS signal.

Below the structure of the message "Tx". **Note** that it has the same structure as REPORT MESSAGE.

Field		Data Field	Meaning (T)	Example	
payload order	SOM	[	Start Of Message	Header	[
	TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"		2020-11-13 23:00:15,
	MESS_TYPE	Tx	Type of message "Terminal Location"		T9,
01	REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	Payload	1,
02	PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet		V1.3.5,
03	S/N	12 char.	Terminal serial number		202000000001,
04	TERM_STATUS	2 char.	Terminal Status is an Ascii coded number (in HEX) representing a set of status bits as follows. Bit0: 1=Output Disabled, 0=Output Enabled; Bit1: 0=Disconnected external battery, 1=Connected external battery;		23,

			<p>Bit2: (0) = Ignition off and (1) = Ignition on (for physical or virtual ignition). The ignition event on the MT-2000 must be collected in this bit.</p> <p>Bit3: 0=Stationary (parked), 1=Moving;</p>	
			Bit3: 0=Stationary (parked), 1=Moving;	
			Bit4: 0=Outside geofence, 1=Inside geofence;	
			Bit5: 0 = ACC off, 1 = ACC on; In this bit we have the information of the physical input (by wire) of the ignition. When MT-2000 in virtual ignition, this bit can be used as a signal for a general input.	
			Bit6: 0=Undue movement, 1=Allowed movement;	
			Bit7: 0=Operation Mode, 1=Standby Mode.	
05	BAT_VOLT	String	External battery voltage. i.e. "12.30"	12.18,
06	LOC_STATUS	3 char.	<p>Number_GPS_Sat + GSM_Signal_strength + GPS_fix.</p> <p>N0: GPS_fix</p> <p>0=No fix, lat and long fields are empty;</p> <p>1=Current GPS fix, lat and long fields are Current GPS fix;</p> <p>2=Last good fix, lat and long fields are last GPS fix.</p> <p>N1: GSM_Signal_strength = 0~9</p> <p>N2: Number_GPS_Sat = 0~9</p>	731,
07	LAT	String	Latitude (+/-xx.xxxxxx)	33.697881,
08	LONT	String	Longitude (+/- xx.xxxxxx)	-117.764332,

09	SPEED	String	Speed in km/h	0,
10	DIR	String	Course on the ground in degree	201,
11	INT_BATT_VOLT	String	Internal battery voltage. i.e. "3.7"	3.70,
12	ODOMETER_TRIP	String	Partial mileage accumulator	10,
13	ODOMETER_TOTAL	String	Total mileage accumulator	200,
14	HORIMETER	String	Total Horimeter	60,
15	HDOP	String	Precision Of GPS	0.69,
16	MCC	String	Mobile Country Code	0724,
17	MNC	String	Mobile Network Code	018,
18	LAC	String	Location Area Code	00919,
19	CELL_ID	String	Cell Identification	050462,
20	RX_LEVEL	String	Signal strength lbs	20,
21	SERIAL_COUNTER	String	Serial message counter	4589
	EOM	]	End Of Message]
The server will receive a message like the following:				
[2021-08-20 19:22:09,T9,1,V1.3.5,201909000982,37,12.55,971,33.697687,-117.76444,30,306,4.16,2,5004,40000,0.72,724,13,00119,03642,21,4589]				

Note:

- Payload Order = 1 to 10 Protocol FW Version V1.2.3;
- Payload Order = 1 to 12 Protocol FW Version V1.2.5;
- Payload Order = 1 to 21 FW Version V1.3.3 or higher.

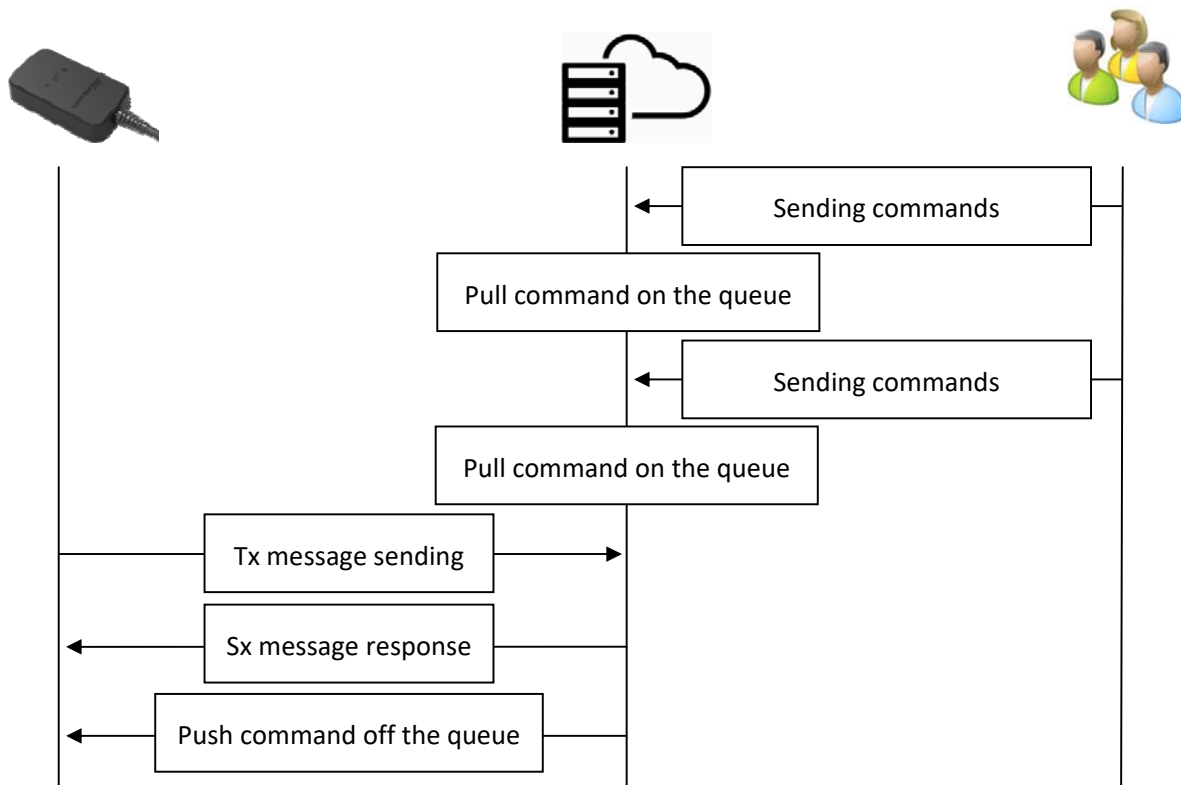
Then, structure of the "Sx" protocol.

