TRAXLOGIX DATA EXCHANGE
COMMUNICATION PROTOCOL

PROTOCOL SPECIFICATION
VERSION 2.9

Scope of this document:

The scope of this document is to specify the communication protocol to follow to exchange information and data between Traxlogix® tracking products and a dedicated computer server. Traxlogix® has developed a proprietary data exchange protocol named TDX® especially dedicated to M2M applications based on Traxlogix® tracking solutions. This protocol allows to quickly exchange information using either the SMS, GPRS and DATA transmission modes of the GSM network.

Audience:

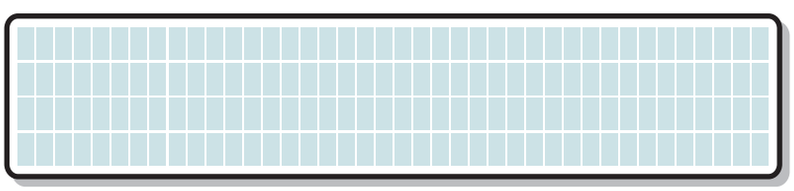
This document is intended to provide to professional software developers in charge of the development of dedicated computer server based platforms, a detailed explanation of the TDX® communication protocol concept. This document provide all necessary information to quickly develop and deploy professional applications and systems that will communicate with Traxlogix® tracking products.

Basics:

Exchange of information between Traxlogix® tracking products an a PC or Mac computer, referenced in this document as a "communication server", are essentially based on the SMS (short message service) GSM transmission mode. The TDX® protocol has been especially developed for this mode of transmission essentially due to the fact that SMS is widely available from nearly any GSM network providers around the world, this mode is quite simple to implement and offer the possibility to uses prepaid SIM cards solutions in Traxlogix® tracking products while GPRS (general packet radio service) transmission mode often requires postpaid SIM cards solutions. On top of that SMS data exchange are generally more power efficient vs GPRS transmissions thus increasing the battery life expectancy of the tracking products. However, some messages are only available in GPRS mode and this document explain how to exchange data using the GPRS mode, the DATA mode is not implemented.

SMS messages are limited in characters length to a maximum of 160 and unfortunately the 256 characters of the ascii table cannot be sent in an SMS, in fact if we try to send the ascii26 and ascii27 characters respectively corresponding to "ctrl-Z" and "esc", the AT+CMGS at-command of the GSM modem will simply be refused because "ctrl-Z" is exclusively used by the modem to send an SMS message to the GSM network and "esc" is exclusively used to cancel an SMS transmission. The eeprom registers of the tracking base often requires to be filled with any decimal byte value from 0 to 255, the solution in this case will be the hexadecimal format allowing to send and receive the 256 characters of the ascii table without troubles.

Practical examples of transmission and reception of information in this document are presented in a 4 lines of 40 characters LCD like window representing the virtual display of a mobile phone with a limited capacity of 160 characters.



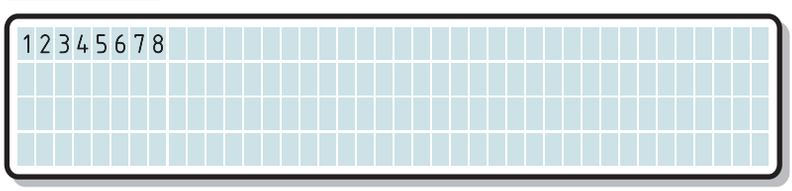
Representation of a virtual mobile phone display awaiting for an SMS text to be entered with a limited capacity of 160 characters.

The practical examples described in this document refers to: TX FORMAT and RX FORMAT, TX format define messages that are sent by the communication server to the tracking base, RX format define messages that are sent by the tracking base to the communication server.

Identifier:

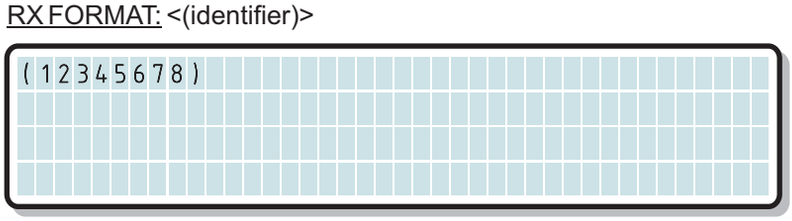
One communication server can communicate with several thousands of Traxlogix® tracking devices, to identify to which tracking device the communication server is dealing with, an identifier (password) is required. The identifier is a unique 8 digits fixed length device identification number, this number is permanently programmed into the microprocessor memory of each Traxlogix® devices at the manufacturing stage. This number is the only valid way of identifying a tracking device, an identification based on the phone number of the device must be avoided because if a device is faulty and returned to repair, the SIM card may be changed thus a new phone number will be assigned to the device. For all messages sent from the communication server to a tracking device, the identifier will fill the 8 first characters spaces in the message string. For all messages sent from a tracking device to the communication server, this identifier will fill the first 10 characters spaces in the message because it will always be placed between a left and a right bracket (ascii40) and (ascii41). Please note that the identifier is always in ascii format.
Remark: If the identifier contained in the TX format message don't match with the one stored in the eeprom of the tracking base, the message is deleted and no confirmation message will be returned to the communication server.

TX FORMAT: <identifier>



In this example, the identifier is 12345678.

RX FORMAT: <(identifier)>

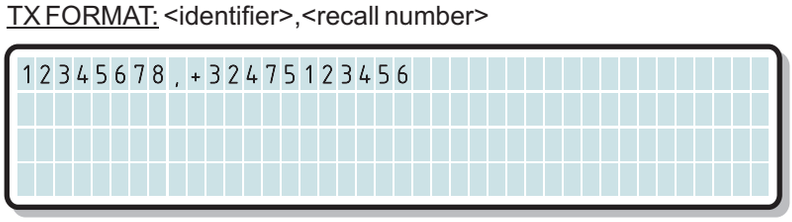


When messages are sent by the tracking unit to the communication server, the RFID tag ID number is always placed between brackets.

Recall number:

When the communication server send a message to a tracking base, an ISDN recall number must be inserted into the message so that the tracking device know where the confirmation message must be sent. An ISDN number is a phone or mobile phone number containing a country code, area code and subscriber identification number, mobile phones accept ISDN numbers at the condition that the + sign (ascii43) is preceding the numerical numbers. For example, Belgium country code is 32, if area code is 475 and subscriber identification number is 123456 the ISDN recall number will be: +32475123456.
please note that in all TX FORMAT messages, the ISDN recall number must follow the identifier, but a comma must always be inserted between them. Please note that the recall number is always in ascii format.

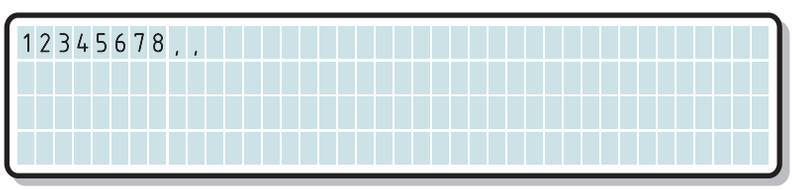
TX FORMAT: <identifier>,<recall number>



In this example, the identifier is 12345678 and the recall number is +32475123456, please note that the identifier and the recall number must always be separated by a comma (ascii44).

Everytime a TX format message from the communication server is received by the tracking base, the recall number is extracted from the incoming message and stored in the eeprom of the product, if the tracking base must send an unsolicited message to the communication server, the recall number currently stored into the eeprom will be used. A special function has been implemented into the tracking base allowing to send RX format messages using the recall number currently stored into the eeprom, in this case the recall number inserted in the TX format messages can be replaced by a comma. The use of this function is highly recommended as it will reduce the numbers of eeprom write cycles.
NOTE: The recall number in TX messages is a variable length string, but must never exceed 16 characters (+ sign included). If a recall number is directly stored in the eeprom configuration registers using the “WRITE CONFIGURATION REGISTERS AND RESET” command (op-code 42h) remaining empty ISDN call number digit registers must imperatively be filled with the X ascii character (58h).

TX FORMAT: <identifier>,<recall number>



In this example, the identifier is 12345678 and the recall number will be the one previously stored in the eeprom of the tracking base , please note that the identifier and the recall number or the replacement comma must always be separated by a comma (ascii44).

Op-code:

When the communication server send a TX format message to a tracking base, the microprocessor of the device will first check if the identifier is the same that the one stored into the on-board eeprom, then the recall number if present will be stored into the eeprom otherwise the currently stored number will be used for the reply. After this procedure the microprocessor will decode the op-code which represent the type of command that must be processed. As the op-code is a one byte code, up to 256 differents commands can be implemented, as a guideline, op-codes from 0 to 126 are reserved for TX format messages and op-codes from 127 to 255 are reserved for RX format messages. Please note that response messages to an incoming TX format message will always return the same op-code. Op-codes must always be sent from the communication server and are always returned by tracking bases in hexadecimal format. **All references to the hex format in this document must comply with the following rules:**

1) When more than one bytes are consecutively transmitted or received they must always be treated or decoded to decimal or binary on a byte per byte basis, for example: 2F2A2C equal 3090988 in decimal but such values are not supported, the TDX® protocol and tracking devices will always consider 2F2A2C as three independent bytes with respective decimal values of 47, 42 and 44.

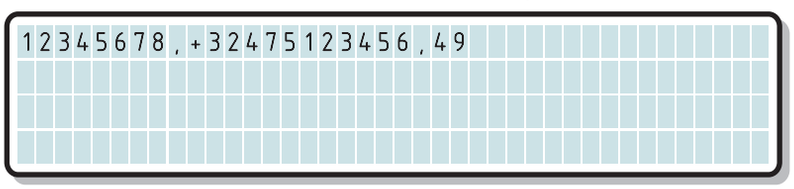
2) The TDX® protocol and tracking devices support only hexadecimal values in a two upper case characters fixed length string format. For decimal values from 0 to 15, for example 11 in decimal correspond to b in hexadecimal, thus it must first be formatted into a two upper case characters fixed length string format, in this case 0B.

To resume: All hexadecimal bytes values contained in all RX and TX format messages are or must be two characters in length and in upper case only and of a decimal value between 0 and 255.

Please note that TX and RX format messages bytes description will be in *italic* if in hexadecimal format, example: <*op-code*>, for references to hex values in this document, a byte value followed by a "h" in lower case denotes hex values, example: 0Fh.

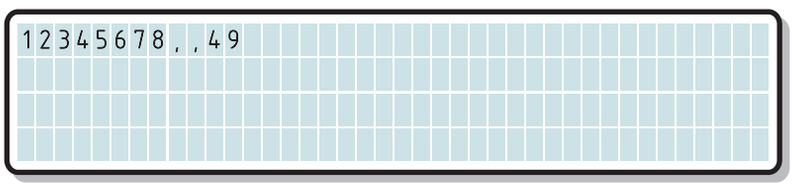
NOTE: A comma between the call number and the op-code must always be inserted in the TX format messages, except if the function "Use eeprom stored recall number" is used, then the op-code will immediately follow the recall number replacement comma.

TX FORMAT: <identifier>,<recall number>,<*op-code*>



In this example, the identifier is 12345678 and the recall number is +32475123456, please note that the identifier, the recall number and the op-code must always be separated by a comma (ascii44). op-code is 49h (Turn GPS power supply on).

TX FORMAT: <identifier>,<recall number>,<*op-code*>

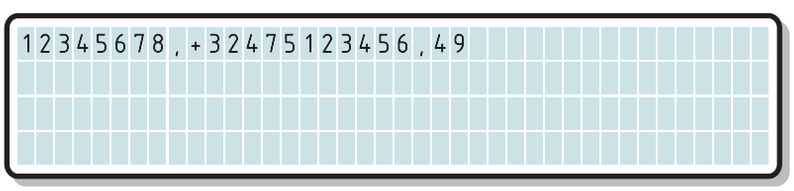


In this example, the identifier is 12345678 and the recall number will be the one previously stored in the eeprom of the tracking base , please note that the identifier and the recall number or the replacement comma must always be separated by a comma (ascii44). op-code is 49h (Turn GPS power supply on).

Data:

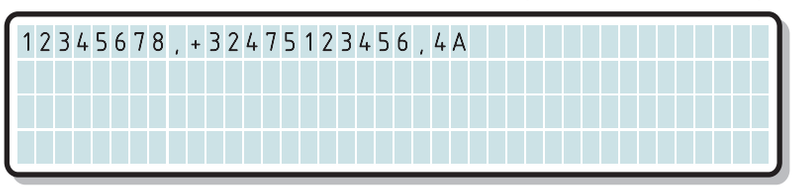
Commands often requires extra data to be transferred to the tracking base, returned RX format and unsolicited messages always contain data. As previously explained in the hexadecimal format description, data are always received and must always be sent as independent bytes, when in hex format a byte will always be a two characters fixed length string in upper case only. When in ascii format, one byte will be of course be represented by one character only. data in RX and TX format messages are always preceded by a comma even if TX format messages don't require any data.

TX FORMAT: <identifier>,<recall number>,<*op-code*> no data required for this command



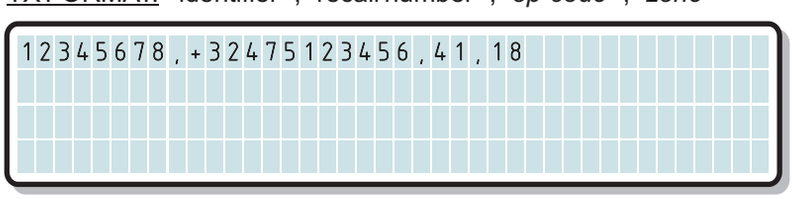
In this example, the identifier is 12345678 and the recall number is +32475123456, op-code is 49h (Turn GPS power supply on), this command don't require any data.

TX FORMAT: <identifier>,<recall number>,<*op-code*>, no data required for this command



In this example, the identifier is 12345678 and the recall number is +32475123456, op-code is 4Ah (Turn GPS power supply off), this command don't require any data.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*zone*>

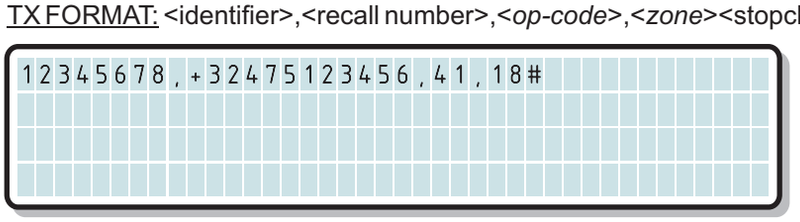


This example demonstrates how to read the 64 registers of the zone 24 data bank, in this example data are required.
op-code and zone data are in *italic* thus in hex format.

Stop character:

All TX format messages must be terminated by a stop character # (ascii35), this character must be inserted in ascii format only.
All RX format messages sent by the tracking base to the communication server are always terminated by a stop character.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*zone*><stopchar>



This example demonstrates how to read the 64 registers of the zone 24 data bank, in this example data are required.
op-code and zone data are in *italic* thus in hex format.

Other general rules:

When registers are referenced as "reserved" of "reserved for future use", when writing into such registers always put a register value of 0 (00h).
This document often refers to bits status, the "false" expression stands for a bit with a value of 0, a cleared bit, the word "true" stands for a bit with a value of 1, a set bit.

