



**ST7200 Data Format
and Decodification**

**ST7200
Data Format and Decoding**

Revision 0.2

06/20/2014

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0.2	Renato Motta	Changed the name of the document from "ST7200 Data Format and Decodification" to "ST7200 Data Format and Decoding" Added Note about ASCII format only	06/19/2014

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DRAFT

Objective

The objective of this document is to provide the user with detailed information regarding the data format and protocol available for the ST7200, it includes how the report messages are sent to the backend server, how to server should handle those messages including how to send the correct ACK confirmation to the device and how to send commands via UDP protocol. The ST7200 can accept commands via serial, SMS or UDP. In this document it describes how the device sends its event report messages over TCP or UDP and how to send commands to the device using the UDP protocol.

References

- 1 - ST7200 Command Set
- 2 – ST7200 User Guide

DRAFT

Device TCP/UDP Message Format for Periodic Locations and Alert Messages

All periodic reporting and alert messages are TCP/UDP based.

Note: All messages from the ST7200 are in ASCII format only.

Type 1 Messages

All the reports that are Type 1 Messages have the following syntax:

\$\$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM> [,<SEQ>]##

Data Format	\$\$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM> [,<SEQ>]##
Parameters	Description
<UID>	Unit ID – 15 digits IMEI
<EV#>	Event number code that triggered the report
<D>	UTC Date of trigger (10 characters – YYYY/MM/DD)
<T>	UTC Time of trigger (8 characters – HH:MM:SS)
<LT>	Latitude in degrees (5 digits after decimal point)
<LN>	Longitude in degrees (5 digits after decimal point)
<AL>	Altitude (meters)
<SP>	Speed (mph) read from GPS
<HD>	Heading (degrees)
<SV>	Number of satellites used for position fix
<HP>	HDOP (GPS accuracy figure of merit)
<BV>	Battery voltage
<CQ>	GSM receive signal strength
<MI>	Miles driven since last reset or power cycle. If disabled, this value will remain at zero
<GS>	GPS status where 0=not locked, 1=locked, 2= no com and 3=GPS OFF power saving mode
<BB>	Back-up Battery voltage
<PM>	Last Power-up/Reset mode: 1=SW Reset, 2=DC Pwr-Up, 3= Motion Sense, 4= Interval Wake-up, 5= IN1
[<SEQ>]	If UDPwAck mode is selected, SEQ is a 3 digit decimal sequence number from 0 to 255 which increments on each successful UDP with ACK response from server. Field is always at end of string (prior to ##) for UDPwAck and is omitted for TCP

and UDP (w/o ACK) modes.

Example:

**\$\$354660046140722,6001,2013/01/22,15:36:18,25.80907,-
80.32531,7.1,19,165.2,11,0.8,11.1,17,1,1,3.9,2##**

	Parameter	Value	Meaning
	\$\$	\$\$	Start of string
1	<UID>	354660046140722	Callsign - Unit ID. The 15 digit IMEI number
2	<EV#>	6001	Status Code - Event ID
3	<D>	2013/01/22	UTC Date of trigger (YYYY/MM/DD)
4	<T>	15:36:18	UTC Time of trigger (HH:MM:SS)
5	<LT>	25.80907	Latitude in degrees. Floating Point with 5 digits after decimal
6	<LN>	-80.32531	Longitude in degrees. Floating Point with 5 digits after decimal
7	<AL>	7.1	Altitude in meters
8	<SP>	19	Speed in MPH
9	<HD>	165.2	Heading in degrees
10	<SV>	11	Number of Satellites
11	<HP>	0.8	HDOP
12	<BV>	11.1	External Battery Voltage
13	<CQ>	17	GSM Signal Strength
14	<MI>	1	Miles driven since last reset or power cycle.
15	<GS>	1	GPS Status: 0 – no lock 1 – locked 2 – no comm. 3 – GPS OFF (power save mode)
16	<BB>	3.9	Internal Battery Voltage
17	<PM>	2	Last Power-up/Reset mode 1 – S/W Reset 2 – DC Power-Up 3 – Motion Sense 4 – Internal Wake-up 5 – Input 1
18	<SEQ>	BLANK	BLANK
	##	##	End of string

Note: <SEQ> is the sequence number that will be used if acknowledge is enabled. In this example it is not enabled.