Field	Data Field	Meaning (S)	Example	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	Sx	Type of message "Terminal Location"		S9
EOM	]	End Of Message]	
The server's response should look like this:				
[2020-11-25 13:15:02,S9]				

8 COMMANDS FOR THE MT2000 BY GPRS

The application server can send several commands to the MT2000 tracker. We suggest that you make a management of the commands and mechanism for sending because we must remember:

- One command must be sent at a time (the same MT2000 unit can only receive another command after the first one has been executed);
- MT2000 is always a client, that is, only MT2000 can open a connection to the server. If the user needs to send a command and the MT2000 is a sleep or disconnected, the server must queue that command and send it at the first opportunity to connect the MT2000.



8.1.1 S6 – WRITE CONFIG PARAMETER (SERVER TO MT2000)

The configuration commands always have the same structure, and the parameters are described in the following table.

Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S6	Type of message "Request Location"		S6,

PARAM	STRING	PARAMETER	Payload	FREQ=
PARAM_VALUE	1 char.	VALUES separated by colons.		60:0:60:0:0
EOM	String]
The server's response should look like this:				
[2020-11-13 23:00:15,T6, YCSJ,1,100]				

Field	Data Field	Meaning
SOM	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"
MESS_TYPE	S6	Type of message "Write config"
PARAM_VAL	String	"Parameter" = "Value"
EOM]	

Example of a S6 message.

Header			Payload	Tail
SOM	TM_STAMP	MESS_TYPE	PARAM_VAL	EOM
[	2020-11-13 23:00:15,	S6,	FREQ=60]

Parameter	Value	Meaning
APN	APN=apn_name:user:pass APN=apn_name	configure the GSM internet access point
URL	URL=dns_name:TCP_port URL=ip_address:TCP_port	Configure the application server address. TCP protocol only. DNS or IPV4 addresses can be used.
FREQ for V1.2.3 FREQ for V1.2.5 FREQ for V1.3.3	FREQ=Timed_Transmission_with_ignition_on(seconds) FREQ=Timed_Transmission_with_ignition_on(seconds) FREQ=Timed_Transmission_with_ignition_on:Angle_D	Communication time with ignition on. Range: 0-65,535 (in seconds). T = "0" does not send data in real time.

	egree	
HEARTBEAT	HEARTBEAT=t_minutes	Communication time with ignition off. Range: 1-60,000 (in minutes).
SLEEPT	SLEEPT=t_seconds	Time to go to sleep after the ignition is turned off. Range: 0-3,600 (in seconds)
SLEEP_MODE	SLEEP_MODE=0(deep sleep) SLEEP_MODE=1(regular sleep) SLEEP_MODE=2(always on)	Energy saving mode: Deep sleep: Does not receive SMS, does not receive GPRS. Regular sleep: Receive SMS, Do not receive GPRS. Always On: Receive SMS, Receive GPRS.
IGNITION_DETECTION	IGNITION_DETECTION=0(by wire) IGNITION_DETECTION=1(by voltage)	Ignition detection, physical or virtual. In the case of virtual ignition, it is necessary to configure the "ENGINEV" parameter.
ENGINEV	ENGINEV=12600(in milivolts)	Threshold voltage to determine ignition on or off. Must be used for virtual ignition (note IGNITION_DETECTION parameter)
STI	STI=0(disabled) STI=1(enabled)	Output 1 activation control. Usually used for blocking.
SPD	SPD=60(in Km/h)	Maximum speed limit (when exceeded generates T13 alert)
LBV	LBV=11500(in milivolts)	Minimum battery voltage (When exceeded, it generates a T11 alert)
GF1	GF1=lat:long:radius_in_meter	Violation of geofence (when violating the perimeter of the fence, it generates a T12 alert).
MOVECNT	MOVECNT=2(in seconds)	Bounce time to consider movement (must be calibrated together with MOVETH parameter)
MOVETH	MOVETH=20(in g-force)	G-force threshold to consider movement (generates T9 alert, when ignition is off)

SEND_PRIORITY	SEND_PRIORITY=0(high priority) SEND_PRIORITY=1(low priority)	Defines Buffer priority: High Priority: Send buffered messages whenever the device logs on to the server (after T1 message); Low Priority: Send a buffered message before going to sleep (after T31 message).
BLK_PARAM*	BLK_PARAM=apn_ou_url:1_ou_0:hashcode	Using this, you can block a parameter(APN) or (URL), it needs the device hashcode

*ONLY FOR FW VERSION 1.2.5 AND 1.3.3.

Commands that only exist in V1.3.4 or higher.