LIST OF COMMANDS

LIST OF TX FORMAT COMMAND MESSAGES

op-code (HEX)	Command description	Page
00	Command reserved for Traxlogix internal use and manufacturing process	n/a
01	Write up to 64 registers in the zone 1 data bank	21
02	Write up to 64 registers in the zone 2 data bank	21
03	Write up to 64 registers in the zone 3 data bank	21
04	Write up to 64 registers in the zone 4 data bank	21
05	Write up to 64 registers in the zone 5 data bank	21
06	Write up to 64 registers in the zone 6 data bank	21
07	Write up to 64 registers in the zone 7 data bank	21
08	Write up to 64 registers in the zone 8 data bank	21
09	Write up to 64 registers in the zone 9 data bank	21
0A	Write up to 64 registers in the zone 10 data bank	21
0B	Write up to 64 registers in the zone 11 data bank	21
0C	Write up to 64 registers in the zone 12 data bank	21
0D	Write up to 64 registers in the zone 13 data bank	21
0E	Write up to 64 registers in the zone 14 data bank	21
0F	Write up to 64 registers in the zone 15 data bank	21
10	Write up to 64 registers in the zone 16 data bank	21
11	Write up to 64 registers in the zone 17 data bank	21
12	Write up to 64 registers in the zone 18 data bank	21
13	Write up to 64 registers in the zone 19 data bank	21
14	Write up to 64 registers in the zone 20 data bank	21
15	Write up to 64 registers in the zone 21 data bank	21
16	Write up to 64 registers in the zone 22 data bank	21
17	Write up to 64 registers in the zone 23 data bank	21
18	Write up to 64 registers in the zone 24 data bank	21
19	Write up to 64 registers in the zone 25 data bank	21
1A	Write up to 64 registers in the zone 26 data bank	21
1B	Write up to 64 registers in the zone 27 data bank	21
1C	Write up to 64 registers in the zone 28 data bank	21
1D	Write up to 64 registers in the zone 29 data bank	21
1E	Write up to 64 registers in the zone 30 data bank	21
1F	Write up to 64 registers in the zone 31 data bank	21
20	Write up to 64 registers in the zone 32 data bank	21

op-code (HEX)	Command description	Page
6B	Reserved for future use	
6C	Reserved for future use	
6D	Reserved for future use	
6E	Reserved for future use	
6F	Reserved for future use	
70	Reserved for future use	
71	Reserved for future use	
72	Reserved for future use	
73	Reserved for future use	
74	Reserved for future use	
75	Reserved for future use	
76	Reserved for future use	
77	Reserved for future use	
78	Reserved for future use	
7A	Reserved for future use	
7B	Reserved for future use	
7C	Reserved for future use	
7D	Reserved for future use	
7E	Reserved for future use	
7F	Reserved for future use	

LIST OF MESSAGES

LIST OF RX FORMAT SOLICITED AND UNSOLICITED MESSAGES

op-code (HEX)	Command description	Page
00	Command reserved for Traxlogix internal use and manufacturing process	n/a
01	Confirmation of a write up to 64 registers in the zone 1 data bank	21
02	Confirmation of a write up to 64 registers in the zone 2 data bank	21
03	Confirmation of a write up to 64 registers in the zone 3 data bank	21
04	Confirmation of a write up to 64 registers in the zone 4 data bank	21
05	Confirmation of a write up to 64 registers in the zone 5 data bank	21
06	Confirmation of a write up to 64 registers in the zone 6 data bank	21
07	Confirmation of a write up to 64 registers in the zone 7 data bank	21
08	Confirmation of a write up to 64 registers in the zone 8 data bank	21
09	Confirmation of a write up to 64 registers in the zone 9 data bank	21
0A	Confirmation of a write up to 64 registers in the zone 10 data bank	21
0B	Confirmation of a write up to 64 registers in the zone 11 data bank	21
0C	Confirmation of a write up to 64 registers in the zone 12 data bank	21
0D	Confirmation of a write up to 64 registers in the zone 13 data bank	21
0E	Confirmation of a write up to 64 registers in the zone 14 data bank	21
0F	Confirmation of a write up to 64 registers in the zone 15 data bank	21
10	Confirmation of a write up to 64 registers in the zone 16 data bank	21
11	Confirmation of a write up to 64 registers in the zone 17 data bank	21
12	Confirmation of a write up to 64 registers in the zone 18 data bank	21
13	Confirmation of a write up to 64 registers in the zone 19 data bank	21
14	Confirmation of a write up to 64 registers in the zone 20 data bank	21
15	Confirmation of a write up to 64 registers in the zone 21 data bank	21
16	Confirmation of a write up to 64 registers in the zone 22 data bank	21
17	Confirmation of a write up to 64 registers in the zone 23 data bank	21
18	Confirmation of a write up to 64 registers in the zone 24 data bank	21
19	Confirmation of a write up to 64 registers in the zone 25 data bank	21
1A	Confirmation of a write up to 64 registers in the zone 26 data bank	21
1B	Confirmation of a write up to 64 registers in the zone 27 data bank	21
1C	Confirmation of a write up to 64 registers in the zone 28 data bank	21
1D	Confirmation of a write up to 64 registers in the zone 29 data bank	21
1E	Confirmation of a write up to 64 registers in the zone 30 data bank	21
1F	Confirmation of a write up to 64 registers in the zone 31 data bank	21
20	Confirmation of a write up to 64 registers in the zone 32 data bank	21

op-code (HEX)	Command description	Page
6B	Reserved for future use	
6C	Reserved for future use	
6D	Reserved for future use	
6E	Reserved for future use	
6F	Reserved for future use	
70	Reserved for future use	
71	Reserved for future use	
72	Reserved for future use	
73	Reserved for future use	
74	Reserved for future use	
75	Reserved for future use	
76	Reserved for future use	
77	Reserved for future use	
78	Reserved for future use	
7A	Reserved for future use	
7B	Reserved for future use	
7C	Reserved for future use	
7D	Reserved for future use	
7E	Reserved for future use	
7F	Reserved for future use	
80	Battery ID notification on product start	67
81	New battery ID notification on product start	67
82	Online notification on product start	68
83	Current temperature notification and alarm status	68
84	Tracking sequence GPS position notification	69
85	RTC error notification	69
86	Cell-ID geofencing result notification	70
87	GPS geofencing result notification	70
88	Offline notification	72
89	Reserved for future use	
8A	Reserved for future use	
8B	Reserved for future use	
8C	Reserved for future use	
8D	Reserved for future use	
8E	Reserved for future use	
8F	Reserved for future use	
90	Reserved for future use	

op-code (HEX)	Command description	Page
91	Reserved for future use	
92	Reserved for future use	
93	Reserved for future use	
94	Reserved for future use	
95	Reserved for future use	
96	Reserved for future use	
97	Reserved for future use	
98	Reserved for future use	
99	Reserved for future use	
9A	Reserved for future use	
9B	Reserved for future use	
9C	Reserved for future use	
9D	Reserved for future use	
9E	Reserved for future use	
9F	Reserved for future use	
A0	Reserved for future use	
A1	Reserved for future use	
A2	Reserved for future use	
A3	Reserved for future use	
A4	Reserved for future use	
A5	Reserved for future use	
A6	Reserved for future use	
A7	Reserved for future use	
A8	Reserved for future use	
A9	Reserved for future use	
AA	Reserved for future use	
AB	Reserved for future use	
AC	Reserved for future use	
AD	Reserved for future use	
AE	Reserved for future use	
AF	Reserved for future use	
B0	Reserved for future use	
B1	Reserved for future use	
B2	Reserved for future use	
B3	Reserved for future use	
B4	Reserved for future use	
B5	Reserved for future use	

op-code (HEX)	Command description	Page
B6	Reserved for future use	
B7	Reserved for future use	
B8	Reserved for future use	
B9	Reserved for future use	
BA	Reserved for future use	
BB	Reserved for future use	
BC	Reserved for future use	
BD	Reserved for future use	
BE	Reserved for future use	
BF	Reserved for future use	
C0	Reserved for future use	
C1	Reserved for future use	
C2	Reserved for future use	
C3	Reserved for future use	
C4	Reserved for future use	
C5	Reserved for future use	
C6	Reserved for future use	
C7	Reserved for future use	
C8	Reserved for future use	
C9	Reserved for future use	
CA	Reserved for future use	
CB	Reserved for future use	
CC	Reserved for future use	
CD	Reserved for future use	
CE	Reserved for future use	
CF	Reserved for future use	
D0	Reserved for future use	
D1	Reserved for future use	
D2	Reserved for future use	
D3	Reserved for future use	
D4	Reserved for future use	
D5	Reserved for future use	
D6	Reserved for future use	
D7	Reserved for future use	
D8	Reserved for future use	
D9	Reserved for future use	
DA	Reserved for future use	

op-code (HEX)	Command description	Page
DB	Reserved for future use	
DC	Reserved for future use	
DE	Reserved for future use	
DF	Reserved for future use	
E0	Reserved for future use	
E1	Reserved for future use	
E2	Reserved for future use	
E3	Reserved for future use	
E4	Reserved for future use	
E5	Reserved for future use	
E6	Reserved for future use	
E7	Reserved for future use	
E8	Reserved for future use	
E9	Reserved for future use	
EA	Reserved for future use	
EB	Reserved for future use	
EC	Reserved for future use	
ED	Reserved for future use	
EF	Reserved for future use	
F0	Reserved for future use	
F1	Reserved for future use	
F2	Reserved for future use	
F3	Reserved for future use	
F4	Reserved for future use	
F5	Reserved for future use	
F6	Reserved for future use	
F7	Reserved for future use	
F8	Reserved for future use	
F9	Reserved for future use	
FA	Reserved for future use	
FB	Reserved for future use	
FC	Reserved for future use	
FD	Reserved for future use	
FE	Reserved for future use	
FF	Reserved for future use	

COMMANDS DEFINITION

WRITE UP TO 64 REGISTERS INTO THE ZONE 1 DATA BANK — 01h

DESCRIPTION: This TDX® command allow to write up to 64 data registers into one zone data bank located in the on-board eeprom of the tracking base, this TDX® command enable, disable and configures the Cell-ID and GPS geofencing parameters. IMPORTANT! All 64 data banks from zone 1 up to zone 64 are identical, please follow the same instructions than the ones described hereafter for zone 1, simply adapt the op-code from 01h for zone 1 up to 40h for zone 64.

EEPROM GEOFENCING DATA BANK CONTENT FOR A ZONE

ADDRESS	REGISTER DESIGNATION
B7	CELL-ID GEOFENCING CONFIGURATION REGISTER
B8	CELL IDENTIFICATION CHARACTER 1
B9	CELL IDENTIFICATION CHARACTER 2
BA	CELL IDENTIFICATION CHARACTER 3
BB	CELL IDENTIFICATION CHARACTER 4
BC	GPS GEOFENCING CONFIGURATION REGISTER
BD	MAXIMUM KNOTS SPEED DIGIT 1 (x100)
BE	MAXIMUM KNOTS SPEED DIGIT 2 (x10)
BF	MAXIMUM KNOTS SPEED DIGIT 3 (x1)
C0	GPS GEOFENCING TIME WINDOW START UTC TIME DIGIT HOUR (x10)
C1	GPS GEOFENCING TIME WINDOW START UTC TIME DIGIT HOUR (x1)
C2	GPS GEOFENCING TIME WINDOW START UTC TIME DIGIT MINUTE (x10)
C3	GPS GEOFENCING TIME WINDOW START UTC TIME DIGIT MINUTE (x1)
C4	GPS GEOFENCING TIME WINDOW STOP UTC TIME DIGIT HOUR (x10)
C5	GPS GEOFENCING TIME WINDOW STOP UTC TIME DIGIT HOUR (x1)
C6	GPS GEOFENCING TIME WINDOW STOP UTC TIME DIGIT MINUTE (x10)
C7	GPS GEOFENCING TIME WINDOW STOP UTC TIME DIGIT MINUTE (x1)
C8	GPS GEOFENCING TOP LINE LATITUDE DIGIT 1 (x1000)
C9	GPS GEOFENCING TOP LINE LATITUDE DIGIT 2 (x100)
CA	GPS GEOFENCING TOP LINE LATITUDE DIGIT 3 (x10)
CB	GPS GEOFENCING TOP LINE LATITUDE DIGIT 4 (x1)
CC	GPS GEOFENCING TOP LINE LATITUDE DECIMAL DIGIT 1 (x0.1)
CD	GPS GEOFENCING TOP LINE LATITUDE DECIMAL DIGIT 2 (x0.01)
CE	GPS GEOFENCING TOP LINE LATITUDE DECIMAL DIGIT 3 (x0.001)
CF	GPS GEOFENCING TOP LINE LATITUDE DECIMAL DIGIT 4 (x0.0001)
D0	GPS GEOFENCING TOP LINE LATITUDE DECIMAL DIGIT 5 (x0.00001)
D1	GPS GEOFENCING TOP LINE LATITUDE ORIENTATION CHARACTER (N/S)
D2	GPS GEOFENCING BOTTOM LINE LATITUDE DIGIT 1 (x1000)
D3	GPS GEOFENCING BOTTOM LINE LATITUDE DIGIT 2 (x100)
D4	GPS GEOFENCING BOTTOM LINE LATITUDE DIGIT 3 (x10)
D5	GPS GEOFENCING BOTTOM LINE LATITUDE DIGIT 4 (x1)
D6	GPS GEOFENCING BOTTOM LINE LATITUDE DECIMAL DIGIT 1 (x0.1)
D7	GPS GEOFENCING BOTTOM LINE LATITUDE DECIMAL DIGIT 2 (x0.01)
D8	GPS GEOFENCING BOTTOM LINE LATITUDE DECIMAL DIGIT 3 (x0.001)
D9	GPS GEOFENCING BOTTOM LINE LATITUDE DECIMAL DIGIT 4 (x0.0001)
DA	GPS GEOFENCING BOTTOM LINE LATITUDE DECIMAL DIGIT 5 (x0.00001)
DB	GPS GEOFENCING BOTTOM LINE LATITUDE ORIENTATION CHARACTER (N/S)
DC	GPS GEOFENCING LEFT LINE LONGITUDE DIGIT 1 (x10000)
DD	GPS GEOFENCING LEFT LINE LONGITUDE DIGIT 2 (x1000)
DE	GPS GEOFENCING LEFT LINE LONGITUDE DIGIT 3 (x100)
DF	GPS GEOFENCING LEFT LINE LONGITUDE DIGIT 4 (x10)
E0	GPS GEOFENCING LEFT LINE LONGITUDE DIGIT 5 (x1)

E1	GPS GEOFENCING LEFT LINE LONGITUDE DECIMAL DIGIT 1 (x0.1)
E2	GPS GEOFENCING LEFT LINE LONGITUDE DECIMAL DIGIT 2 (x0.01)
E3	GPS GEOFENCING LEFT LINE LONGITUDE DECIMAL DIGIT 3 (x0.001)
E4	GPS GEOFENCING LEFT LINE LONGITUDE DECIMAL DIGIT 4 (x0.0001)
E5	GPS GEOFENCING LEFT LINE LONGITUDE DECIMAL DIGIT 5 (x0.00001)
E6	GPS GEOFENCING LEFT LINE LONGITUDE ORIENTATION CHARACTER (E/W)
E7	GPS GEOFENCING RIGHT LINE LONGITUDE DIGIT 1 (x10000)
E8	GPS GEOFENCING RIGHT LINE LONGITUDE DIGIT 2 (x1000)
E9	GPS GEOFENCING RIGHT LINE LONGITUDE DIGIT 3 (x100)
EA	GPS GEOFENCING RIGHT LINE LONGITUDE DIGIT 4 (x10)
EB	GPS GEOFENCING RIGHT LINE LONGITUDE DIGIT 5 (x1)
EC	GPS GEOFENCING RIGHT LINE LONGITUDE DECIMAL DIGIT 1 (x0.1)
ED	GPS GEOFENCING RIGHT LINE LONGITUDE DECIMAL DIGIT 2 (x0.01)
EE	GPS GEOFENCING RIGHT LINE LONGITUDE DECIMAL DIGIT 3 (x0.001)
EF	GPS GEOFENCING RIGHT LINE LONGITUDE DECIMAL DIGIT 4 (x0.0001)
F0	GPS GEOFENCING RIGHT LINE LONGITUDE DECIMAL DIGIT 5 (x0.00001)
F1	GPS GEOFENCING RIGHT LINE LONGITUDE ORIENTATION CHARACTER (E/W)
F2	RESERVED
F3	GPS GEOFENCING RESULT STATUS REGISTER
F4	LAST TRANSMISSION REFERENCE GPS GEOFENCING STATUS REGISTER
F5	CELL-ID GEOFENCING RESULT STATUS REGISTER
F6	LAST TRANSMISSION REFERENCE CELL-ID GEOFENCING STATUS REGISTER

CELL-ID CONFIGURATION REGISTER: If bit0 of this register is true, the Cell-ID geofencing procedure is activated thus the microprocessor of the tracking base will compare the cell identification strings stored in the data bank with the Cell-ID's strings currently available on the GSM network. If bit1 is true, the microprocessor will send an alarm message to the communication server, but only if the GSM engine find on the GSM network the same cell identification strings stored in the data bank, if bit1 is false, the microprocessor will send an alarm message to the communication server but, only if the GSM engine don't find on the GSM network the cell identification strings stored in the data bank. If bit0 is false, the Cell-ID geofencing procedure is not executed by the microprocessor of the tracking base.