Note: These messages will come in the comma-delimited format indicated above.

Event Number Codes for Type 1 Messages

Event Number Code	Meaning
4001	Wired Ignition ON - Periodic Reporting
4002	Wired Ignition OFF - Periodic Reporting
4003	Virtual Ignition ON - Periodic Reporting
4004	Virtual Ignition OFF - Periodic Reporting
4005	Main Battery Disconnect – Periodic Reporting
6001	Direction Change
6002	Speed Threshold
6005	Mileage Threshold
6008	Main Battery Threshold
6009	Main Battery Disconnect
6010	Main Battery Reconnect
6011	Wired Ignition ON
6012	Wired Ignition OFF
6013	Virtual Ignition ON
6014	Virtual Ignition OFF
6016	Idle Threshold
6017	Towing Started
6018	Towing Stopped
6019	Input 2 High
6020	Input 2 Low
6021	Power Shutdown Pending
6022	Power Shutdown Canceled
6026	Wake on Motion
6030	Movement Started
6031	Movement Stopped
6032	Parked Time Threshold

Type 2 Messages

The reports that are Type 2 Messages have the following syntax:

```
$$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM>,<XY>[,<SEQ>]##
```

Data Format	\$\$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM>,<XY>[,<SEQ>]##
-------------	---------------------------------------------------------------------------------------------------------

Parameters	Description
<UID>	Unit ID – 15 digits IMEI
<EV#>	Event number code that triggered the report
<D>	UTC Date of trigger (10 characters – YYYY/MM/DD)
<T>	UTC Time of trigger (8 characters – HH:MM:SS)
<LT>	Latitude in degrees (5 digits after decimal point)
<LN>	Longitude in degrees (5 digits after decimal point)
<AL>	Altitude (meters)
<SP>	Speed (mph) read from GPS
<HD>	Heading (degrees)
<SV>	Number of satellites used for position fix
<HP>	HDOP (GPS accuracy figure of merit)
<BV>	Battery voltage
<CQ>	GSM receive signal strength
<MI>	Miles driven since last reset or power cycle. If disabled, this value will remain at zero
<GS>	GPS status where 0=not locked, 1=locked, 2= no com and 3=GPS OFF power saving mode
<BB>	Back-up Battery voltage
<PM>	Last Power-up/Reset mode: 1=SW Reset, 2=DC Pwr-Up, 3= Motion Sense, 4= Interval Wake-up, 5= IN1
<XY>	X=Geofence ID number and Y=1 is outside of fence violation and Y=2 is inside the fence violation (valid on 6004 alert only)
[<SEQ>]	If UDPwAck mode is selected, SEQ is a 3 digit decimal sequence number from 0 to 255 which increments on each successful UDP with ACK response from server. Field is always at end of string (prior to ##) for UDPwAck and is omitted for TCP and UDP (w/o ACK) modes.

Example:

\$\$354660046140722,6004,2013/01/24,16:08:54,25.80224,-80.33307,2.5,13,115.7,10,0.9,0.0,19,0,1,3.7,2,02##

	Parameter	Value	Meaning
	\$\$	\$\$	Start string
1	<UID>	354660046140722	Callsign - Unit ID. The IMEI number.
2	<EV#>	6004	Status Code - Event ID
3	<D>	2013/01/24	UTC Date of trigger (YYYY/MM/DD)
4	<T>	16:08:54	UTC Time of trigger (HH:MM:SS)
5	<LT>	25.80224	Latitude in degrees. Floating Point with 5 digits after decimal
6	<LN>	-80.33307	Longitude in degrees. Floating Point with 5 digits after decimal
7	<AL>	2.5	Altitude in meters