*Commands marked in red will be released in future releases

NTW	NTW=apn:apn_user:apn_pass:url1:port1:url2:port2	Set Network Information to make connection
FREQ	FREQ=Timed_Transmission_with_ignition_on(seconds):Timed_Transmission_with_ignition_off(minutes):Sleep_timer(seconds):heartbeat(minutes):Towing_timed_transmission(seconds)	Set Frequency of Events such as Timed Transmission, Transmission while ignition is Off, Sleep Timer, HeartBeat, Towing Alert Transmission
REPORT	REPORT=Angle_degree:Distance(meters):value_of_speed(km/h)	Set Report Events such as Angle:Mileage:Overspeed
MDM	MDM=URL:PORT	Set Url and Port for Mobile Device Management.
MOD	MOD=sleep_mode:Ignition_detection:send_Priority:Transmission_Mode:Package_supervisor	Set Sleep Mode, Ignition Detection, Send Priority, Transmission Mode and Package Supervisor.
BAT	BAT=LBV:HBV:LIBV:HIBV:BAT_BOUNCE	Set Battery reading configuration(Low Battery Voltage Warning, High Battery Voltage Warning, Low Internal Battery Voltage Warning, High Internal Battery Voltage Warning, Battery Bounce)
ACM	ACM=HOD_TOTAL:HOURLY_METER_VALUE	Set Initial value for Odometer and Set the Hour meter
ACL	ACL=MOVEMENT_THRESHOLD	Set Bounce threshold value

PWD	PWD=8_DIGITS_PASSWORD	Set a password for the device (8 numeric digits).
STI	STI=1_OR_0	Set Output 1 activation control, normally used for smart interruptions
RELAY	RELAY=1_OR_0	Set OUTPUT 1 activation control, normally used for blocking the vehicle immediately
BLK	BLK=apn_ou_url:1_ou_0:hashcode	Using this, you can block a parameter (APN) or (URL), it needs the device hash-code provided by the manufacturer.
ENGIN-NEV	ENGINEV=Electric_Tension_in_milivolts	Set Electric Tension (in milivolts).
GF1	GF1=lat:long:radius_in_meters	Set embedded geofence.

8.1.2 T6 – ACK WRITE CONFIG PARAMETER (MT2000 TO SERVER)

MT2000 sends an ACK to the server to know if the command was received and to process successfully or not. The server does not need to send a new ACK to the tracker.

Field	Data Field	Meaning (S)	Exemple	
SOM	[[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	T6	Type of message "Write config"		T6,
PARAM=VALUE	String	"Parameter"="VALUE"	Payload	FREQ=60:60:120:0:0
ACCEPT_BOOLEAN	STRING	1 TO TRUE, 0 TO FALSE		1
SERIAL_NUMBER	12 char.	Serial number from the device,		201909000982
SERIAL_COUNTER	STRING	Serial message counter		799
EOM]]	
The server's response should look like this:				

[2020-11-13 23:00:15,S6,FREQ,1]

- ACK = 1: Command received and accepted successfully;
- ACK = 0: Command received and was not accepted (failed).

Example of a T6 message.

Header			Payload	Tail
SOM	TM_STAMP	MESS_TYPE	PARAM_VAL	EOM
[	2020-11-13 23:00:15,	T6,	,FREQ,1, 201909000982,500]

8.1.3 S5 – READ CONFIG PARAMETER (SERVER TO MT2000)

The S5 command reads the parameters configured in the MT2000 (the configuration can be done by the S6 command).

Field	Data Field	Meaning (S)	Exemple	
SOM	[[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S5	Type of message "Write config"		S5,
PARAM	String	"Parameter"="VALUE"	Payload	FREQ
EOM]]

The server's response should look like this:

[2021-08-30 20:14:12,T5,FREQ=15:120:60:0:0,201909000982,12236]

Example of a S5 message.

Header			Payload	Tail
SOM	TM_STAMP	MESS_TYPE	PARAM	EOM
[	2020-11-13 23:00:15,	S5,	FREQ]

See below the table of parameters that can be read.

Parameter	Meaning
APN	GSM internet access point
URL	Application server address. TCP protocol only. DNS or IPV4 addresses can be used.
FREQ	Communication time with ignition on. Range: 0-65,535 (in seconds). T = "0" does not send data in real time.
HEARTBEAT	Communication time with ignition off. Range: 1-60,000 (in minutes).
SLEEPT	Time to go to sleep after the ignition is turned off. Range: 0-3,600 (in seconds)
SLEEP_MODE	Energy saving mode: Deep sleep: Does not receive SMS, does not receive GPRS. Regular sleep: Receive SMS, Do not receive GPRS. Always On: Receive SMS, Receive GPRS.
IGNITION_DETECTION	Ignition detection, physical or virtual. In the case of virtual ignition, it is necessary to configure the "ENGINEV" parameter.
ENGINEV	Threshold voltage to determine ignition on or off. Must be used for virtual ignition (note IGNITION_DETECTION parameter)
STI	Output 1 activation control. Usually used for blocking.
SPD	Maximum speed limit (when exceeded generates T13 alert)
LBV	Minimum battery voltage (When exceeded, it generates a T11 alert)
GF1	Violation of geofence (when violating the perimeter of the fence, it generates a T12 alert).
MOVECNT	Bounce time to consider movement (must be calibrated together with MOVETH parameter)
MOVETH	G-force threshold to consider movement (generates T9 alert, when ignition is off)
SEND_PRIORITY	Defines Buffer priority: High Priority: Send buffered messages whenever the device logs on to the server (after T1 message); Low Priority: Send a buffered message before going to sleep (after T31 message).

Commands that only exist in V1.3.4 or higher.