Cell-ID geofencing configuration register (address: B7h)

BIT	VALUE	DESCRIPTION
0	1	Cell-ID geofencing procedure enabled
	0	Cell-ID geofencing procedure disabled
1	1	Send alarm message if cell identification is found
	0	Send alarm message if cell identification is not found
2	1	Reserved
	0	Reserved
3	1	Reserved
	0	Reserved
4	1	Reserved
	0	Reserved
5	1	Reserved
	0	Reserved
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

CELL IDENTIFICATION CHARACTERS: A GSM radio cell is identified by a unique four alphanumeric characters string, addresses B8h, B9h, BAh and BBh of the zone data bank must respectively contain the first, second, third and fourth character. When the microprocessor of the tracking base execute the Cell-ID geofencing procedure these four characters are compared to the available four characters Cell-ID's strings on the GSM network. Up to seven current Cell-ID's strings can be SIMultaneously available from the GSM engine. Character comparison is of course upper and lower case sensitive.

GPS GEOFENCING CONFIGURATION REGISTER: If bit0 is true, the GPS geofencing procedure is executed by the microprocessor of the tracking base, if bit0 is false the GPS geofencing including or excluding speed check is not executed. GPS geofencing can be executed by the microprocessor in different ways, if bit1 is true the procedure will compare the current GPS position of the tracking base with the square geographical zone stored in the data bank, if bit1 is false the current GPS position of the tracking base will not be compared with the square geographical zone stored in the data bank. If bit2 is true, the GPS geofencing procedure will only be executed by the microprocessor if the current GPS UTC time is inside or outside the time window stored in the data bank depending of the value of bit4, if bit3 is false the GPS procedure will always be executed regardless of the current GPS time and the time window parameters. If bit3 is true the GPS geofencing procedure will also include a speed check, if the current GPS speed of the tracking base is currently above the maximum speed limit stored in the data bank, an alarm message will be sent to the communication server, if the current GPS speed is below the maximum speed limit, no alarm message is sent to the communication server. Please note that the maximum speed limit and the current GPS speed are in knots (1 knot = 1.852 KPH or 1.150 MPH).

GPS geofencing configuration register (address: BCh)

BIT	VALUE	DESCRIPTION
0	1	GPS geofencing enabled
	0	GPS geofencing disabled
1	1	Position Fix check enabled
	0	Position Fix check disabled
2	1	GPS Geofencing procedure is executed in accordance with time window
	0	GPS Geofencing procedure is executed independently of time window
3	1	GPS Geofencing procedure including speed check
	0	GPS Geofencing procedure without speed check
4	1	GPS Geofencing procedure is executed if inside time window
	0	GPS Geofencing procedure is executed if outside time window
5	1	Reserved
	0	Reserved
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

MAXIMUM SPEED LIMIT: Data bank addresses BDh, BEh and BFh must contain a valid maximum allowed speed limit, if bit3 of the GPS geofencing configuration register is true, the microprocessor of the tracking base will check if the current GPS speed is above or below this maximum speed limit. Any non decimal maximum speed limit in knots between 001 and 999 knots can be stored in the data bank, decimal speed values like 12.58 or 99.2 are not allowed thus speed check resolution is 1 knot. Please note that the maximum speed limit and the current GPS speed are in knots (1 knot = 1.852 KPH or 1.150 MPH). It's mandatory to always store the maximum speed limit in a 3 digits fixed length string, thus for a maximum speed of 5 knots, BDh, BEh and BFh registers must respectively be filled with 30h, 30h and 35h, for a maximum speed of 82 knots, BDh, BEh and BFh registers must respectively be filled with 30h, 38h and 32h and for a maximum speed of 274 knots, BDh, BEh and BFh registers must respectively be filled with 32h, 37h and 34h. Please note that if the current GPS speed equal the maximum speed limit no alarm message will be sent, the current GPS speed must be at least one knot above the maximum speed limit to generate an alarm message.

GPS GEOFENCING TIME WINDOW : The tracking base has the possibility to execute the GPS geofencing procedure in accordance with a time window previously stored in the zone data bank, if bit2 of the GPS geofencing configuration register is true, prior to execute the GPS geofencing procedure, the microprocessor of the tracking base will first check the status of bit4 of the GPS geofencing configuration register, if bit4 is true the GPS geofencing procedure will only be executed if the current GPS time is after the start time limit and before the stop time limit. If bit4 is false the GPS geofencing procedure will only be executed if the current GPS time is before the start time limit and after the stop time limit. Please note that the start and stop time limits don't include seconds, which means that time comparison is only performed on hour and minute digits thus there will be a tolerance on time inspection of maximum 59 seconds. The start and stop time limits must always be stored in UTC time due to the fact that the GPS engine outputs only UTC time. The microprocessor of the tracking base accept any time value between 00h02 and 23h58, 12 hour system AM/PM is not supported, the start limit must be always "later in the same day" than the stop limit, for example a start time limit of 07h05 and stop time limit of 15h30 will be OK, but a start time limit of 11h24 and stop time limit of 09h16 will not be OK and can create an erroneous, unstable microprocessor operation. Time limits must be in the same day, if the tracking base must execute the GPS geofencing procedure at night let's say between 22h15 and 06h52 then a start time limit of 06h52 and a stop time limit of 22h15 must be stored in the data bank, and bit4 of the GPS geofencing configuration register must be set to false in order to ask the microprocessor to execute the GPS geofencing procedure only if the current GPS time outside the time window. Time limits must always be stored as a 4 digits fixed length string, for example to store a start time limit of 2hours and 31 minutes in the morning, data bank registers with addresses C0h, C1h, C2h and C3h must be respectively filled with 30h, 32h, 33h and 31h. To store a stop time limit of 22hours and 54 minutes, data bank registers with addresses C4h, C5h, C6h and C7h must be respectively filled with 32h, 32h, 35h and 34h. If bit2 of the GPS geofencing configuration register is false, then the time window is ignored and the GPS geofencing procedure will always be executed.

GPS TOP LINE LATITUDE: To execute the GPS position geofencing procedure, at least one square geographical zone must be defined in 1 of the 64 zones data banks. The tracking base can contain up to 64 different and independent square geographical zones. The virtual square zone is defined by two horizontal and two vertical virtual lines, for the top horizontal line of the virtual square, a valid latitude and north or south orientation is required, for the bottom horizontal line of the virtual square, a valid latitude and north or south orientation is also required, to be logical the top line of the virtual square must be located above and not below the bottom line of the virtual square. A valid latitude and a north or south orientation must be stored into the data bank, Latitude must always be a 9 digits fixed length string, the first four registers starting at address C8h will contain the four latitude digits, the five following registers starting at address CCh will contain the five decimals latitude digits, north or south orientation will be stored in the data register with address D1h. Please note that north or south orientation data register can only contain the N or S character, lower case characters (n or s) are not supported. For example, to store a top line latitude of 1234.56789 NORTH in the data bank, registers with addresses C8h, C9h, CAh and CBh must respectively be filled with 31h, 32h, 33h and 34h, registers with addresses CCh, Cdh, Ceh, CFh and D0h will respectively be filled with 35h, 36h, 37h, 38h and 39h, register with address D1h must be filled with 4Eh.

GPS BOTTOM LINE LATITUDE: To execute the GPS position geofencing procedure, at least one square geographical zone must be defined in 1 of the 64 zones data banks. The tracking base can contain up to 64 different and independent square geographical zones. The virtual square zone is defined by two horizontal and two vertical virtual lines, for the top horizontal line of the virtual square, a valid latitude and north or south orientation is required, for the bottom horizontal line of the virtual square, a valid latitude and north or south orientation is also required, to be logical the top line of the virtual square must be located above and not below the bottom line of the virtual square. A valid latitude and a north or south orientation must be stored into the data bank, Latitude must always be a 9 digits fixed length string, the first four registers starting at address D2h will contain the four latitude digits, the five following registers starting at address D6h will contain the five decimals latitude digits, north or south orientation will be stored in the data register with address DBh. Please note that north or south orientation data register can only contain the N or S character, lower case characters (n or s) are not supported. For example, to store a bottom line latitude of 1234.56789 SOUTH in the data bank, registers with addresses D2h, D3h, D4h and D5h must respectively be filled with 31h, 32h, 33h and 34h, registers with addresses D6h, D7h, D8h, D9h and DAh will respectively be filled with 35h, 36h, 37h, 38h and 39h, register with address DBh must be filled with 53h.

GPS LEFT LINE LONGITUDE: To execute the GPS position geofencing procedure, at least one square geographical zone must be defined in 1 of the 64 zones data banks. The tracking base can contain up to 64 different and independent square geographical zones. The virtual square zone is defined by two horizontal and two vertical virtual lines, for the left vertical line of the virtual square, a valid longitude and east or west orientation is required, for the left vertical line of the virtual square, a valid longitude and east or west orientation is also required, to be logical the left line of the virtual square must be located on the left hand side and not on the right hand side of the right line of the virtual square. A valid longitude and an east or west orientation must be stored into the data bank, Longitude must always be a 10 digits fixed length string, the first five registers starting at address DCh will contain the five longitude digits, the five following registers starting at address E1h will contain the five decimals longitude digits, east or west orientation will be stored in the data register with address E6h. Please note that east or weast orientation data register can only contain the E or W character, lower case characters (e or w) are not supported. For example, to store a left line longitude of 12345.56789 WEST in the data bank, registers with addresses DCh, DDh, DEh, DFh and E0h must respectively be filled with 31h, 32h, 33h, 34h and 35h, registers with addresses E1h, E2h, E3h, E4h and E5h will respectively be filled with 35h, 36h, 37h, 38h and 39h, register with address E6h must be filled with 57h.

GPS RIGHT LINE LONGITUDE: To execute the GPS position geofencing procedure, at least one square geographical zone must be defined in 1 of the 64 zones data banks. The tracking base can contain up to 64 different and independent square geographical zones. The virtual square zone is defined by two horizontal and two vertical virtual lines, for the left vertical line of the virtual square, a valid longitude and east or west orientation is required, for the right vertical line of the virtual square,a valid longitude and east or west orientation is also required, to be logical the right line of the virtual square must be located on the right hand side and not on the left hand side of the left line of the virtual square. A valid longitude and an east or west orientation must be stored into the data bank, Longitude must always be a 10 digits fixed length string, the first five registers starting at address E7h will contain the five longitude digits,the five following registers starting at address ECh will contain the five decimasl longitude digits, east or west orientation will be stored in the data register with address F1h. Please note that east or west orientation data register can only contain the E or W character, lower case characters (e or w) are not supported. For example, to store a right line longitude of 12345.56789 EAST in the data bank, registers with addresses E7h, E8h, E9h, EAh and EBh must respectively be filled with 31h, 32h, 33h, 34h and 35h, registers with addresses ECh, Edh, Eeh, EFh and F0h will respectively be filled with 35h, 36h, 37h, 38h and 39h, register with address F1h must be filled with 45h.

GPS GEOFENCING RESULT STATUS REGISTER: After a GPS geofencing procedure execution, the result of the operation is compared by the microprocessor of the tracking base with the GPS geofencing result status register located at address F3h. If the result of the operation is equal to the GPS geofencing result status register, no geofencing alarm message is sent by the product to the communication server, if the result of the operation is not equal an alarm message will be sent by the product to the communication server. This configuration register must represent a "no alarm" or "regular situation" and has to be written to the zone data bank, for example if the tracking base must send an alarm message when the current GPS position is located outside the geofencing square zone and the current GPS speed is above the maximum speed limit then the value to store in the GPS geofencing result status register located at address F3h must be 1Eh, in fact if the tracking base stay inside the geofencing square zone and the maximum speed limit is respected the result of the GPS geofencing procedure execution will give the following result: bit1, bit2, bit3, bit4 will be true and bit5 will be false, thus the result of the GPS geofencing procedure execution will be 1Eh, when compared with the geofencing result status register (also 1Eh) because the result of the GPS geofencing procedure execution and the GPS geofencing result status register are equals, no alarm message will be sent by the tracking base, this is considered a "normal situation". On the other hand, if the tracking base is not located inside the geofencing square zone or/and if the maximum speed limit is not respected (current GPS speed above the maximum speed limit) the result of the GPS geofencing procedure execution will not be 1Eh, in this case the result of the GPS geofencing procedure execution and the GPS geofencing result status register is not equal, an alarm message will be sent by the tracking base, this is considered an "alarm situation". This way of procedure execution provide a full flexibility and allow to detect if the tracking base is located inside, outside, north, south, east, west, north east, north west, south east, or south west of the square geofencing zone.

GPS geofencing result status register (address: F3h)

BIT	VALUE	DESCRIPTION
0	1	Reserved
	0	Reserved
1	1	Tracking base is located below the top line of the square zone
	0	Tracking base is located above the top line of the square zone
2	1	Tracking base is located above the bottom line of the square zone
	0	Tracking base is located below the bottom line of the square zone
3	1	Tracking base is located at the right hand side of the left line of the square zone
	0	Tracking base is located at the left hand side of the left line of the square zone
4	1	Tracking base is located at the left hand side of the right line of the square zone
	0	Tracking base is located at the right hand side of the right line of the square zone
5	1	Current GPS speed is above the maximum speed limit
	0	Current GPS speed is below the maximum speed limit
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

GPS GEOFENCING LAST TRANSMISSION REFERENCE REGISTER: The GPS geofencing procedure can be executed at regular intervals, to avoid the tracking base to endlessly send and resend the same repeated alarm message to the communication server every time the microprocessor execute this procedure, when an alarm message is sent, the microprocessor copy the content of the last transmission to the GPS geofencing last transmission reference register located at address F4h. Basically to avoid repeated alarm messages when modifying the value of the GPS geofencing result status register located at address F3h, simply store exactly the same value into the GPS geofencing last transmission reference register.

GPS geofencing last transmission reference register (address: F4h)

BIT	VALUE	DESCRIPTION
0	1	Reserved
	0	Reserved
1	1	Tracking base is located below the top line of the square zone
	0	Tracking base is located above the top line of the square zone
2	1	Tracking base is located above the bottom line of the square zone
	0	Tracking base is located below the bottom line of the square zone
3	1	Tracking base is located at the right hand side of the left line of the square zone
	0	Tracking base is located at the left hand side of the left line of the square zone
4	1	Tracking base is located at the left hand side of the right line of the square zone
	0	Tracking base is located at the right hand side of the right line of the square zone
5	1	Current GPS speed is above the maximum speed limit
	0	Current GPS speed is below the maximum speed limit
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

CELL-ID GEOFENCING RESULT STATUS REGISTER: Every time the Cell-ID configuration register located at address B7h is modified, it's mandatory to store a value in accordance with the updated Cell-ID configuration. If the Cell-ID geofencing procedure is disabled in the Cell-ID configuration register, the Cell-ID result status register located at address F5h must be filled with 30h, if the Cell ID geofencing procedure is enabled in the Cell-ID configuration register then the Cell-ID result status register must be filled with 31h.

CELL-ID GEOFENCING LAST TRANSMISSION REFERENCE REGISTER: This register has exactly the same function as the GPS geofencing last transmission reference register. Every time the Cell-ID geofencing result status register located at address F5h is modified , the same value must be written in the Cell-ID geofencing last transmission reference register.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*Reg1*><*Reg2*>...<*Reg63*><*Reg64*><stopchar>

```
12345678,+32475123456,01,,,,,,,303236,,,
,32333431#
```

In this example, a maximum speed limit of 26 knots is written into the zone 1 data bank, in the three corresponding registers respectively located at addresses BDh, BEh and BFh, a comma in place of two hexadecimal digits can be inserted to jump a data register, in this case six commas have been inserted resulting in a jump of six data registers respectively located at addresses B7h, B8h, B9h, BAh, BBh and BCh. Please note that jumped data registers are not written thus remain unchanged versus previously stored values. Then a stop UTC time limit of 23h41 is written into the four corresponding data registers, the # stop character ends the write cycle thus all data registers located at addresses after C7h are not written and remain unchanged versus previously stored values.
Up to 64 data registers can be written in one bank by sending a single SMS message to the tracking base allowing to fully configure one bank in one step. Please note that the write cycle always start to write in the register located at address B7h.