8	<SP>	13	Speed in MPH
9	<HD>	115.7	Heading in degrees
10	<SV>	10	Number of Satellites
11	<HP>	0.9	HDOP
12	<BV>	0.0	External Battery Voltage
13	<CQ>	19	GSM Signal Strength
14	<MI>	0	Miles driven since last reset or power cycle.
15	<GS>	1	GPS Status: 0 – no lock 1 – locked 2 – no comm. 3 – GPS OFF (power save mode)
16	<BB>	3.7	Internal Battery Voltage
17	<PM>	2	Last Power-up/Reset mode 1 – S/W Reset 2 – DC Power-Up 3 – Motion Sense 4 – Internal Wake-up 5 – Input 1
18	<XY>	02	Geofence Information: X=Geofence ID number (0 – 9) Y=1 outside geofence Y=2 inside geofence 02 -> Geofence ID = 0 Device is inside Geofence 0
19	<SEQ>	BLANK	BLANK
	##	##	End of string

Event Number Codes for Type 2 Messages

Event Number Code	Meaning
6004	Geofence Crossing Alert

Type 3 Messages

The reports that are Type 3 Messages have the following syntax:

\$\$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM>,<FW>,<PF>[,<SEQ>]##

Data Format	Parameters	Description
		\$\$<UID>,<EV#>,<D>,<T>,<LT>,<LN>,<AL>,<SP>,<HD>,<SV>,<HP>,<BV>,<CQ>,<MI>,<GS>,<BB>,<PM>,<FW>,<PF>[,<SEQ>]##
<UID>		Unit ID – 15 digits IMEI
<EV#>		Event number code that triggered the report
<D>		UTC Date of trigger (10 characters – YYYY/MM/DD)
<T>		UTC Time of trigger (8 characters – HH:MM:SS)
<LT>		Latitude in degrees (5 digits after decimal point)
<LN>		Longitude in degrees (5 digits after decimal point)
<AL>		Altitude (meters)
<SP>		Speed (mph) read from GPS
<HD>		Heading (degrees)
<SV>		Number of satellites used for position fix
<HP>		HDOP (GPS accuracy figure of merit)
<BV>		Battery voltage
<CQ>		GSM receive signal strength
<MI>		Miles driven since last reset or power cycle. If disabled, this value will remain at zero
<GS>		GPS status where 0=not locked, 1=locked, 2= no com and 3=GPS OFF power saving mode
<BB>		Back-up Battery voltage
<PM>		Last Power-up/Reset mode: 1=SW Reset, 2=DC Pwr-Up, 3= Motion Sense, 4= Interval Wake-up, 5= IN1
<FW>		Firmware Version
<PF>		Profile name
[<SEQ>]		If UDPwAck mode is selected, SEQ is a 3 digit decimal sequence number from 0 to 255 which increments on each successful UDP with ACK response from server. Field is always at end of string (prior to ##) for UDPwAck and is omitted for TCP and UDP (w/o ACK) modes.

Example:

\$\$354660046140722,4006,2013/01/24,13:03:37,25.80886,-80.18591,8.4,1,0.0,3,2.5,13.8,25,0,0,3.9,2,S4x1-1119B2,Unknown##