*Commands marked with * will be released in future releases

NTW	GET Network Information to make connection
FREQ	Get Frequency of Events such as Timed Transmission, Transmission while ignition is Off, Sleep Timer, HeartBeat, Towing Alert Transmission

REPORT	Get Report Events such as Angle:Mileage:Overspeed
MDM	Get Url and Port
MOD	Get Sleep Mode, Ignition Detection,Send Priority, Transmission_Mode*
BAT	Get Battery reading configuration(Low, Battery Voltage, High Battery Voltage, Low Battery Voltage warning, high battery voltage warning,Battery Bounce)
ACM	Get nitial value for Hodometer and Set the Hour meter
ACL	Get Bouch threshold value
PWD	Get a password for the device(8digits)
STI	Get Output 1 activation control, normally used for smart interruptions
RELAY	Get OUTPUT 1 activation control, normally used for blocking the vehicle im- mediately
BLK_PARAM	Using this, you can block a parameter(APN) or (URL), it needs the device hash- code
ENGINEV	Set Electric Tension(in milivolts)
GF1	Set Geofence
INFO	Brings information of the device
PROG	Brings information about the configuration used in reports and alerts messages

8.1.4 T5 – ACK READ CONFIG PARAMETER (MT2000 TO SERVER)

MT2000 sends the response to the server to know the configured parameter. The server does not need to send a new ACK to the tracker.

Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	T5	Type of message "Write config"		T5,
PARAM_VAL	"Parameter"="Value"	Parameter: The same parameter used in the message tables for S5 and S6; Value: The value is delivered in the same way as it was configured in S6 (same format, type of field and range).	Payload	FREQ=60:60:120:0:0
SERIAL_NUMBER	12 char	Serial number of the device		201909000982



SERIAL_COUNTER	String	Serial message counter		799
EOM	]	End Of Message]
The server's response should look like this:				
[2020-11-13 23:00:15,S5,FREQ]				

Example of a T5 message.

Header			Payload	Tail
SOM	TM_STAMP	MESS_TYPE	PARAM_VAL	EOM
[	2020-11-13 23:00:15,	T5,	FREQ=60:60:120:0:0,201909000982,799]

8.1.5 S4 – REQUEST TERMINAL LOCATION (SERVER TO MT2000)

This command request the location of the MT2000 immediately. It can be used to request a single location, or to request multiple locations with a time interval between them, different from the FREQ time.

Note 1: MT2000 needs to be awake and connected to the GPRS network.

Note 2: If the device is sleeping in sleep mode 1 or 2, (that is, connected to the GSM network, but not connected to the GPRS network) the MT2000 may be asked for a location by SMS.

Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S4	Type of message "Request Location"		S4,
PERIOD	String	Time (in seconds) of sending between each packet (number of packets defined by the COUNT field).	Payload	FREQ=60:60:120:0:0,
COUNT	String	Number of packages to be sent (every PERIOD time)		2589
EOM	]	End Of Message]	

The server's response should look like this:

```
[2021-08-12 18:26:00,T4,1,V1.3.5,201909000982,37,12.55,971,33.697881,-117.764332,30,306,4.16,765,5004,40000,0.72,724,13,00119,03642,21,2589]
```

S4 message.

Header			Payload		Tail
SOM	TM_STAMP	MESS_TYPE	PERIOD	COUNT	EOM
[	2020-11-13 23:00:15,	S4,	0,	1]
One time sending example					
[2020-11-13 23:00:15,S4,0,1]					

8.1.6 T4 – REQUEST TERMINAL LOCATION (MT2000 TO SERVER)

Periodically sends (configurable by the user) the location information when a trip is taking place. It is the most common location message.

Field		Data Field	Meaning (T)	Example	
payload order	SOM	[	Start Of Message	[
	TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
	MESS_TYPE	Tx	Type of message "Terminal Location"		T4,
01	REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	Payload	1,
02	PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet		V1.x.x,
03	S/N	12 char.	Terminal serial number		202000000001,
04	TERM_STATUS	2 char.	Terminal Status is an Ascii coded number (in HEX) representing a set of status bits as follows. Bit0: 1=Output Disabled, 0=Output Enabled; Bit1: 0=DisConnected external battery, 1=Connected external battery; Bit2: (0) = Ignition off and (1) = Ignition on (for physical or virtual ignition). The ignition event on the MT-2000 must be collected in this bit. Bit3: 0=Stationary (parked), 1=Moving;		23,

			<p>Bit4: 0=Outside geofence, 1=Inside geofence;</p> <p>Bit5: 0 = ACC off, 1 = ACC on; In this bit we have the information of the physical input (by wire) of the ignition. When MT-2000 in virtual ignition, this bit can be used as a signal for a general input.</p> <p>Bit6: 0=Undue movement, 1=Allowed movement;</p> <p>Bit7: 0=Operation Mode, 1=Standby Mode.</p>	
05	BAT_VOLT	String	External battery voltage. i.e. "12.30"	12.18,
06	LOC_STATUS	3 char.	<p>Number_GPS_Sat + GSM_Signal_strength + GPS_fix.</p> <p>N0: GPS_fix</p> <p>0=No fix, lat and long fields are empty;</p> <p>1=Current GPS fix, lat and long fields are Current GPS fix;</p> <p>2=Last good fix, lat and long fields are last GPS fix.</p> <p>N1: GSM_Signal_strength = 0~9</p> <p>N2: Number_GPS_Sat = 0~9</p>	731,
07	LAT	String	Latitude (+/-xx.xxxxx)	33.697881,
08	LONT	String	Longitude (+/- xx.xxxxx)	-117.764332,
09	SPEED	String	Speed in km/h	0,
10	DIR	String	Course on the ground in degree	201,
11	INT_BATT_VOLT	String	Internal battery voltage. i.e. "3.7"	3.70,
12	ODOMETER_TRIP	String	Partial mileage accumulator	10,
13	ODOMETER_TOTAL	String	Total mileage accumulator	200,
14	HORIMETER	String	Total Horimeter	60,
15	HDOP	String	Precision Of GPS	0.69,
16	MCC	String	Mobile Country Code	0724,