RX FORMAT: <(identifier)>,<*op-code*>,<*Reg1*><*Reg2*>...<*Reg63*><*Reg64*><stopchar>

```
(12345678),01,003132333400303236313334353233334313132333343132333435533132333431323334355331323334354531323334353132333435450000000303 0#
```

Independently of the numbers of data registers that has been written into the data bank, the tracking base always return all 64 registers of the concerned zone data bank.

NOTE: When writing a latitude or/and a longitude into a data bank, GPS geofencing latitude and longitude data format must be identical to the GPS engine data output format, in this case WGS84 will apply.

READ THE 64 REGISTERS OF A ZONE DATA BANK — 41h

DESCRIPTION: This TDX® command allow to read the 64 registers of a zone data bank located in the on-board eeprom of the tracking base.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*zone*><stopchar>

```
12345678,+32475123456,41,18#
```

This example demonstrates how to read the 64 registers of the zone 24 data bank.

RX FORMAT: <(identifier)>,<*op-code*>,<*zone*>,<*Reg1*><*Reg2*>...<*Reg63*><*Reg64*><stopchar>

```
(12345678),41,18,00313233340030323631333
435323334313132333431323334355331323334 3
132333435533132333435313233343545313233 3
435313233343545000000030 30#
```

The tracking base will return an SMS message containing all 64 registers of the zone 24 data bank. For read data details please refer to the data bank content definition described in "WRITE UP TO 64 REGISTERS IN THE ZONE 1 DATA BANK".

WRITE PRODUCT CONFIGURATION REGISTERS AND RESET — 42h

DESCRIPTION: This TDX® command allow to write the 64 configuration registers of the tracking base located in the on-board eeprom, immediately after the response SMS message transmission, a software reset is performed so that the updated configuration registers modifications can take effect. Please note that these configuration registers are differents from zone data banks.

EEPROM PRODUCT CONFIGURATION REGISTERS

ADDRESS	REGISTER DESIGNATION
01	SIM CARD PIN DIGIT 1
02	SIM CARD PIN DIGIT 2
03	SIM CARD PIN DIGIT 3
04	SIM CARD PIN DIGIT 4
05	SIM CARD PIN DIGIT 5
06	SIM CARD PIN DIGIT 6
07	SIM CARD PIN DIGIT 7
08	SIM CARD PIN DIGIT 8
09	TEMPERATURE HIGH ALARM LIMIT LSB
0A	TEMPERATURE HIGH ALARM LIMIT MSB

0B	TEMPERATURE LOW ALARM LIMIT LSB
0C	TEMPERATURE LOW ALARM LIMIT MSB
0D	GPS TRACKING SEQUENCE COUNTER
0E	SMS ALERT CATCH TIMER
0F	RESERVED
10	ISDN RECALL NUMBER DIGIT 1
11	ISDN RECALL NUMBER DIGIT 2
12	ISDN RECALL NUMBER DIGIT 3
13	ISDN RECALL NUMBER DIGIT 4
14	ISDN RECALL NUMBER DIGIT 5
15	ISDN RECALL NUMBER DIGIT 6
16	ISDN RECALL NUMBER DIGIT 7
17	ISDN RECALL NUMBER DIGIT 8
18	ISDN RECALL NUMBER DIGIT 9
19	ISDN RECALL NUMBER DIGIT 10
1A	ISDN RECALL NUMBER DIGIT 11
1B	ISDN RECALL NUMBER DIGIT 12
1C	ISDN RECALL NUMBER DIGIT 13
1D	ISDN RECALL NUMBER DIGIT 14
1E	ISDN RECALL NUMBER DIGIT 15
1F	ISDN RECALL NUMBER DIGIT 16
20	RTC INTERVAL UNIT
21	RTC INTERVAL COUNTER
22	DEVICE CONFIGURATION REGISTER 1
23	DEVICE CONFIGURATION REGISTER 2
24	LOG MEMORY CONFIGURATION REGISTER 1
25	LOG MEMORY CONFIGURATION REGISTER 2
26	RESERVED
27	RESERVED
28	RESERVED
29	RESERVED
2A	RESERVED
2B	RESERVED
2C	RESERVED
2D	RESERVED
2E	RESERVED
2F	RESERVED
30	RESERVED
31	RESERVED
32	RESERVED
33	RESERVED
34	RESERVED
35	RESERVED
36	RESERVED
37	RESERVED
38	RESERVED
39	RESERVED
3A	RESERVED
3B	RESERVED
3C	RESERVED
3D	RESERVED
3E	RESERVED
3F	RESERVED
40	RESERVED

SIM CARD PIN DIGITS: Registers with addresses from 01h up to 08h, must contain the SIM card pin code that can be any numerical value between 0000 and 99999999, unused digits must always be filled with an X character (58h), thus if the pin code is for example "1234" registers with addresess from 01h to 04h must respectively be filled with 31h, 32h, 33h and 34h and registers with addresess from 05h to 08h must be filled with 58h. If the SIM pin code function is not used then the eight registers must be filled with 58h.

TEMPERATURE HIGH ALARM LIMIT: Registers with addresses 09h and 0Ah, can contain the temperature high alarm limit if this function needs to be used, please refer to the GET CURRENT TEMPERATURE AND ALARM STATUS (op-code54h) TDX® command.

TEMPERATURE LOW ALARM LIMIT: Registers with addresses 0Bh and 0Ch, can contain the temperature low alarm limit if this function needs to be used, please refer to the GET CURRENT TEMPERATURE AND ALARM STATUS (op-code54h) TDX® command.

GPS TRACKING SEQUENCE COUNTER: Register with address 0Dh, can contain any value between 0 and 255, please refer to the START GPS TRACKING SEQUENCE (op-code4Eh) TDX® command. When the GPS tracking procedure is not used, this register must be filled with 00h.

SMS CATCH TIMER: If the sequential mode is used, the tracking base wake-up at regular intervals, the value stored in this register will define the time the GSM engine will stay connected on the network waiting for an incoming message before going back to sleep. The unit of the value of the register is 10 seconds, thus if a value of 0Ah (10) is stored, the GSM engine will stay 100 seconds on the network. This register value is critical and extreme care must be taken, for example if a value of 01h is stored into the register and the required time to catch an SMS from the network is longer the tracking base will NEVER be able to catch any incoming messages from the communication server.

ISDN RECALL NUMBER DIGITS: These sixteen registers are handled by the microprocessor of the tracking base and automatically updated, however if it's required to write into these registers, note that the recall number must always be formatted as a fixed length string of 16 characters and unused digits must be filled with 58h.
Example: "+32475123456XXXX"

RTC INTERVAL UNIT: This register is described in the MODIFY RTC PARAMETERS (op-code56h) TDX® command.

RTC INTERVAL COUNTER: This register is described in the MODIFY RTC PARAMETERS (op-code56h) TDX® command.

DEVICE CONFIGURATION REGISTERS: These two Registers with addresses 22h and 23h, contain the status of the tracking base configuration.

Device configuration register 1 (address: 22h)

BIT	VALUE	DESCRIPTION
0	1	Battery ID notification message on product start enabled
	0	Battery ID notification message on product start disabled
1	1	Battery change ID notification message on product start enabled
	0	Battery change ID notification message on product start disabled
2	1	Clean SIM on product start enabled
	0	Clean SIM on product start disabled
3	1	Temperature check procedure enabled
	0	Temperature check procedure disabled
4	1	Unconditional temperature check notification message enabled
	0	Unconditional temperature check notification message disabled
5	1	Tracking base mode in continuous mode
	0	Tracking base mode in sequential mode
6	1	Online notification message on product start & wake-up enabled
	0	Online notification message on product start & wake-up disabled
7	1	Event recording in Log memory enabled
	0	Event recording in Log memory disabled

Register 1 bit0 status description: If bit0 is true, the tracking base send a notification message containing the nine digits battery identification number every time the product starts. if bit0 is false the notification message is never sent.

Register 1 bit1 status description: If bit1 is true, the tracking base send a notification message containing the nine digits battery identification number when the product starts, but at the only condition that a new battery identification number is detected. If bit1 is false the notification message is never sent.

Register 1 bit2 status description: If bit2 is true, when the product starts, the SMS messages contained in the memory of the SIM card are deleted. If bit2 is false the the SMS messages are not deleted.

Register 1 bit3 status description: If bit3 is true, the current temperature is read and compared to the low and high alarm limits, the frequency of this temperature check procedure is executed in accordance with the RTC parameters. If bit3 is false the temperature is never read and never compared.

Register 1 bit4 status description: If bit4 is true and at the condition that bit3 is true, the temperature check procedure is executed in accordance with the RTC parameters and a notification is systematically sent to the communication server regardless of the alarm status. If bit4 is false and at the condition that bit3 is true, the temperature check procedure is executed in accordance with the RTC parameters and a notification is only sent if a change of alarm status is detected.

Register 1 bit5 status description: If bit5 is true, the tracking base will operate in continuous mode, the GSM engine will be permanently connected to the network and stay ready to treat incoming messages in real time. If bit5 is false, the tracking base will operate in sequential mode, the tracking base will wake-up at regular intervals in accordance with the RTC parameters, turn the GSM ON, wait for an incoming message for a period of time determined by the value stored in the SMS catch timer register and finally go back in sleep.

Register 1 bit6 status description: If bit6 is true, a notification message indicating that the tracking base is attached to the GSM network will be sent when the product starts. If bit6 is false, the online notification message will never be sent.

Register 1 bit7 status description: If bit7 is true, various data like temperature, GPS position,... will be stored into the Log memory located in the battery pack attached to the tracking base. If bit7 is false, nothing will be recorded in the Log memory.

Device configuration register 2 (address: 23h)

BIT	VALUE	DESCRIPTION
0	1	Cell-ID geofencing function enabled
	0	Cell-ID geofencing function disabled
1	1	GPS geofencing function enabled
	0	GPS geofencing function disabled
2	1	Turn the GPS engine ON on product start
	0	Turn the GPS engine OFF on product start
3	1	Led indication enabled
	0	Led indication disabled
4	1	Offline notification message on product sleep enabled
	0	Offline notification message on product sleep disabled
5	1	Vibration device wake-up enabled
	0	Vibration device wake-up disabled
6	1	TDX prefix added to RX Format SMS messages
	0	TDX prefix not added to RX Format SMS messages
7	1	Reserved
	0	Reserved

Register 2 bit0 status description: If bit0 is true, the Cell-ID geofencing procedures will be executed in accordance with the Cell-ID geofencing configuration registers and the RTC parameters. If bit0 is false, the Cell-ID procedures will be totally skipped. If the Cell-ID procedures are not used, we strongly advice to clear this bit even if individual configuration bits in all zones data banks are cleared.

Register 2 bit1 status description: If bit1 is true, the GPS geofencing procedures will be executed in accordance with the GPS geofencing configuration registers and the RTC parameters. If bit1 is false, the GPS procedures will be totally skipped. If the GPS procedures are not used, we strongly advice to clear this bit even if individual configuration bits in all zones data banks are cleared.

Register 2 bit2 status description: If bit2 is true, the GPS engine will be turned ON every time the tracking base starts. If bit2 is false, the GPS engine will not be supplied every time the tracking base starts.

Register 2 bit3 status description: If bit3 is true, the tricolor led on the pcb will flash following a scheme described in a document (available on the traxlogix website) to provide a visual operation indication. If bit3 is false, all visual indications except the result of AT+CPIN will be disabled.

Register 2 bit4 status description: If bit4 is true, the tracking base will send a notification message prior to enter in sleep mode. If bit4 is false, this notification message will never be sent.

Register 2 bit5 status description: If bit5 is true, the tracking base can not only exit from sleep mode when the RTC time interval expire, but also if vibrations are detected. If bit5 is false, the tracking base can only exit from sleep mode when the RTC time interval expire.

Register 2 bit6 status description: If bit6 is true, a TDX prefix will be added in all RX Format SMS messages sent from the tracking base. If bit6 is false, the TDX prefix will not be added. This function is only available on devices with software versions: 2.14 or later.

LOG MEMORY CONFIGURATION REGISTERS: These two Registers with addresses 24h and 25h, defines which data must be recorded into the Log memory located in the battery pack attached to the tracking base. Please note that the memory capacity of all available battery packs is 32KB.

LOG memory configuration register 1 (address: 24h)

BIT	VALUE	DESCRIPTION
0	1	GPS UTC time will be stored
	0	GPS UTC time will not be stored
1	1	GPS signal quality indicator will be stored
	0	GPS signal quality indicator will not be stored
2	1	GPS latitude will be stored
	0	GPS latitude will not be stored
3	1	GPS north/south orientation will be stored
	0	GPS north/south orientation will not be stored
4	1	GPS longitude will be stored
	0	GPS longitude will not be stored
5	1	GPS east/west orientation will be stored
	0	GPS east/west orientation will not be stored
6	1	GPS course over ground will be stored
	0	GPS course over ground will not be stored
7	1	GPS date will be stored
	0	GPS date will not be stored

LOG memory configuration register 2 (address: 25h)

BIT	VALUE	DESCRIPTION
0	1	GPS knots speed will be stored
	0	GPS knots speed will not be stored
1	1	GPS satellites in view indication will be stored
	0	GPS satellites in view indication will not be stored
2	1	GPS altitude will be stored
	0	GPS altitude will not be stored
3	1	Current temperature will be stored
	0	Current temperature will not be stored
4	1	A carriage return character at the end of each line will be stored
	0	A carriage return character at the end of each line will not be stored
5	1	A line feed character at the end of each line will be stored
	0	A line feed character at the end of each line will not be stored
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*CfgReg1*><*CfgReg2*>...<*CfgReg63*><*CfgReg64*><stopchar>

```
12345678,+32475123456,42,,,,,,,,,,,,,,,,
2B333234373736353433323158585858#
```

In this example, an ISDN recall number +32477654321XXXX is written into the sixteen corresponding registers respectively located at addresses 10h, 11h, 12h, 13h, 14h,15h,16h,17h,18h, 19h, 1Ah, 1Bh, 1Ch, 1Dh, 1Eh and 1Fh, like previously explained in the ISDN recall number section, the recall number must always be formatted as a 16 characters fixed length string, due to the fact that the recall number string length is 12 characters only, four X characters (58h) must be added to get a fixed length of 16 characters.
A comma in place of two hexadecimal digits can be inserted to jump a configuration register, in this case 15 commas have been inserted resulting in a jump of 15 configuration registers respectively located at addresses 01h, 02h, 03h, 04h, 05h, 06h, 07h, 08h, 09h, 0Ah, 0Bh, 0Ch, 0Dh, 0Eh and 0Fh.
Please note that jumped configuration registers are not written thus remain unchanged versus previously stored values.
The # stop character ends the write cycle thus all configuration registers located at addresses after 1Fh are not written and remain unchanged versus previously stored values.
The 64 configuration registers can be written by sending a single SMS message to the tracking base allowing to fully configure the tracking device in one step. Please note that the write cycle always start to write in the register located at address 01h.

RX FORMAT: <(identifier)>,<*op-code*>,<*CfgReg1*><*CfgReg2*>...<*CfgReg63*><*CfgReg64*><stopchar>

```
(12345678),42,3132333458585858B8019 0FCFF
00002B333234373736353433323158585858 0000
0000000000000000000000000000000000000000
00000000000000000000000#
```

Independently of the numbers of configuration registers that has been written into the eeprom, the tracking base always return all 64 configuration registers of the tracking base.