Parameter	Value	Meaning
-----------	-------	---------

	\$\$	\$\$	Start of string
1	<UID>	354660046140722	Callsign - Unit ID. The IMEI number.
2	<EV#>	4006	Status Code - Event ID
3	<D>	2013/01/24	UTC Date of trigger (YYYY/MM/DD)
4	<T>	13:03:37	UTC Time of trigger (HH:MM:SS)
5	<LT>	25.80886	Latitude in degrees. Floating Point with 5 digits after decimal
6	<LN>	-80.18591	Longitude in degrees. Floating Point with 5 digits after decimal
7	<AL>	8.4	Altitude in meters
8	<SP>	1	Speed in MPH
9	<HD>	0.0	Heading in degrees
10	<SV>	3	Number of Satellites
11	<HP>	2.5	HDOP
12	<BV>	13.8	External Battery Voltage
13	<CQ>	25	GSM Signal Strength
14	<MI>	0	Miles driven since last reset or power cycle.
15	<GS>	0	GPS Status: 0 – no lock 1 – locked 2 – no comm. 3 – GPS OFF (power save mode)
16	<BB>	3.9	Internal Battery Voltage
17	<PM>	2	Last Power-up/Reset mode 1 – S/W Reset 2 – DC Power-Up 3 – Motion Sense 4 – Internal Wake-up 5 – Input 1
18	<FW>	S4x1-1119B2	Firmware Version
19	<PF>	Unknown	Profile Name
20	<SEQ>	BLANK	BLANK
	##	##	End of string

Event Number Codes for Type 3 Messages

Event Number Code	Meaning
4006	Periodic Reporting while device is powered (heartbeat)
6015	Alert message on Power up/Reset and GPS lock

Type 4 Messages

The reports that are Type 4 Messages have the following syntax:

```
$$<UID>,4050,<GSM>,<GPR>,<PDP>,<HD>,<HO>,<PU>,<R>,<%GPS>,<%GPSQ>,<%GSM>,<%GPR>,<%PDP>,<LV>,<HV>,<CX>,<DBO>,<ABI>,<DBI>,<SO>,<SI>,<SS>##
```

Data Format	Parameters	Description
		\$\$<UID>,4050,<GSM>,<GPR>,<PDP>,<HD>,<HO>,<PU>,<R>,<%GPS>,<%GPSQ>,<%GSM>,<%GPR>,<%PDP>,<LV>,<HV>,<CX>,<DBO>,<ABI>,<DBI>,<SO>,<SI>,<SS>##
<UID>		Unit ID – 15 digits IMEI
<EV#>		Event number code that triggered the report
<GSM>		GSM registration state: 0=Not Reg, 1=Home,2=Search, 3=Denied, 4=Unknown, 5=Roaming
<GPR>		GPRS registration state: 0=Not Reg, 1=Home, 2=Search, 3=Denied, 4=Unknown, 5=Roaming
<PDP>		GPRS PDP state, 0=Deactivated, 1=Activated
<HD>		Hours Disconnected counter, 1000 max
<HO>		Hours ON counter, 1000 max
<PU>		Power Up counter, 255 max
<R>		Reset counter,255 max
<%GPS>		Percent lost GPS
<%GPSQ>		Percent lost GPS based on 5 Sat Quality Factor
<%GSM>		Percent lost GSM
<%GPR>		Percent lost GPRS
<%PDP>		Percent lost PDP context activation
<LV>		Low Voltage counter, # sec < 9 Volts, 60000 max
<HV>		High Voltage counter, # sec > 16 Volts 60000 max
<CX>		Context activation counter, 1000 max
<DBO>		Data Bytes Out, 10000000 max
<ABI>		ACK Bytes In, 10000000 max
<DBI>		DOTA Bytes In, 10000000 max
<SO>		SMS Msg Out counter, 1000 max
<SI>		SMS Msg In counter, 1000 max
<SS>		SMS Spam Msg In counter, 1000 max

Example:

```
$$354660046140722,4050,5,5,1,26.1,34.1,9,0,17,23,0,0,1,60000,0,15,55765,0,0,1,1,0##
```