17	MNC	String	Mobile Network Code		018,
18	LAC	String	Location Area Code		00919,
19	CELL_ID	String	Cell Identification		050462,
20	RX_LEVEL	String	Signal strength lbs		20,
21	SERIAL_COUNTER	String	Serial message counter		9999
	EOM	]	End Of Message]
The server will receive a message like the following:					
[2021-08-12 18:26:00,T4,1,V1.3.5,201909000982,37,12.55,971,33.697881,-117.764332,30,306,4.16,765,5004,40000,0.72,724,13,00119,03642,21,489]					

Note:

- Payload Order = 1 to 10 Protocol FW Version V1.2.3;
- Payload Order = 1 to 12 Protocol FW Version V1.2.5;
- Payload Order = 1 to 21 FW Version V1.3.3 or higher.

8.1.7 S7 – REBOOT TERMINAL (SERVER TO MT2000)

This command forces the terminal to reboot.

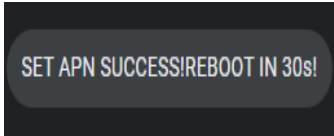
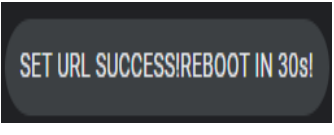
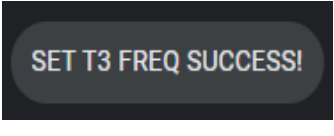
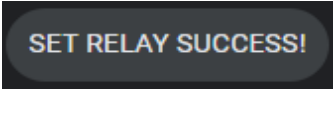
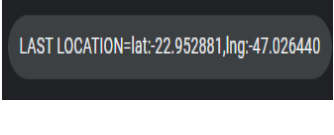
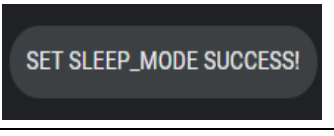
Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S7	Type of message "Request Location"		S7,
EOM	]	End Of Message]	
The server's response should look like this:				
[2020-11-13 23:00:15,T7,1,542]				

Header			Tail
SOM	TM_STAMP	MESS_TYPE	EOM
[	2020-11-13 23:00:15,	S7]
One time sending example			
[2020-11-13 23:00:15,S7]			

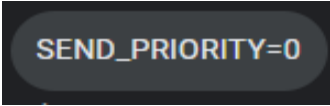
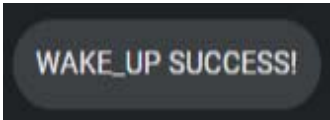
Note: This command has no ACK.

9 COMMANDS FOR THE MT2000 BY SMS (FOR V1.2.3 ONLY)

Some MT2000 commands can be sent via SMS. This alternative is very useful when a device is not connected to the GPRS service, or in the initial setup of the devices.

Parameter	Meaning	SMS command	SMS response
APN	GSM internet access point	SET APN=apn:user_apn:pass_apn	
URL	Application server address. TCP protocol only. DNS or IPV4 addresses can be used.	SET URL=dns_name_srv:tcp_port SET URL=ipv4_address:tcp_port	
FREQ	Communication time with ignition on. Range: 0-65,535 (in seconds). T = "0" does not send data in real time.	SET T3 FREQ=time_in_seconds	
STI	Output 1 activation control. Usually used for blocking.	SET RELAY=state	
REBOOT	Rebooting the device	REBOOT	
GET LOCATION	asks for immediate information from MT2000	GET LOCATION	
SET SLEEP MODE	Energy saving mode: 0: Deep sleep - Does not receive SMS, does not receive GPRS. 1: Regular sleep -	SET SLEEP_MODE=number_mode	

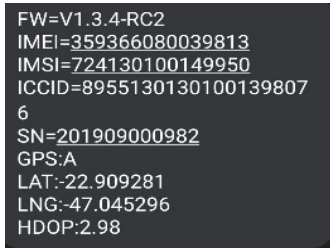
	Receive SMS, Do not receive GPRS. 2: Always On - Receive SMS, Receive GPRS.		
GET SLEEP MODE	Get mode of energy saving: 0: Deep sleep - Does not receive SMS, does not receive GPRS. 1: Regular sleep - Receive SMS, Do not receive GPRS. 2: Always On - Receive SMS, Receive GPRS.	GET SLEEP_MODE	SLEEP MODE=1
SET IGNITION_DETECTION	Ignition detection, "0" for physical or "1" for virtual. In the case of virtual ignition, it is necessary to configure the "SET ENGINEV" parameter.	SET IGNITION_DETECTION=mode	SET IGNITION_DETECTION SUCCESS!
GET IGNITION_DETECTION	Get mode of Ignition detection, "0" for physical or "1" for virtual. In the case of virtual ignition, it is necessary to configure the "SET ENGINEV" parameter.	GET IGNITION_DETECTION	IGNITION_DETECTION=0
SET ENGINEV	Threshold voltage to determine ignition on or off. Must be used for virtual ignition (note IGNITION_DETECTION parameter)	SET ENGINEV=value_in_milivolts	SET ENGINEV SUCCESS!
SET SEND_PRIORITY	Defines Buffer priority: 0: High Priority - Send buffered messages whenever the device logs on to the server (after T1 message);	SET SEND_PRIORITY=mode	SET SEND_PRIORITY FAIL!WRONG RANGE!