READ PRODUCT CONFIGURATION REGISTERS 43h

DESCRIPTION: This TDX® command allow to read the 64 configuration registers of the tracking base located in the on-board eeprom.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,,43#
```

This example demonstrates how to read the 64 configuration registers of the tracking base and use the ISDN recall number stored in the configuration eeprom.

RX FORMAT: <(identifier)>,<*op-code*>,<*CfgReg1*><*CfgReg2*>...<*CfgReg63*><*CfgReg64*><stopchar>

```
(12345678),43,3132333458585858B8019 0FCFF
00002B3332343737363534333231585858580000
0000000000000000000000000000000000000000
00000000000000000000000000#
```

The tracking base returns the 64 configuration registers of the tracking base.

DISABLE CELL-ID GEOFENCING PROCEDURE IN ALL ZONE DATA BANKS 44h

DESCRIPTION: This TDX® command allow to disable the Cell-ID geofencing procedure in the 64 zone data banks. Regardless of the actual value of the bit0 of the 64 Cell-ID geofencing configuration registers located at address B7h in the 64 data banks, the value of bit0 of the 64 Cell-ID geofencing configuration registers located at address B7h in the 64 zone data banks is set to false.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,44#
```

This example demonstrates how to disable the Cell-ID geofencing procedure in the 64 zone data banks.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),44,OK#
```

The tracking base returns an OK confirmation message.

ENABLE CELL-ID GEOFENCING PROCEDURE IN ALL ZONE DATA BANKS 45h

DESCRIPTION: This TDX® command allow to enable the Cell-ID geofencing procedure in the 64 zone data banks. Regardless of the actual value of the bit0 of the 64 Cell-ID geofencing configuration registers located at address B7h in the 64 data banks, the value of bit0 of the 64 Cell-ID geofencing configuration registers located at address B7h in the 64 zone data banks is set to true.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,45#
```

This example demonstrates how to enable the Cell-ID geofencing procedure in the 64 zone data banks.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),45,OK#
```

The tracking base returns an OK confirmation message.

DISABLE GPS GEOFENCING PROCEDURE IN ALL ZONE DATA BANKS 46h

DESCRIPTION: This TDX® command allow to disable the GPS geofencing procedure in the 64 zone data banks. Regardless of the actual value of the bit0 of the 64 GPS geofencing configuration registers located at address B7h in the 64 data banks, the value of bit0 of the 64 GPS geofencing configuration registers located at address BCh in the 64 zone data banks is set to false.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,46#
```

This example demonstrates how to disable the GPS geofencing procedure in the 64 zone data banks.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

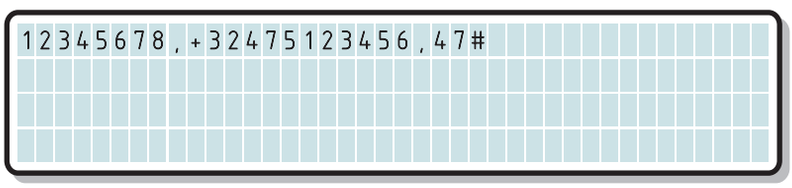
```
(12345678),46,OK#
```

The tracking base returns an OK confirmation message.

ENABLE GPS GEOFENCING PROCEDURE IN ALL ZONE DATA BANKS 47h

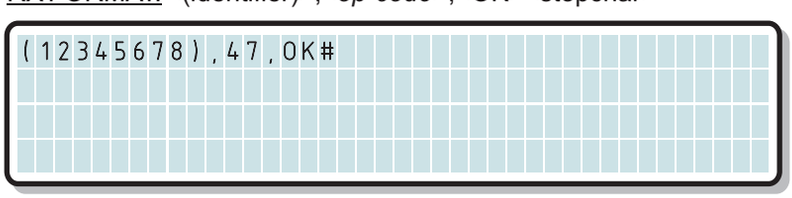
DESCRIPTION: This TDX® command allow to enable the GPS geofencing procedure in the 64 zone data banks. Regardless of the actual value of the bit0 of the 64 GPS geofencing configuration registers located at address B7h in the 64 data banks, the value of bit0 of the 64 GPS geofencing configuration registers located at address BCh in the 64 zone data banks is set to true.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to enable the GPS geofencing procedure in the 64 zone data banks.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

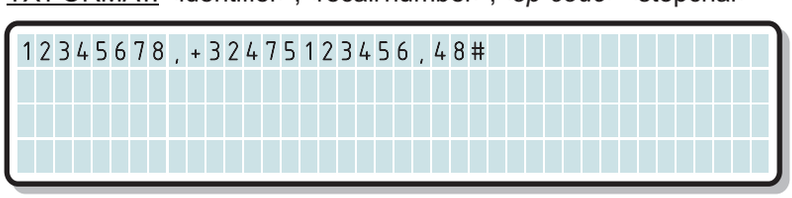


The tracking base returns an OK confirmation message.

READ CURRENT CELL IDENTIFICATION IN REGISTER 48h

DESCRIPTION: This TDX® command allow to read the current GSM cell identification strings in the RAM registers located in the microprocessor of the tracking base. A GSM radio cell is identified by a unique four alphanumeric characters string, up to seven current Cell-ID's strings can be SIMultaneously available from the GSM engine.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to read the current cell identification strings in the RAM registers of the microprocessor.

RX FORMAT: <(identifier)>,<*op-code*>,<*CellChar1*><*CellChar2*>...<*CellChar27*><*CellChar28*><stopchar>

```
(12345678),48,6162646364636162 7E7E7E7E7E
7E7E7E7E7E7E7E7E7E7E7E7E7E7E7E7E7E#
```

The tracking base returns the available Cell-Id's characters currently stored in the RAM registers, in this example, two cell-id's only are available, cell-id 1 is "abdc" and cell-id 2 is "dcab", the other five cell-id's are currently not available, in this case empty registers are always filled with a dummy ~ character (7Eh or ascii126).

TURN GPS POWER SUPPLY ON — 49h

DESCRIPTION: This TDX® command allow to turn ON the GPS power supply.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,49#
```

This example demonstrates how to turn the GPS power supply ON.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),49,OK#
```

The tracking base returns an OK confirmation message.

TURN GPS POWER SUPPLY OFF — 4Ah

DESCRIPTION: This TDX® command allow to turn OFF the GPS power supply.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,4A#
```

This example demonstrates how to turn the GPS power supply OFF.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),4A,OK#
```

The tracking base returns an OK confirmation message.

GPS DATA FORMAT

IMPORTANT: The tracking base include a high sensitivity Antaris®4 Supersense® GPS receiver from U-blox® AG (U-blox®5 generation of receivers will supersede the actual Antaris®4 generation and will be available in all Traxlogix® products by the end of Q3/2007). For GPS related TDX® commands, extreme care must be taken to good understand how GPS receivers works, how NMEA GPS messages are formatted, to know what WGS84 means,... prior to start to develop communication server software applications. For example, NMEA messages may sometimes contain parameters like an altitude that may sometimes be a negative value, if the tracking base is located below MSL (sea level) the returned value will be negative. In order to avoid unstable and erratic operation of software programs deployed in communication servers, it's worth to acquire a good knowledge of such details.

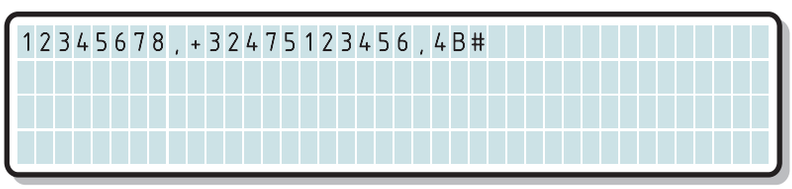
For a better understanding of NMEA messages and WGS84 basics, you can obtain documentation from:

http://www.u-blox.com/
or
http://www.nmea.org/

GET GPS POWER SUPPLY STATUS 4Bh

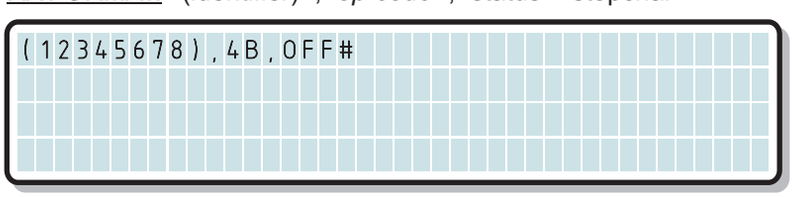
DESCRIPTION: This TDX® command allow to determine if the GPS engine power supply is currently on or off.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to retrieve the GPS power supply status.

RX FORMAT: <(identifier)>,<*op-code*>,<status><stopchar>

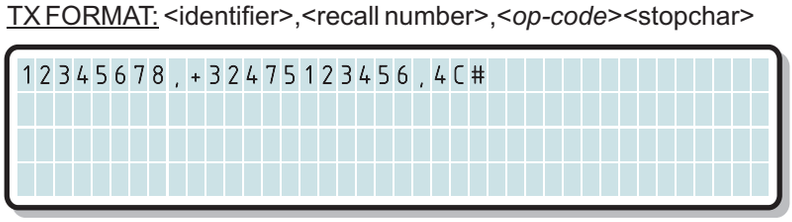


The tracking base returns a confirmation message containing the status of the power supply, if the GPS engine is power supplied the status will be ON, if the GPS engine is not power supplied the status will be OFF.

GET PRODUCT INFORMATION 4Ch

DESCRIPTION: This TDX® command allow to retrieve various product information such as Identifier, serial number, software version and revision, ...

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to retrieve various product information.

RX FORMAT: <(identifier)>,<*op-code*>,<*data1*><*data2*>...<*data63*><*data64*><stopchar>

```
(12345678),4C,3132333435363738313233343536373839000000003031323330313037313233343536373839000000000000000000000000000000000000000000000000#
```

The tracking base returns a confirmation message containing various data described hereafter.

- <*data1*> *Product Identifier digit 1, in this example 31h,* "1"
- <*data2*> *Product Identifier digit 2, in this example 32h,* "2"
- <*data3*> *Product Identifier digit 3, in this example 33h,* "3"
- <*data4*> *Product Identifier digit 4, in this example 34h,* "4"
- <*data5*> *Product Identifier digit 5, in this example 35h,* "5"
- <*data6*> *Product Identifier digit 6, in this example 36h,* "6"
- <*data7*> *Product Identifier digit 7, in this example 37h,* "7"
- <*data8*> *Product Identifier digit 8, in this example 38h,* "8"
- <*data9*> *Product Serial Number digit 1, in this example 31h,* "1"
- <*data10*> *Product Serial Number digit 2, in this example 32h,* "2"
- <*data11*> *Product Serial Number digit 3, in this example 33h,* "3"
- <*data12*> *Product Serial Number digit 4, in this example 34h,* "4"
- <*data13*> *Product Serial Number digit 5, in this example 35h,* "5"
- <*data14*> *Product Serial Number digit 6, in this example 36h,* "6"
- <*data15*> *Product Serial Number digit 7, in this example 37h,* "7"
- <*data16*> *Product Serial Number digit 8, in this example 38h,* "8"
- <*data17*> *Product Serial Number digit 9, in this example 39h,* "9"
- <*data18*> *Reserved for internal or future use, don't care.*
- <*data19*> *Reserved for internal or future use, don't care.*
- <*data20*> *Reserved for internal or future use, don't care.*
- <*data21*> *Reserved for internal or future use, don't care.*
- <*data22*> *Software version digit 1, in this example 30h,* "0"
- <*data23*> *Software version digit 2, in this example 31h,* "1"
- <*data24*> *Software revision digit 1, in this example 32h,* "2"
- <*data25*> *Software revision digit 2, in this example 33h,* "3"
- <*data26*> *Manufacturing date month (x10) digit 1, in this example 30h,* "0"
- <*data27*> *Manufacturing date month (x1) digit 2, in this example 31h,* "1"
- <*data28*> *Manufacturing date year (x10) digit 1, in this example 30h,* "0"
- <*data29*> *Manufacturing date year (x1) digit 2, in this example 37h,* "7"
- <*data30*> *Attached Battery Serial Number character 1, in this example 31h,* "1"
- <*data31*> *Attached Battery Serial Number character 2, in this example 32h,* "2"
- <*data32*> *Attached Battery Serial Number character 3, in this example 33h,* "3"
- <*data33*> *Attached Battery Serial Number character 4, in this example 34h,* "4"
- <*data34*> *Attached Battery Serial Number character 5, in this example 35h,* "5"
- <*data35*> *Attached Battery Serial Number character 6, in this example 36h,* "6"
- <*data36*> *Attached Battery Serial Number character 7, in this example 37h,* "7"
- <*data37*> *Attached Battery Serial Number character 8, in this example 38h,* "8"
- <*data38*> *Attached Battery Serial Number character 9, in this example 39h,* "9"
- <*data39*>...<*data64*> *Reserved for internal or future use, don't care.*

In this example, the tracking base has returned the 64 configuration registers containing the following parameters, identifier is 12345678, product serial number is 123456789, software version and revision is 01.23, product has been manufactured in January 2007, currently attached battery serial number is 123456789, attached battery model is a BP-165 Primary lithium battery pack. Please note that if the attached battery pack or the DC/DC converter cannot be identified or if the tracking base is currently attached to the evaluation kit development board, the battery serial number will be XXXXXXXXX (58h).

Please note that in order to determine which model of battery is currently attached to the tracking base, follow the description hereafter:
If <*data30*> = *31h,* "1" then the attached battery pack or DC/DC converter model is a BP-165
If <*data30*> = *32h,* "2" then the attached battery pack or DC/DC converter model is a BP-155
If <*data30*> = *33h,* "3" then the attached battery pack or DC/DC converter model is a BS-118
If <*data30*> = *34h,* "4" then the attached battery pack or DC/DC converter model is a BS-236
If <*data30*> = *35h,* "5" then the attached battery pack or DC/DC converter model is a BS-315
If <*data30*> = *36h,* "6" then the attached battery pack or DC/DC converter model is a PSC-800
If <*data30*> = *37h,* "7" then the attached battery pack or DC/DC converter model is a PSC-900
If <*data30*> = *58h,* "X" then the attached battery pack or DC/DC converter model cannot be identified or the tracking base is currently attached to the evaluation kit development board.

TEST THE VIBRATION SENSOR 4Dh

DESCRIPTION: This TDX® command allow to determine if movements are detected in a period of 10 seconds by the vibration sensor of the tracking base. Please note that the vibration sensor input must be enabled by the bit5 of the device configuration register 2 prior to test the sensor or the test procedure will not be executed and the word FAIL will be returned in the RX format message.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,4D#
```

This example demonstrates how to determine if vibration are detected by the sensor.

RX FORMAT: <(identifier)>,<*op-code*>,<status><stopchar>

```
(12345678),4D,FAIL#
```

The tracking base returns a confirmation message containing the word FAIL, because the bit5 of the device configuration register 2 is false.

RX FORMAT: <(identifier)>,<*op-code*>,<status><stopchar>

```
(12345678),4D,FALSE#
```

In this case, The tracking base returns a confirmation message containing the word FALSE, because the bit5 of the device configuration register 2 is true but no vibration has been detected by the sensor during the 10 sec test period.

RX FORMAT: <(identifier)>,<*op-code*>,<status><stopchar>

```
(12345678),4D,TRUE#
```

In this case, The tracking base returns a confirmation message containing the word TRUE, because the bit5 of the device configuration register 2 is true and at least one vibration has been detected by the sensor during the 10 sec test period.

START GPS TRACKING SEQUENCE 4Eh

DESCRIPTION: This TDX® command allow to start a GPS tracking sequence. The tracking base will send at regular intervals, messages containing the current geographic position of the GPS engine, if this TDX® command is sent to the tracking base and the GPS engine power supply is currently OFF, the GPS power supply will automatically be turned ON, when the last message has been sent to the communication server, the GPS engine power supply will be turned OFF, a data filter is provided, allowing the tracking base to send messages only if the current GPS position is valid, unvalidated position fix are ignored and thus no messages are sent. The number of messages sent (from 1 up to 255) will depend of the value inserted into the TDX® command. After each transmission this counter register will be decremented. Time intervals between transmissions are determined by the values stored in the RTC interval unit and RTC interval counter registers respectively located at addresses 20h and 21h. The RTC interval unit register must contain one of the four following values: 04h for second, 05h for minute, 06h for hour and 07h for month. The RTC interval counter register must contain any value from 1 up to 255 (01h up to FFh). Please note that if the battery pack or the DC/DC converter is detached from the tracking base, the GPS tracking sequence will be aborted.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*counter*>,<filter><stopchar>

```
12345678,+32475123456,4E,96,U#
```

This example demonstrates how to start a GPS tracking sequence, if <filter> is U, the tracking base will send 150 position messages at regular intervals independently of the signal quality of the $GPRMC NMEA GPS position (A or V). if <filter> is F, the tracking base will send a maximum of 150 position messages at regular or multiple of regular intervals depending of the signal quality of the $GPRMC NMEA GPS position (A or V) thus in any case the GPS tracking counter register will be decremented. Lower case of U and F are not supported.
Assuming that the RTC interval unit and the RTC interval counter registers have previously been respectively filled with 05h and 2Dh, position messages will be sent by the tracking base to the communication server every 45 minutes.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),4E,OK#
```

The tracking base returns a confirmation message, after 45 minutes the first of the 150 position messages will be sent by the tracking base, please refer to the UNSOLICITED MESSAGES chapter for a complete description of the content of these messages.

STOP GPS TRACKING SEQUENCE — 4Fh

DESCRIPTION: This TDX® command allow to stop the GPS tracking sequence currently in progress.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,4F#
```

This example demonstrates how to stop the GPS tracking sequence currently in progress.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

```
(12345678),4F,OK#
```

The tracking base returns a confirmation message (even if no GPS tracking sequence was in progress) and the GPS engine power supply is OFF.

GET GPS TRACKING SEQUENCE STATUS — 50h

DESCRIPTION: This TDX® command allow to retrieve the GPS tracking sequence status currently in progress.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,50#
```

This example demonstrates how to retrieve the GPS tracking sequence status currently in progress.

RX FORMAT: <(identifier)>,<*op-code*>,<*counter*>,<filter><stopchar>

```
(12345678),50,1A,F#
```

The tracking base returns a confirmation message, 26 position messages still need to be sent and the signal quality filter is currently enabled, if no GPS tracking sequence was in progress, the counter will be 0 (00h) and filter status will not be defined (can either be F or U).

GET BATTERY STATUS AND GSM RSSI 51h

DESCRIPTION: This TDX® command allow to retrieve the battery charge level and the GSM radio strength signal indication (rssi).

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,51#
```

This example demonstrates how to retrieve the battery charge level and the GSM rssi.

RX FORMAT: <(identifier)>,<*op-code*>,<*batt*><*rssi*><stopchar>

```
(12345678),51,3234#
```

The tracking base returns a confirmation message containing the battery charge level and the GSM rssi.
Battery charge level: (0 to 5), 0 = discharged, 5= full.
Radio strength signal indication: (0 to 5), 0 = poor, 5 = good.
In this example: battery charge level = 2 and rssi = 4
NOTE: the battery charge level and rssi are retrieved from the GSM engine by the microprocessor using the "AT+CIND" AT-command.

RESET TRACKING BASE 52h

DESCRIPTION: This TDX® command allow to reset the tracking base.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,52#
```

This example demonstrates how to remotely reset the tracking base.

RX FORMAT: <(identifier)>,<*op-code*>,<RESET><stopchar>

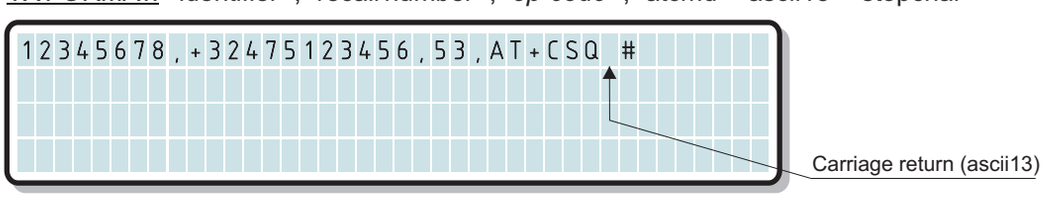
```
(12345678),52,RESET#
```

The tracking base returns a confirmation message, immediately after the message has been sent, the device will be reset.

SEND AT COMMAND TO GSM ENGINE 53h

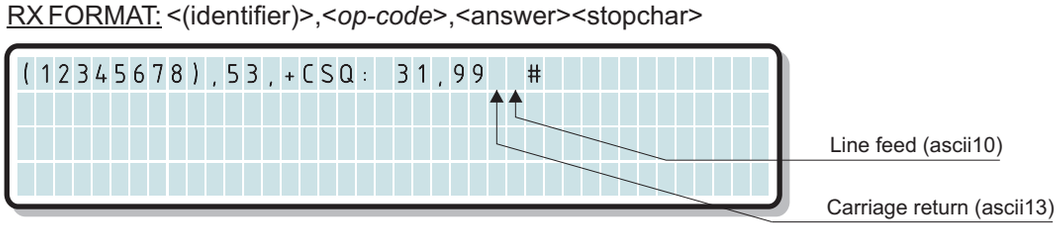
DESCRIPTION: This TDX® command allow to remotely send an AT-command to the GSM engine, the tracking base will return a response message containing the AT command response of the GSM engine.
IMPORTANT: Extreme care must be taken when using this command as it will give full access and the possibility to modify the original default configuration of the modem that may result in an erroneous/erratic microprocessor operation or simply DEFINITIVELY block the product.
For example, if the baud-rate of the serial port is modified, the microprocessor will NEVER be able to communicate with the GSM engine, resulting in a definitively blocked product.
Feel free to contact Traxlogix support to submit the AT-commands you plan to use for an approbation by our technical staff.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<atcmd><ascii13><stopchar>



This example demonstrates how to send an AT-command to the GSM engine, the AT-command string must always be terminated by a carriage return character (ascii13). The length of the AT-command string must never be longer than 120 characters. AT-command string can be sent in lower or upper case, (ascii26) and (ascii27) are prohibited characters.

RX FORMAT: <(identifier)>,<*op-code*>,<answer><stopchar>



The tracking base returns a confirmation message containing the answer of the GSM engine, if the length of the response if more than 145 characters following characters are not returned.

GET CURRENT TEMPERATURE AND ALARM STATUS 54h

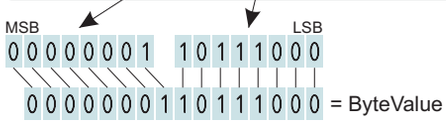
DESCRIPTION: This TDX® command allow to retrieve the current temperature inside the enclosure of the tracking base. A low and high temperature limit can be programmed in the configuration registers of the on-board eeprom, when this command is sent to the tracking base, the temperature is read from the embedded Dallas® DS18B20 temperature sensor and compared to the low and high alarm limits. Temperature resolution is 0.5°C ranging from -55°C to +125°C.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,54#
```

RX FORMAT: <(identifier)>,<*op-code*>,<*curTempLSB*><*curTempMSB*>,<alarmcode><stopchar>

```
(12345678),54,B801,THA#
```



If the decimal value of “ByteValue” is greater than 2048 then the temperature is negative thus apply the following formula to convert “ByteValue” into a negative current temperature in Celsius degrees:
1) 65536 - ByteValue = TX
2) TX/16 = Current NegativeTemperature in Celsius degrees (-°C)
If the decimal value of “ByteValue” is less than 2048 then the temperature is positive thus apply the following formula to convert “ByteValue” into a positive current temperature in Celsius degrees:
ByteValue/16 = Current PositiveTemperature in Celsius degrees (+°C)

Example 1: If curTempLSB = B8h, curTempMSB = 01h
ByteValue = 440 in decimal
Because 440 is less than 2048 then the temperature is Positive thus 440 / 16 = +27.5°C

Example 2: If curTempLSB = 90h, curTempMSB = Fch
ByteValue = 64656 in decimal
Because 64656 is greater than 2048 then the temperature is Negative thus 65536 - 64656 = 880 then 880 / 16 = -55°C

TEMPERATURE ALARM: If the current temperature is ABOVE the temperature high limit previously into the configuration registers of the eeprom, the alarm code will be “THA” for TEMPERATURE HIGH ALARM, if the current temperature is BELOW the temperature low limit previously stored into the eeprom, the alarm code will be “TLA” for TEMPERATURE LOW ALARM, if the current temperature is BELOW the temperature high limit and ABOVE the temperature low limit previously stored into the eeprom, the alarm code will be “TOK” for TEMPERATURE OK.

NOTE 1: If the current temperature is exactly zero degree Celsius, the curTempLSB and the curTempMSB will be 00h, thus 0°C is considered as positive temperature (+0°C).
NOTE 2: Due to the fact that the temperature sensor is fully encapsulated into the tracking base enclosure, keep in mind that some temperature inertia must be kept into account.
NOTE 3: To store a negative and positive temperature limit in the configuration registers, reverse the above formulas.

Dallas semiconductor is a registered trademark of Dallas semiconductor inc.

GET CURRENT GPS POSITION, BATTERY STATUS AND GSM RSSI 55h

DESCRIPTION: This TDX® command allow to retrieve the current GPS position, the battery charge level and the radio strength signal indication of the GSM engine. If this TDX® command is sent to the tracking base and the GPS power supply is currently OFF, the microprocessor of the tracking base will automatically turn the GPS power supply ON and will keep it ON after the confirmation message has been sent to the communication server.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<format><stopchar>

```
12345678,+32475123456,55,A#
```

This example demonstrates how to retrieve the current GPS position, battery status and GSM rssi in ascii. If format is A then the confirmation message will contain data in ascii format, If format is H the confirmation message will contain data in hex format. Lower case of A or H is not supported. Please note that if the GPS receiver power supply is currently OFF or satellites are not in view, the position will be last one stored in the RAM register.

RX FORMAT: <(identifier)>,<*op-code*>,<char1><char2>...<char48><char49><stopchar>

```
(12345678),55,123456V123456789N012345678
9E008010207004010008423#
```

The tracking base returns a confirmation message containing the current GPS position, battery status and GSM rssi in ascii.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<format><stopchar>

```
12345678,+32475123456,55,H#
```

This example demonstrates how to retrieve the current GPS position, battery status and GSM rssi in hexadecimal. If format is A, then the confirmation message will contain data in ascii format, If format is H the confirmation message will contain data in hex format. Lower case of A or H is not supported.

RX FORMAT: <(identifier)>,<*op-code*>,<*data1*><*data2*>...<*data48*><*data49*><stopchar>

```
(12345678),55,313233343536563132333435363
7383945303038303130323037303034303130303038343233#
```

The tracking base returns a confirmation message containing the current GPS position, battery status and GSM rssi in hexadecimal.

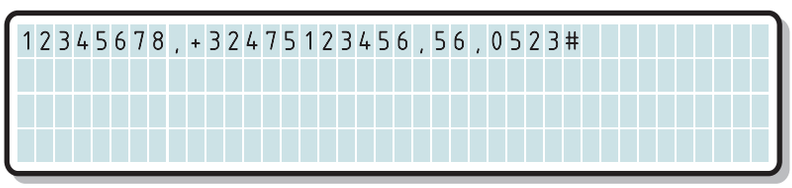
CONTENT OF AN op-code 55h CONFIRMATION MESSAGE

CHAR	DATA DESIGNATION
1	GPS UTC TIME DIGIT HOUR (x10)
2	GPS UTC TIME DIGIT HOUR (x1)
3	GPS UTC TIME DIGIT MINUTE (x10)
4	GPS UTC TIME DIGIT MINUTE (x1)
5	GPS UTC TIME DIGIT SECOND (x10)
6	GPS UTC TIME DIGIT SECOND (x1)
7	GPS SIGNAL QUALITY CHARACTER (A = VALID, V = GPS WARNING)
8	GPS LATITUDE DIGIT 1 (x1000)
9	GPS LATITUDE DIGIT 2 (x100)
10	GPS LATITUDE DIGIT 3 (x10)
11	GPS LATITUDE DIGIT 4 (x1)
12	GPS LATITUDE DECIMAL DIGIT 1 (x0.1)
13	GPS LATITUDE DECIMAL DIGIT 2 (x0.01)
14	GPS LATITUDE DECIMAL DIGIT 3 (x0.001)
15	GPS LATITUDE DECIMAL DIGIT 4 (x0.0001)
16	GPS LATITUDE DECIMAL DIGIT 5 (x0.00001)
17	GPS LATITUDE ORIENTATION CHARACTER (N/S)
18	GPS LONGITUDE DIGIT 1 (x10000)
19	GPS LONGITUDE DIGIT 2 (x1000)
20	GPS LONGITUDE DIGIT 3 (x100)
21	GPS LONGITUDE DIGIT 4 (x10)
22	GPS LONGITUDE DIGIT 5 (x1)
23	GPS LONGITUDE DECIMAL DIGIT 1 (x0.1)
24	GPS LONGITUDE DECIMAL DIGIT 2 (x0.01)
25	GPS LONGITUDE DECIMAL DIGIT 3 (x0.001)
26	GPS LONGITUDE DECIMAL DIGIT 4 (x0.0001)
27	GPS LONGITUDE DECIMAL DIGIT 5 (x0.00001)
28	GPS LONGITUDE ORIENTATION CHARACTER (E/W)
29	GPS COURSE OVER GROUND DIGIT 1 (x100)
30	GPS COURSE OVER GROUND DIGIT 2 (x10)
31	GPS COURSE OVER GROUND DIGIT 3 (x1)
32	GPS DATE DIGIT 1 DAY (x10)
33	GPS DATE DIGIT 2 DAY (x1)
34	GPS DATE DIGIT 3 MONTH (x10)
35	GPS DATE DIGIT 4 MONTH (x1)
36	GPS DATE DIGIT 5 YEAR (x10)
37	GPS DATE DIGIT 6 YEAR (x1)
38	GPS SPEED IN KNOTS DIGIT 1 (x100)
39	GPS SPEED IN KNOTS DIGIT 2 (x10)
40	GPS SPEED IN KNOTS DIGIT 3 (x1)
41	GPS SATELLITES IN VIEW DIGIT 1 (x10)
42	GPS SATELLITES IN VIEW DIGIT 2 (x1)
43	GPS ALTITUDE IN METERS DIGIT 1 (x10000)
44	GPS ALTITUDE IN METERS DIGIT 2 (x1000)
45	GPS ALTITUDE IN METERS DIGIT 3 (x100)
46	GPS ALTITUDE IN METERS DIGIT 4 (x10)
47	GPS ALTITUDE IN METERS DIGIT 5 (x1)
48	BATTERY CHARGE LEVEL DIGIT (0 TO 5) 0 = DISCHARGED, 5 = FULL
49	GSM RSSI DIGIT (0 TO 5) 0 = POOR, 5 = GOOD

MODIFY REAL TIME CLOCK PARAMETERS 56h

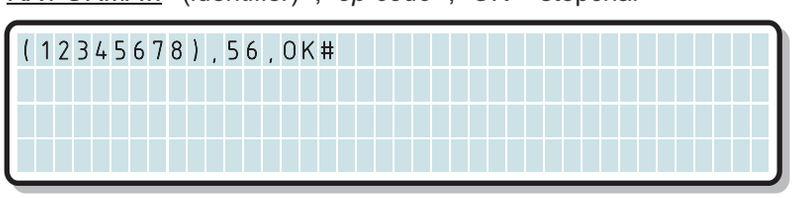
DESCRIPTION: This TDX® command allow to configure, modify and update the RTC (real time clock) of the tracking base. Even if it's also possible to configure the RTC parameters using the TDX® command WRITE CONFIGURATION REGISTERS AND RESET (op-code 42H) described earlier in this document, this command will only modify the RTC time unit and RTC time counter registers respectively located at addresses 20h and 21h of the eeprom then update the current time interval but without resetting the tracking base.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*RegUnit*><*RegCounter*><stopchar>



This example demonstrates how to set a time interval of 35 minutes. RegUnit support four different values only: 04h for 1 second, 05h for 1 minute, 06h for 1 hour and 07h for 1 month. RegCounter support any value from 1 to 255. To calculate a time interval apply the following formula: unit x counter = time interval, in this case 1 minute x 35 = time interval of 35 minutes.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>

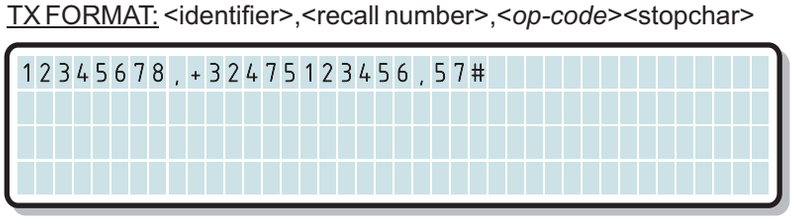


The tracking base returns an OK confirmation message.

GET REAL TIME CLOCK PARAMETERS 57h

DESCRIPTION: This TDX® command allow to retrieve the current RTC (real time clock) parameters of the tracking base.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to retrieve the current RTC parameters.

RX FORMAT: <(identifier)>,<*op-code*>,<*RegUnit*><*RegCounter*><*RamRegCounter*><stopchar>