	1: Low Priority - Send a buffered message before going to sleep (after T31 message).		
GET SEND_PRIORITY	Get defines of Buffer priority: 0: High Priority - Send buffered messages whenever the device logs on to the server (after T1 message); 1: Low Priority - Send a buffered message before going to sleep (after T31 message).	GET SEND_PRIORITY	
WAKE UP	Wake up MT2000 and get a location.	WAKE_UP	

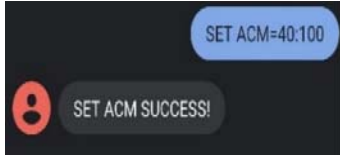
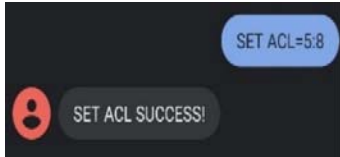
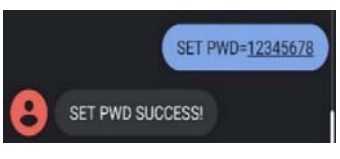
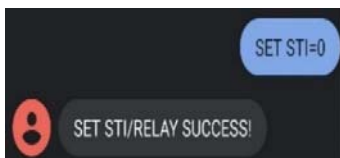
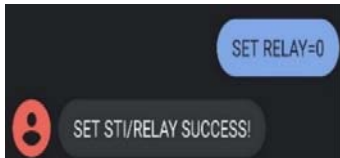

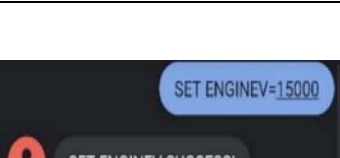
10 COMMANDS FOR THE MT2000 BY SMS AND UART(FOR V1.3.4 AND ABOVE)

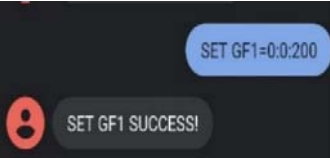
All commands below can be sent as a GET (except for INFO and PROG that only has the GET function on them)

When using as a GET, you should just use the name of the field.

Parameter	Meaning	Command	Response
GET INFO	Get information out MT2000 configuration.	GET INFO	

GET PROG	Get information out MT2000 configuration.	GET PROG	<pre>APN=datelo.nlt.br:nlt:nlt URL=187.11.203.81:9200 FREQ=60:0:120:58 IGNDET=0 SLEPM=2</pre>
SET NTW	Set Network Information to make connection	<pre>SET NTW=apn:apn_user:apn_pass: url1:port1:url2:port2</pre>	<pre>SET NTW=datelo.nlt.br:nlt:nlt: 187.11.203.81:9200 SET NTW: APN-OK URL-OK REBOOT IN 30s!</pre>
SET FREQ	Set Frequency of Events such as Timed Transmission(T3):Ignition Off Transmission(T23):SLEPT(T31): HEART-BEAT(T14):Towing Alert Transmission(T15)	<pre>SET FREQ=time_in_seconds(T3):ti me_in_second(T23):time_in_ mi- nutes(T31):time_in_seconds(T 14):time_in_seconds(T15)</pre>	<pre>SET FREQ=30:58:120 SET FREQ SUCCESS!</pre>
SET REPORT	Set Report Events such as Angle:Mileage:Overspeed	<pre>SET RE- PORT=ANGLE_DEGREE:Distanc e_in_meters:value_of_speed</pre>	<pre>SET REPORT=30:140 SET REPORT SUCCESS!</pre>
SET MDM	Set Url and Port	SET MDM=URL:PORT	<pre>SET MDM=187.11.203.81:9200 SET MDM SUCCESS!</pre>
SET MOD	Set Sleep Mode, Ignition Detection, Send Priority, Transmission Mode and Package Supervisor.	<pre>SET MOD=SLEEP_MODE:IGNITION _DETECTION:SEND_PRIORITY: TRANSMIS- SION_MODE:PACKAGE_SUPER VISOR</pre>	<pre>SET MOD=1:1:0 SET MOD SUCCESS!</pre>
SET BAT	Set Battery reading configuration (Low, Battery Voltage, High Battery Voltage, Low Battery Voltage warning, high battery voltage warning, Battery Bounce)	<pre>SET BAT=LBV:HBV:LBV_ACTIVATIO N:HBV_ACTIVATION:BAT_BOU NCE</pre>	<pre>SET BAT=12500 SET BAT SUCCESS!</pre>

SET ACM	Set Initial value for H odometer and Set the Hour meter	SET ACM=HOD_TOTAL:HO UR_METER_Value	
SET ACL	Set Bounce threshold value(MOVCNT) and G force quantity(MOVETH), these values are used for accelerometer usage	SET ACL=MOVCNT:MOVETH	
SET PWD	Set a password for the device(	SET PWD=8_DIGITS_PASSWORD	
SET STI	Set OUTPUT 1 activation control, normally used for smart interruptions	SET STI=1_OR_0	
SET RELAY	Set OUTPUT1 activation control, normally used for blocking the vehicle immediately	SET RELAY=1_OR_0	
SET BLK	Using this, you can block a parameter (APN) or (URL), it needs the device hashcode	SET BLK=apn_ou_url:1_ou_0_hash code	
SET ENGINEV	Set Electric Tension(in volts)	SET ENGI- NEV=Electric_Tension_in_volts	

SET GF1	Set Geofence	SET GF1=lat:long:radius_in_meters	
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All commands above can be used with a GET

I.E:

GET REPORT

REPORT=30:1000:255
OK

GET FREQ

FREQ=60:60:120:4:0
OK

SET NTW=datelo.nlt.br:nlt:nlt:187.11.203.81:9200:0:0

SET NTW: APN-OK URL-OK REBOOT IN 10s!
OK

SET MOD=0:0:0:1:0

SET MOD SUCCESS!
OK

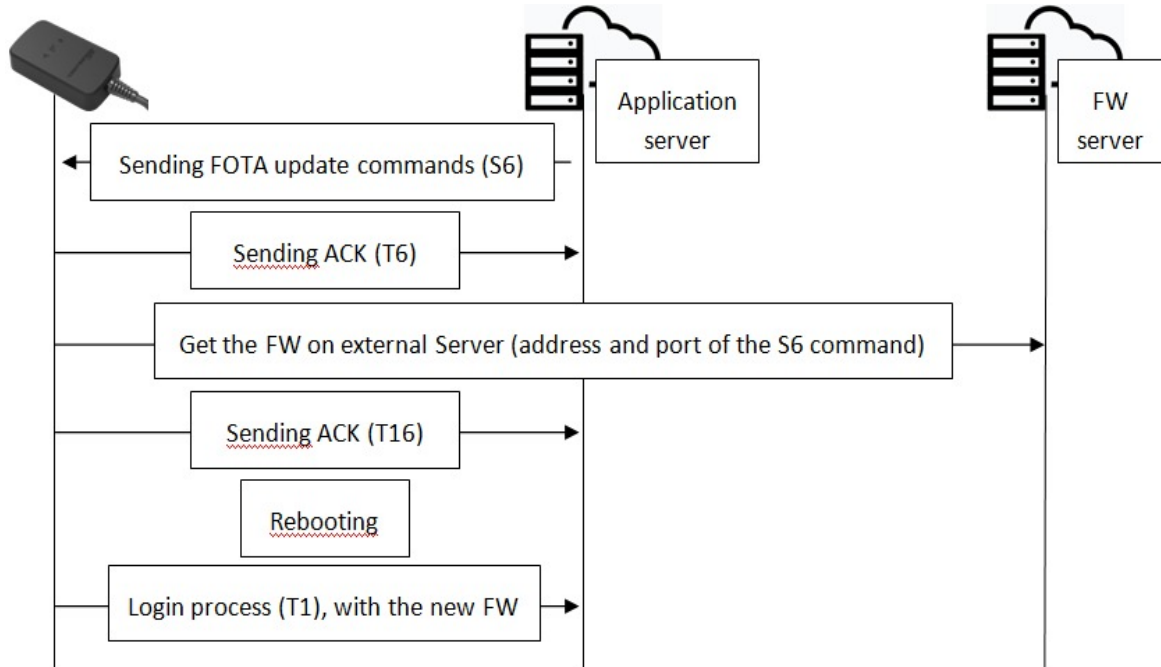
11 FIRMWARE OVER THE AIR UPDATE (FOTA)

The MT2000 terminal, is prepared to make updates "Over the air". The update is done through HTTP protocol, and can be done directly on Mobilogix servers using simple commands via GPRS.

That is, the device takes the firmware from another server, but remains connected to the main application server. This makes the over the air update process simpler to be integrated by the platform.

11.1.1 S6 – FOTA COMMAND (SERVER TO MT2000)

The configuration commands always have the same structure, and the parameters are described in the following table.



Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	S6	Type of message "Request Location"		S6,
PARAM	STRING	PARAMETER	Payload	YCSJ=
PARAM_VALUE	STRING	URL		http://fusioniot.uk:9080/app_V1_2_3.bin
EOM	STRING]	
The server's response should look like this:				
[2020-11-13 23:00:15,T6, YCSJ,1,100]				

Example of a S6 message.

Header			Payload	Tail
SOM	TM_STAMP	MESS_TYPE	PARAM_VAL	EOM
[	2020-11-13 23:00:15,	S6,	YCSJ=http://fusioniot.uk:9080/app_V1_2_3.bin]

11.1.1.2 T6 – FOTA COMMAND (MT2000 TO SERVER)

MT2000 ACK command for the application server. This ACK indicates the start of the FOTA process.

Field	Data Field	Meaning (S)	Exemple	
SOM	[	Start Of Message	[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	T6	Type of message "Request Location"		T6,
PARAM	STRING	PARAMETER	Payload	YCSJ
PARAM_VALUE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer		1
SERIAL_NUMBER	STRING	Device Serial Number		201909000982
SERIAL_COUNTER	STRING	SERIAL MESSAGE COUNTER		400
EOM	String]	
The server's response should look like this:				
[2020-11-13 23:01:11,T6,YCSJ,1,201909000982,12328]				

T6 message.

Header			Payload				Tail
SOM	TM_STAMP	MESS_TYPE	PARAM	VAL	S/N	SERIAL MESSAGE COUNTER	EOM
[	2020-11-13 23:00:15,	T6,	YCSJ,	1,	201909000982,	400]

11.1.1.3 T16 – FOTA PROCESS FINISHED (MT2000 TO SERVER)

MT2000 ACK command for the application server. This ACK indicates the end of the FOTA process.

Field	Data Field	Meaning (S)	Exemple	
SOM	[[
TM_STAMP	19 char.	GPS Time stamp "YYYY-MM-DD HH:MM:SS"	Header	2020-11-13 23:00:15,
MESS_TYPE	T16	Type of message "FOTA process finished"		T16
REPT_TYPE	1 char.	1 = Report is real time from MT2000 0 = Report from buffer	Payload	1
PRT_VER	6 char.	Protocol version, always starting with "V" followed by 3 period separated numbers "V1.x.x". Note: Do not use this field to reject packet		1.3.5
S/N	12 char.	Terminal serial number		201909000982
STATUS	String	ACK from FOTA process: 1: All is OK, and the FOTA process is successfully; 0: Something is wrong.		1
SERIAL_COUNTER	String	Serial message counter		426
EOM				1
The server's response should look like this:				
[2020-11-13 23:00:15,T6,YCSJ,1,443]				

T16 message.