```
(12345678),57,042302#
```

The tracking base returns a confirmation message containing the current values of the RTC time unit, RTC time counter and current RTC time counter in RAM registers.

GET RAW DATA FROM GPS ENGINE 58h

DESCRIPTION: This TDX® command allow to retrieve an NMEA raw data message from the GPS engine in ascii format. If this TDX® command is sent to the tracking base and the GPS power supply is currently OFF, the microprocessor of the tracking base will automatically turn the GPS power supply ON and will keep it ON after the confirmation message has been sent to the communication server.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*MsgToTrap*><stopchar>

```
12345678,+32475123456,58,RMC#
```

This example demonstrates how to retrieve a $GPRMC raw NMEA data string from the GPS engine, MsgToTrap can be GGA, GLL, GSA, GSV*, RMC, VTG, GRS, GST and ZDA only. All other raw data like U-blox® proprietary or binary messages and lower case characters in MsgToTrap are not supported and can cause an erroneous/erratic microprocessor operation.

*In some cases $GPGSV can return a multiple line message, but the confirmation message will only contain the first line of the GSV message.

RX FORMAT: <(identifier)>,<*op-code*>,<GPSdata><stopchar>

```
(12345678),58,$GPRMC,161407.00,A,4321.23
456,N,00421.42881,E,0.233,142.07,180206,
,,A*6B#
```

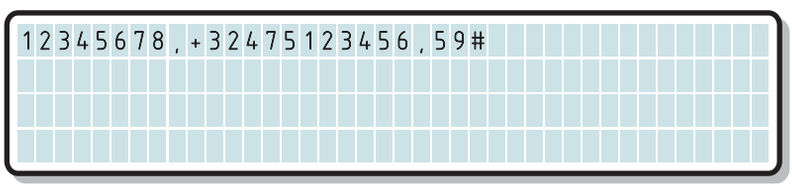
The tracking base returns a confirmation message containing:
$GPRMC,161407.00,A,4321.23456,N,00421.42881,E,0.233,142.07,180206,,,A*6B

U-blox® is a registered trademark of U-blox AG.

SEND WAKE-UP ALERT 59h

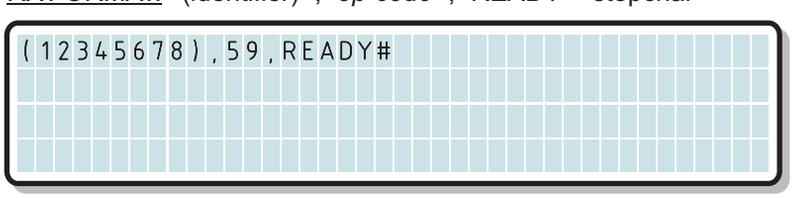
DESCRIPTION: This TDX® command allow to wake-up the tracking base when in sequential mode, when this command is sent, as soon as the tracking base wake-up, the incoming SMS will be caught by the microprocessor then a confirmation message is sent to the communication server and the product is toggled in continuous mode waiting for further TDX® commands.
Please note that if the tracking base is in sleep mode, the message will only be caught when the unit is waked-up by the RTC at the time interval expiration.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to toggle the tracking base in continuous mode when the RTC wake-up the unit at the time interval expiration. Please note that when the tracking base is toggled in sequential mode, if a GPS tracking sequence was in progress, this sequence is automatically aborted.

RX FORMAT: <(identifier)>,<*op-code*>,<READY><stopchar>



The tracking base returns a confirmation message confirming that the tracking base has been toggled in continuous mode and is ready for further action.

WRITE GPRS CONNECTION PARAMETERS PART A 5Ah

DESCRIPTION: This TDX® command allow to write the GPRS parameters required to establish a connection and exchange data in FTP protocol at the condition that the SIM card subscription include a GPRS access. These parameters are stored in the eeprom of the tracking base, thus won't be lost if the battery is disconnected. Up to 255 acsii characters can be stored, fields are comma or semicolon separated. As it is not possible to send 256 characters in one single SMS, the memory bank is separated in two parts A & B, each parts may contain up to 128 characters but due to the fact that the last character (256) is used by the microprocessor, the total text string must not exceed 255 characters. Please note it's mandatory to first write the part A before part B.
GPRS parameters must be written in the following order:

<APN*>,<LOGIN>,<PASSWORD>,<IP>,<DNS1>,<DNS2>;<TIMER1*>,<TRIAL*>,<TIMER2*>;<FTPSERV*>,<USERLOG>,<USERPASS>,<PORT*>,<MODE*>;<FTPSUBDIR>
* = Required, these fields cannot be left blank.
IMPORTANT: DNS2 & TIMER1, TIMER2 & FTPSERV, MODE & FTPSUBDIR must always be separated by a semicolon.
Example:**"internet.proximus.be","yourlogin","yourpassword",,"195.238.2.31","195.238.2.32";60,2,70;"ftp://ftp.myownwebsite.com","myusername","myuserpassword",21,1;"/mydedicatedtraxlogixdir"**

Please note that the ? & # characters (ascii 63 & 35) are not allowed in the text string.

TX FORMAT: <identifier>,<recall number>,<GPRSdata><stopchar>

```
12345678,+32475123456,5A,"internet.proxi
mus.be","yourlogin","yourpassword",,"195
.238.2.31","195.238.2.32";60,2,70;"ftp.m
yownwebsite.com","myusern#
```

This example demonstrates how to write the GPRS connection and FTP parameters into the eeprom of the tracking base, due to the fact that in this example the text string is longer than 128 characters it will be needed to use the WRITE GPRS CONNECTION PARAMETERS PART B (op-code 5B) to store the second part of the string.

RX FORMAT: <(identifier)>,<*op-code*>,<char1>...<char128><stopchar>

```
(12345678),5A,"internet.proximus.be","yo
urlogin","yourpassword",,"195.238.2.31",
"195.238.2.32";60,2,70;"ftp.myownwebsite
.com","myusern????????#
```

Regarless of the number of characters that has been written into the eeprom, the tracking base always return a confirmation message containing the first 128 of the 256 characters memory bank. Please note that blank text positions are always filled with a dummy ? character.

WRITE GPRS CONNECTION PARAMETERS PART B — 5Bh

DESCRIPTION: This TDX® command allow to write the GPRS parameters required to establish a connection and exchange data in FTP protocol. These parameters are stored in the eeprom of the tracking base thus won't be lost if the battery is disconnected. Up to 255 acsii characters can be stored, fileds are comma or semicolon separated. As it is not possible to send 256 characters in one single SMS, the memory bank is separated in two parts A & B, each parts may contain up to 128 characters but due to the fact that the last character (256) is used by the microprocessor, the total text string must not exceed 255 characters. Please note it's mandatory to first write the part A before part B.
GPRS parameters must be written in the following order:

<APN*>,<LOGIN>,<PASSWORD>,<IP>,<DNS1>,<DNS2>;<TIMER1*>,<TRIAL*>,<TIMER2*>;<FTPSERV*>,<USERLOG>,<USERPASS>,<PORT*>,<MODE*>;<FTPSUBDIR>
* = Required, these fields cannot be left blank.
IMPORTANT: DNS2 & TIMER1, TIMER2 & FTPSERV, MODE & FTPSUBDIR must always be separated by a semicolon.
Example:**"internet.proximus.be","yourlogin","yourpassword",,"195.238.2.31","195.238.2.32";60,2,70;"ftp://ftp.myownwebsite.com","myusername","myuserpassword",21,1;"/mydedicatedtraxlogixdir"**

Please note that the ? & # characters (ascii 63 & 35) are not allowed in the text string.

TX FORMAT: <identifier>,<recall number>,<GPRSdata><stopchar>

```
12345678,+32475123456,5B,ame",“myuserpas
sword",21,1;"/mydedicatedtraxlogixdir“#
```

Assuming that the first part of the text string has been previously stored using the WRITE GPRS CONNECTION PARAMETERS PART A (op-code 5A), This example demonstrates how to write the second part of the GPRS connection and FTP parameters into the eeprom of the tracking base, due to the fact that in this example the text string is longer than 128 characters it will be needed to write the parameters in two parts.

RX FORMAT: <(identifier)>,<*op-code*>,<char129>...<char256><stopchar>

```
(12345678),5B,ame",“myuserpassword",21,1
;"/mydedicatedtraxlogixdir"????????????????
????????????????????????????????????????
????????????????????????#
```

Regarless of the number of characters that has been written into the eeprom, the tracking base always return a confirmation message containing the second 128 of the 256 characters memory bank. Please note that blank text positions are always filled with a dummy ? character.

GPRS DATA DEFINITION

APN*:
Internet access point, delivered by the GPRS network provider.

LOGIN*:
Username required to access the APN, delivered by the network provider if the access is protected.

PASSWORD*:
Password required to access the APN, delivered by the network provider if the access is protected.

IP*:
IP address if required (if a dynamic IP address is provided by network, can be left blank).

DNS1*:
Must be left blank if not used.

DNS2*:
Must be left blank if not used.

TIMER1:
Connection time-out in seconds, must be between 15 and 120 sec (30 is recommended as default value).

TRIAL:
Number of attempts to connect to the network, must be between 1 and 4 (2 is recommended as default value).

TIMER2:
Linger timer is seconds, must be between 60 and 300 sec (60 is recommended as default value).

FTPSERV*:
Internet address where the FTP server is located.

USERLOG*:
Username required to gain upload and download access to the concerned FTP directory, only if the access is protected.

USERPASS*:
Password required to gain upload and download access to the concerned FTP directory, only if the access is protected.

PORT:
Specify the remote command port (21 is recommended as default value for FTP transfer).

MODE:
Specify the transmission mode, 0 for Active, 1 for Passive (0 is recommended as default value for mode).

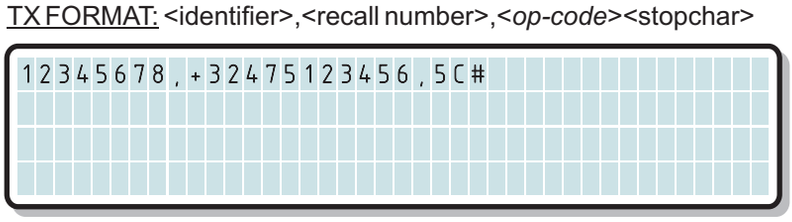
FTPSUBDIR*:
Specify where the upload/download directory is located.

* = These fields when used must always be placed between double quote (ascii34).

READ GPRS CONNECTION PARAMETERS PART A — 5Ch

DESCRIPTION: This TDX® command allow to read the first 128 characters of the currently stored GPRS connection parameters . As it is not possible to read 256 characters in one single SMS, the memory bank is separated in two parts A & B, each parts may contain up to 128 characters.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to retrieve the first 128 characters of the GPRS connection parameters currently stored into the eeprom of the tracking base.

RX FORMAT: <(identifier)>,<*op-code*>,<char1>...<char128><stopchar>

```
(12345678),5C,"internet.proximus.be","yo
urlogin","yourpassword",,"195.238.2.31",
"195.238.2.32";60,2,70;"ftp.myownwebsite
.com","myusername","my#
```

The tracking base always return a confirmation message containing the first 128 of the 256 characters memory bank. Please note that blank text positions are always filled with a dummy ? character.

READ GPRS CONNECTION PARAMETERS PART B — 5Dh

DESCRIPTION: This TDX® command allow to read the second 128 characters of the currently stored GPRS connexion parameters. As it is not possible to read 256 characters in one single SMS, the memory bank is separated in two parts A & B, each parts may contain up to 128 characters.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>

```
12345678,+32475123456,5D#
```

This example demonstrates how to retrieve the second 128 characters of the GPRS connection parameters currently stored into the eeprom of the tracking base.

RX FORMAT: <(identifier)>,<*op-code*>,<char129>...<char256><stopchar>

```
(12345678),5D,userpassword",21,1;"/myded
icatedtraxlogixdir"????????????????????
????????????????????????????????????????
????????????????????????#
```

The tracking base always return a confirmation message containing the second 128 of the 256 characters memory bank. Please note that blank text positions are always filled with a dummy ? character.

SEND LOG MEMORY CONTENT TO AN FTP SERVER 5Eh

DESCRIPTION: This TDX® command allow to upload the content of the event log memory located into the battery pack of the tracking unit to an FTP (file transfer protocol) server. The GPRS parameters currently stored into the eeprom of the tracking base will be used for the data transfer. In place of a RX format confirmation message, a text file with the log content is placed in the concerned directory, please note that the directory must not contain a previously uploaded file or the transfer will be aborted, as a good practise always transfer to another local directory and then delete the file as soon as received, the transferred file name will be the identifier, underscore and the two op-codes characters because the text file is transmitted from the tracking base, file extension will be .trs, as in the other direction files must have the .trr extension.

TX FORMAT: <identifier>,<recall number>,<*op-code*>cc

```
12345678,+32475123456,5E#
```

This example demonstrates how to upload the content of the log memory to an FTP server, even if in this case the recall number will not be used, for compatibility reason, the TX format still need to be respected thus the recall number must be either inserted or replaced by a comma. In this example, a file named: 12345678_5E.trs will be uploaded to the concerned directory.

REQUEST ASSISTED GPS ONLINE AIDING 5Fh

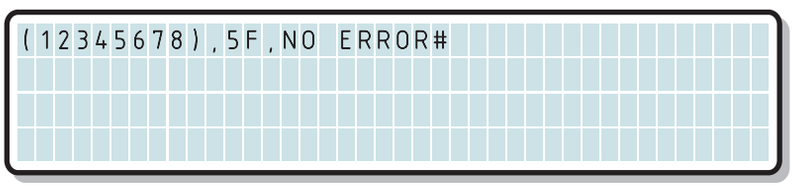
DESCRIPTION: This TDX® command allow to request the tracking unit to access the U-Blox® AssistNow® online server using a GPRS connection, to download the binary data and transfer them to the GPS receiver in order to reduce the first time to first fix (TTFF), this command will help the GPS receiver to find a first position in degraded radio signal receiving conditions. The parameters used to establish the GPRS connection are the same as the ones used for the LOG memory content FTP transfer. The TX format message must contain the following parameters: server address, port number, username, password, approximated latitude, approximated longitude, position accuracy (optional). Please note that when this command is sent to the tracking base, the RTC parameters are not affected, but the clock circuitry will be re-initialized. This command automatically turn the GPS receiver ON and will keep it ON after the procedure has been executed.
This command requires to open an AssistNow® Premium account from U-Blox® AG.
NOTE: This TDX® command is only available on tracking base with firmware version 3.10 or later.

TX FORMAT:<identifier>,<recall>,<*op-code*>,<serv>,<prt>,<cdl>,<cd>;<usr>;<pw>;<lat>;<lon>;<accur><stopchar>