Header			Payload					Tail
SOM	TM_STAMP	MESS_TYPE	REPT_TYPE	PRT_VER	S/N	STATUS	SERIAL MESSAGE COUNTER	EOM
[	2020-11-13 23:00:15,	T16,	1,	1.x.x,	201909000982,	1,	426]
Example T16								
[2021-08-23 23:00:15,T16,1,1.3.5,201909000982,1,426]								

12 APPENDIX RANGE OF VALUES:

Below is a description of the space allocation required for the data that will be added to the payload between fields 12 and 21, in REPORT MESSAGE, ALERT MESSAGE and T4 - ORDER TERMINAL.

	Field	Range	Bytes
12	ODOMETER_TRIP	0 a 4.294.967.295	4
13	ODOMETER_TOTAL	0 a 4.294.967.295	4
14	HORIMETER	0 a 4.294.967.295	4
15	HDOP	0 a 255	1
16	MCC	0 a 65535	2
17	MNC	0 a 65535	2
18	LAC	0 a 65535	2
19	CELL_ID	0 a 65535	2
20	RX_LEVEL	0 a 255	1
21	SERIAL_COUNTER	0 a 65535	2

13 APPENDIX GSM, RSSI, DBM LEVEL RATIO:

Reference table for querying the information "N1: GSM_Signal_strength = 0 ~ 9" located in the LOC_STATUS payload.

Flag MT2000	RSSI	dBm	Status
0	0	-113	Awful
0	1	-111	Awful
0	2	-109	Marginal
1	3	-107	Marginal
1	4	-105	Marginal
1	5	-103	Marginal
2	6	-101	Marginal
2	7	-99	Marginal
2	8	-97	Marginal
3	9	-95	Marginal
3	10	-93	OK
3	11	-91	OK
4	12	-89	OK
4	13	-87	OK
4	14	-85	OK
5	15	-83	Good
5	16	-81	Good
5	17	-79	Good
6	18	-77	Good
6	19	-75	Good
6	20	-73	Excellent
7	21	-71	Excellent
7	22	-69	Excellent
7	23	-67	Excellent
8	24	-65	Excellent
8	25	-63	Excellent
8	26	-61	Excellent
9	27	-59	Excellent
9	28	-57	Excellent
9	29	-55	Excellent
9	30	-53	Excellent

14 APPENDIX RELEASE NOTES

follow are the changes made in each release:

V1.0.0

New Feature:

1. Device does not restart;
2. Connects to GSM network without authentication;
3. It attaches to the GPRS network without authentication;
4. No need to configure service server address.lalala

Bug Fix

1. No bug fix log;

Note: This firmware version must be used only for ANATEL approval, it does not have commercial use functions and services.

V1.1.1

New Feature:

1. SMS APN configuration;
2. URL configuration via SMS;
3. T3 time setting by SMS;
4. Output relay configuration by SMS
5. SMS reboot command;
6. GET LOCATION command via SMS.

Bug Fix

1. No bug fix log;

Note: This firmware was little used in Brazil, applied to few local customers (BR).

V1.2.3

New Feature:

1. 300-position message buffer when communication loss occurs;
2. Modified heartbeat to transmission timer with ignition off;
3. Virtual voltage ignition detection;
4. creation of Unauthorized Movement Event;

Bug Fix

1. No bug fix log;

Note: Massively used firmware

V1.2.5

New Feature:

1. Added field of internal battery voltage in T message protocol;
2. Added field of TRIP odometer in T message protocol;
3. APN and URL blocking function.

Bug Fix

1. No bug fix log;

Note: No comments

V1.3.3

New Feature:

1. NF:Create of Transmission by angle event on T-message and added into FREQ configuration variable.

Note: A bug was found in the APN command in a specific condition of APN length and some characters, so this release was used in a single batch and can no longer be traded.

V1.3.6

New Feature:

1. Mileage Report
2. MDM configuration mode
3. Added A Package Supervisor
4. Transmission while ignition is off
5. Added settings regarding low battery voltage(LBV), Internal low battery voltage(ILBV):internal high battery voltage, Voltage Battery BOUNCE
6. Added Odometer and Horimeter into settings and on the T-message report
7. Transmission Mode(Absolute and Relative)
8. Secondary IP:PORT added to device
9. added "INVALID COMMAND" answers for non-know messages
10. Added command structure to GET/SET parameters;(And removed old configuration commands, see protocol docume
11. Added NST command
12. Added External, and Internal, Battery information on GET INFO command
13. Changed gps information from get INFO to get NST
14. GET PROG is now divided on 2 messages(SMS only)
15. Added Packet Counter at the end of the T-message report
16. Added [V] on INT/EXT-BAT SMS message;

Bug Fix

1. USR. PWD, APN variables fixed
2. PORT sending wrong characters
3. Remove GET ALL, change of GET INFO SMS command
4. saving SN also on flash
5. Removing buffer before FOTA update
6. Fix on FOTA when NV_RESET command was sent to Device
7. Saving tripDistance on FLASH
8. Added variables for Last valid lat and lng on NVM so it avoids sending position 0.0000 on report.
9. Fixed GET MOD
10. Fixed sleep function that was resetting when IGN-OFF and BAT-OFF
11. Changed field name from IGNM to IGTM
12. Fix URL not accepting when bigger than 32 digits
13. NV_RESET command does not cancel BLK setting when used
14. GET ENGINEV command fix
15. SET APN command fix