```
12345678,+32475123456,5F,"dragon.u-blox.
com",46434,71,cmd=aid;user=xyz@hotmail.c
om;pwd=whatever;lat=47.28;lon=8.56;pacc=
1000#
```

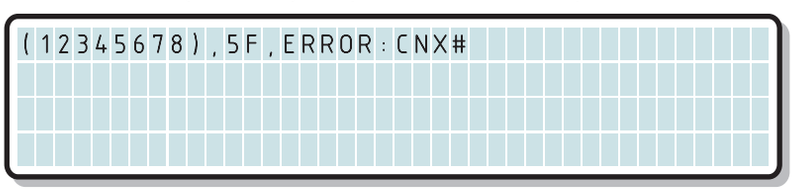
This example demonstrates how to request the tracking base to establish a GPRS connection with the AssistNow® online server from U-Blox AG.
All parameters and commas must be contained in a string of 120 characters maximum. Parameter fields must be separated by commas or semi colon, decimal character used for latitude and longitude must be a point (asc46). All parameters are mandatory except position accuracy, which is optional. For a complete definition how the data of the A-GPS data string must be formatted, please request the U-Blox® PDF document: "Implementing GPS Assistance Data for Antaris® based receivers" ref: GPS.G4-SW-05017 from www.u-blox.com

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>



The tracking base returns a NO ERROR confirmation message to confirm that no error has been detected during the Assisted GPS procedure.

RX FORMAT: <(identifier)>,<*op-code*>,<OK><stopchar>



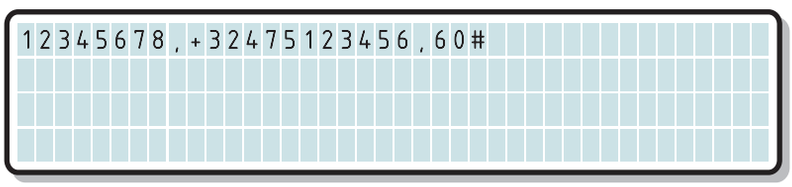
If an error has been detected during the Assisted GPS procedure, the confirmation message will contain one of the following error code:

- CNX GPRS network connection error
- TMR Timer parameter error
- GAT Not attached to network error
- CFG TCP address and/or port number error
- PNX Initiate connection error
- SND GPRS data transmission error
- RCV GPRS data reception error
- NOR No response from server error
- NCO No "CONNECT" received after data reception request

RETRIEVE LOG MEMORY FORMATTING STATUS 60h

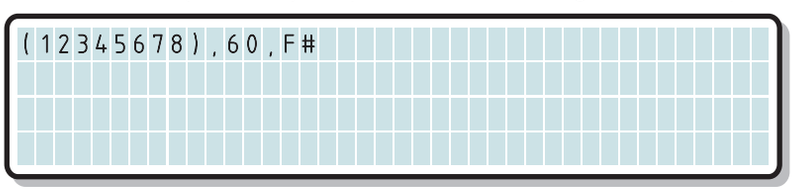
DESCRIPTION: This TDX® command allow to retrieve the status of the LOG memory embedded in the battery pack attached to the tracking base. When delivered, the battery packs are unformatted, **prior** to request the tracking base to store events into the LOG memory or to send LOG memory content to an FTP server, it's **mandatory** to format this memory. Thus, this TDX® command allow to find out if the memory of the battery pack currently attached to the tracking base has been previously formatted.
NOTE: This TDX® command is only available on tracking base with firmware version 3.13 or later.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to retrieve the status of the LOG memory embedded in the battery pack attached to the tracking base.

RX FORMAT: <(identifier)>,<*op-code*>,<formatting status><stopchar>

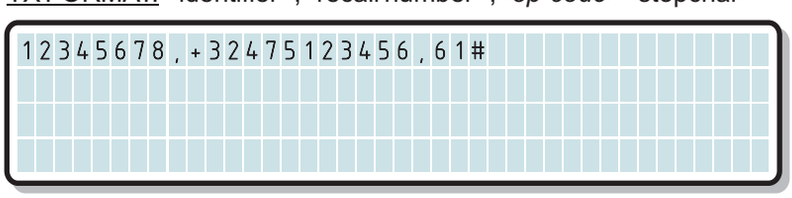


The tracking base returns a confirmation message confirming that the LOG memory of the battery pack attached to the tracking base has already been formatted, U = Unformatted, F= Previously formatted, if the status cannot be determined by the tracking base, for example if the tracking base is currently connected to an evaluation kit (thus no battery attached) the formatting status confirmation message will contain FAIL.

FORMAT LOG MEMORY 61h

DESCRIPTION: This TDX® command allow to format the LOG memory embedded in the battery pack attached to the tracking base. When delivered, the battery packs are unformatted, **prior** to request the tracking base to store events into the LOG memory or to send LOG memory content to an FTP server, it's **mandatory** to format the LOG memory. Please note that this formatting procedure takes approx. 228 seconds, the red led of the tracking base is turned ON during procedure execution.
NOTE: This TDX® command is only available on tracking base with firmware version 3.13 or later.

TX FORMAT: <identifier>,<recall number>,<*op-code*><stopchar>



This example demonstrates how to format the LOG memory embedded in the battery pack attached to the tracking base.

RX FORMAT: <(identifier)>,<*op-code*>,<formatting result><stopchar>

```
(12345678),61,OK#
```

The tracking base returns a confirmation message confirming that the LOG memory of the battery pack attached to the tracking base has been successfully formatted, if the format cannot be executed by the tracking base, for example if the tracking base is currently connected to an evaluation kit (thus no battery attached) the confirmation message will contain FAIL.

CONTROL ACCESSORY I/O PORT 62h

DESCRIPTION: This TDX® command allow to individually set or clear the bits of the general purpose I/O port available on the FPC 20 pole accessory connector, this command must be used if the tracking base is currently attached to an evaluation kit (EVK-01 or EVK-02) and the two FPC connectors (20 & 30 pole) must of course be connected.
Please note that when the tracking base resets, the port value is 00.
NOTE: This TDX® command is only available on tracking base with firmware version 3.14 or later.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*PortValue*><stopchar>

```
12345678,+32475123456,62,FF#
```

This example demonstrates how to set the 8 bits of the general purpose I/O port of the tracking base. Leds RF0, RF1, RF2, RF3, RF4, RF5, RF6 and RF7 of the evaluation kit are turned ON.

TX FORMAT: <identifier>,<recall number>,<*op-code*>,<*PortValue*><stopchar>

```
12345678,+32475123456,62,00#
```

This example demonstrates how to clear the 8 bits of the general purpose I/O port of the tracking base. Leds RF0, RF1, RF2, RF3, RF4, RF5, RF6 and RF7 of the evaluation kit are turned OFF.

RX FORMAT: <(identifier)>,<*op-code*>,<formatting status><stopchar>

```
(12345678),62,OK#
```

The tracking base returns a confirmation message confirming that the I/O port has been uploaded accordingly.

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NOTIFICATION MESSAGES DEFINITION

BATTERY ID NOTIFICATION ON PRODUCT START — 80h

DESCRIPTION: This TDX® unsolicited message sends the nine digits battery identification number in hex format when the product starts, this message is only sent if the bit0 of the device configuration register 1 is true.

RX FORMAT: <(identifier)>,<*op-code*>,<*battid1*><*battid2*>...<*battid8*><*battid9*><stopchar>

```
(12345678),80,313233343536373839#
```

When the product is powered-on, the tracking base send a notification message containing the battery identification number in hex format, in this example the battery identification number is 123456789.

NEW BATTERY ID NOTIFICATION ON PRODUCT START — 81h

DESCRIPTION: This TDX® unsolicited message sends the nine digits battery identification number in hex format when the product starts, but only if a new battery is detected.This function will allow to detect if for example the end user has well replaced the battery by a new one, this message is only sent if the bit1 of the device configuration register 1 is true.

RX FORMAT: <(identifier)>,<*op-code*>,<*battid1*><*battid2*>...<*battid8*><*battid9*><stopchar>

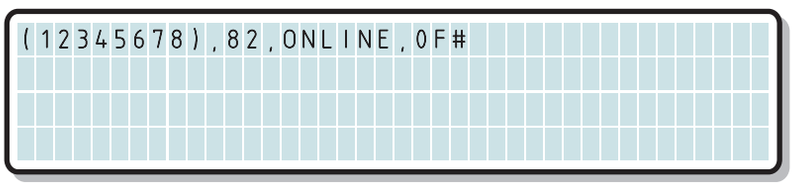
```
(12345678),81,313233343536373839#
```

When the product is powered-on, the tracking base send a notification message containing the new battery identification number in hex format, in this example the new battery identification number is 123456789.

ONLINE NOTIFICATION ON PRODUCT START 82h

DESCRIPTION: This TDX® unsolicited message sends the word ONLINE in ascii format and the current value of the SMS Catch Timer register when the product starts, this message is only sent if the bit6 of the device configuration register 1 is true. This message will allow the communication server to detect that the tracking base has been correctly started. Please note that this message is sent regardless of the tracking base mode (sequential or continuous).

RX FORMAT: <(identifier)>,<*op-code*>,<ONLINE>,<*SMScatch*><stopchar>

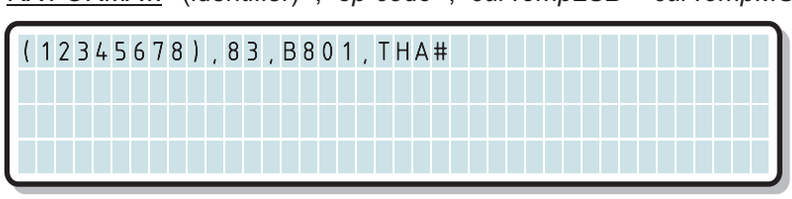


When the product is powered-on, the tracking base send a notification message containing the word ONLINE, in this example the current value in hex format of the SMS catch timer register indicating that the product will remain online, waiting for an incoming SMS for 150 seconds if in sequential mode, before going back to sleep mode.

CURRENT TEMPERATURE NOTIFICATION AND ALARM STATUS 83h

DESCRIPTION: This TDX® unsolicited message sends the current temperature and related alarm status if the bit3 of the device configuration register 1 is true. This temperature check procedure is executed in accordance with the RTC time interval expiration. If the bit4 of the device configuration register 1 is true, this message will be sent at every RTC time interval expiration, if the bit4 is false, messages are only sent if a temperature alarm status change is detected by the microprocessor.

RX FORMAT: <(identifier)>,<*op-code*>,<*curTempLSB*><*curTempMSB*>,<alarmcode><stopchar>



The tracking base sends a message containing the current temperature and related alarm status, please refer to GET CURRENT TEMPERATURE AND ALARM STATUS (op-code 54h) for a complete description of the temperature and alarm status format.

TRACKING SEQUENCE GPS POSITION NOTIFICATION 84h

DESCRIPTION: This TDX® unsolicited message sends the tracking sequence counter status, the current GPS position, the battery charge level and GSM rssi indication, this message is only sent to the communication server if a tracking as previously been started. Please note that the current GPS position, battery charge level and GSM rssi are in ascii format, allowing to test the product on the field with a mobile phone. The GPS ascii data format is identical to the GET CURRENT GPS POSITION, BATTERY STATUS AND GSM RSSI (op-code 55h) command.

RX FORMAT: <(identifier)>,<*op-code*>,<*counter*><char1><char2>...<char48><char49><stopchar>

```
(12345678),84,AC123456V123456789N0123456
789E00801020700401000842 3#
```

The tracking base returns a notification message containing the status of the tracking sequence counter in hex format, the current GPS position, battery status and GSM rssi in ascii format. For a complete description of the GPS data please refer to GET CURRENT GPS POSITION, BATTERY STATUS AND GSM RSSI (op-code 55h) command. In this example, the current value of the tracking counter is 172.

RTC ERROR NOTIFICATION 85h

DESCRIPTION: This TDX® unsolicited message is sent if an error has been detected in the RTC circuitry of the tracking unit. The RTC crystal oscillator can be sensitive to excessive condensation that can sometimes result in an oscillator halt, in this case, it will be mandatory to reload the RTC parameters and reconfigure if required the tracking product in sequential mode because when this error message is sent, the tracking unit is always forced to continuous mode. Please note that it's mandatory for the communication server application to include the eventuality of getting this error message.

RX FORMAT: <(identifier)>,<*op-code*>,<FAIL><stopchar>

```
(12345678),85,FAIL#
```

The tracking base sends a notification error message with the word FAIL in upper case.

CELL-ID GEOFENCING RESULT NOTIFICATION 86h

DESCRIPTION: This TDX® unsolicited message is sent if the Cell-ID geofencing procedure is enabled in the Cell-ID configuration registers. This message will contain the result of the Cell-ID procedure register <result> followed by the last transmission reference register <lastTX> for the 64 zones. The result and last transmission characters are in ascii format, 0 (ascii48) correspond to a "disabled zone", 1 (ascii49) stands for "no alarm status" and 2 (ascii50) for an "alarm status".

RX FORMAT: <(identifier)>,<*op-code*>,<result1><lastTX1>...<result64><lastTX64><stopchar>

```
(12345678),86,2112211212122122000000000000
0000000000000000000000000000000000000000000000
0000000000000000000000000000000000000000000000
00000000000000000000000#
```

The tracking base sends a notification message containing the result of the Cell-ID procedures and the last transmission reference registers of the 64 zones.

GPS GEOFENCING RESULT NOTIFICATION 87h

DESCRIPTION: This TDX® unsolicited message is sent if the GPS geofencing procedure is enabled in the GPS configuration registers. This message will contain the current GPS position of the tracking base in ascii followed by the result of the GPS geofencing procedure registers. The result is encoded in a format that allow to transmit results details in a single byte per zone. For a definition of the GPS position data format, please refer to GET CURRENT GPS POSITION, BATTERY STATUS AND GSM RSSI (op-code 55h) command, but note that the battery charge level and GSM rssi are not available in this message.

RX FORMAT: <(identifier)>,<*op-code*>,<GPSpos>,<GPSgeo1>...<GPSgeo64><stopchar>

```
(12345678),87,123456V123456789N012345678
9E0080102070040100084,ACHFgdjFgbFsfdarcA
RfgytGfFHhHHfGcgfFfgKklKhjhGhgHHhhgFAsDd
JKGCFg#
```

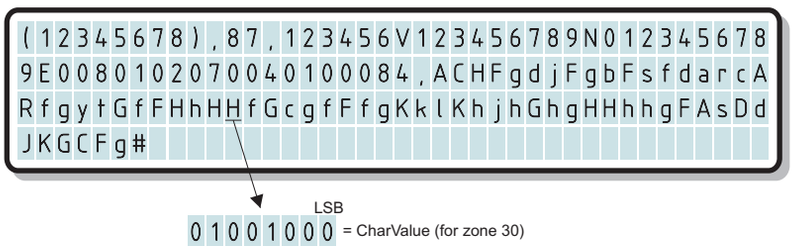
LSB
01100011 = CharValue (for zone 33)

If the decimal value of “CharValue” is greater than 96 then the current GPS speed is below the maximum speed limit thus the following formula apply:
CharValue - 97 = ResultValue

In this example: CharValue = 99, thus greater than 96, thus the current GPS speed is below the maximum speed limit, 99 - 97 = 2, ResultValue = 2

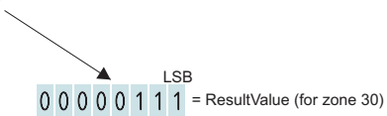
LSB
00000010 = ResultValue (for zone 33)

RX FORMAT: <(identifier)>,<*op-code*>,<GPSpos>,<GPSgeo1>...<GPSgeo64><stopchar>



If the decimal value of “CharValue” is not greater than 96 then the current GPS speed is above the maximum speed limit thus the following formula apply:
CharValue - 65 = ResultValue

In this example: CharValue = 72, thus not greater than 96, thus the current GPS speed is above the maximum speed limit, 72 - 65 = 7, ResultValue = 7



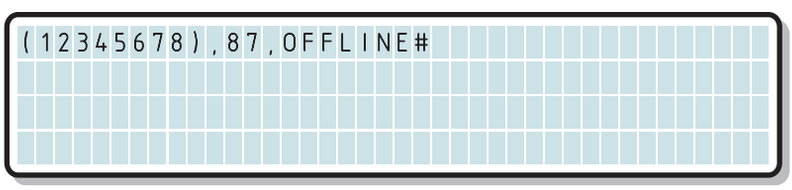
Definition of bits status for ResultValue

BIT	VALUE	DESCRIPTION
0 LSB	1	Tracking base is located below the top line of the square zone
	0	Tracking base is located above the top line of the square zone
1	1	Tracking base is located above the bottom line of the square zone
	0	Tracking base is located below the bottom line of the square zone
2	1	Tracking base is located at the right hand side of the left line of the square zone
	0	Tracking base is located at the left hand side of the left line of the square zone
3	1	Tracking base is located at the left hand side of the right line of the square zone
	0	Tracking base is located at the right hand side of the right line of the square zone
4	1	Reserved
	0	Reserved
5	1	Reserved
	0	Reserved
6	1	Reserved
	0	Reserved
7	1	Reserved
	0	Reserved

OFFLINE NOTIFICATION 88h

DESCRIPTION: This TDX® unsolicited message is sent if bit4 of the device configuration register 2 is true, it indicates that the tracking base enter in sleep mode.

RX FORMAT: <(identifier)>,<*op-code*>,<OFFLINE><stopchar>



The tracking base sends a notification message containing the word OFFLINE that indicates that the product enter in sleep mode.