Parameter	Value	Meaning
-----------	-------	---------

	\$\$	\$\$	Start of string
1	<UID>	354660046140722	Callsign - Unit ID. The IMEI number.
2	<EV#>	4050	Status Code - Event ID
3	<GSM>	5	GSM Registration State: 0 – Not Registered 1 – Home 2 – Search 3 – Denied 4 – Unknown 5 – Roaming
4	<GPR>	5	GPRS Registration State: 0 – Not Registered 1 – Home 2 – Search 3 – Denied 4 – Unknown 5 – Roaming
5	<PDP>	1	GPRS PDP State 0 – Deactivated 1 – Activated
6	<HD>	26.1	Hours Disconnected
7	<HO>	34.1	Hours ON
8	<PU>	9	Power Up Counter
9	<R>	0	Reset Counter
10	<%GPS>	17	Percent Lost GPS
11	<%GPSQ>	23	Percent Lost GPS based on 5 Satellites
12	<%GSM>	0	Percent Lost GSM
13	<%GPR>	0	Percent Lost GPRS
14	<%PDP>	1	Percent Lost PDP
15	<LV>	60000	Low Voltage Counter (# of sec < 9 Volts)
16	<HV>	0	High Voltage Counter (# of sec > 16 Volts)
17	<CX>	15	Context Activation Counter
18	<DBO>	55765	Data Bytes Out
19	<ABI>	0	ACK Bytes In
20	<DBI>	0	DOTA Bytes In
21	<SO>	1	SMS Msg Out Counter
22	<SI>	1	SMS Msg In Counter
23	<SS>	0	SMS Spam Msg In Counter
	##	##	End of string

Event Number Codes for Type 4 Messages

Event Number Code	Meaning
4050	Diagnostics Data

Server UDP Commands

This section describes how the server must send commands when in UDP with command (UPDC) mode.

When sending commands to the ST7200 via UDP, the server must use the last known IP and port from the device based on the most recently received message.

Note: Not available for +XT:1001, +XT:1002, +XT:1004, +XT:1006, +XT:1008, +XT:1010 commands.

Syntax:

+XT:<UID>,<CMD>,<field1>...<fieldn>##

Command number: Applicable to +XT:1003, +XT:1005, +XT:1007 and +XT:30xx, +XT:50xx or +XT:70xx commands when in UDPC mode.

Data Format	+XT:<UID>,<CMD>,<field1>...<fieldn>##
Parameters	Description
<CMD>	4 digit CMD code same as in SMS Command (ie:3001)
<fieldn>	Fields associated with the particular command as defined in the "ST7200 Command Set" document.

Server Initiated SMS or UDPC Commands Summary

Command Code	Description
3001	Set ignition ON reporting interval and alert
3002	Set ignition OFF interval and alert
3004	Set change of direction (degrees) threshold
3006	Set speed threshold
3008	Set mileage threshold
3009	Set low battery threshold
3010	Set battery disconnect interval and alert
3012	Set Ignition type (Wired or Virtual)

3013	Set idle alert period
3014	Set tow alert enable/disable
3015	Set Input 2 enable setting
3016	Set wake time, sleep interval and motion wake
3019	Set movement start/stop enable/disable
3020	Set park time threshold
3040	Sets all 3000 series intervals and thresholds
3050	Query interval and threshold settings
5001	Add rectangular geofence
5002	Delete all geofences
5003	Add polygon geofence
5050	Query geofence settings
7001	Read current GPS position
7003	RESET modem
7004	Erase NVM
7005	Set Output Port
7006	Set virtual odometer
7007	Reset GPS
7008	Save profile to memory
7009	Clear profile from memory
7010	Read profile name in memory
7050	Query diagnostics

Note: Refer to the “ST7200 Command Set” document, for the response format the device will send for these commands.

Server Initiated SMS (ONLY) Commands Summary

Command Code	Description
1001	Set server TCP or UDP IP address and port
1002	Set APN configuration
1003	Query TCP/UDP/APN settings
1004	Set FTP configuration
1005	Query FTP settings
1006	Update FW
1007	Query FW versions and GSM/GPS type
1008	Set server SMS number
1010	Set 1001, 1002 and 1008 combination

Note: Commands sent via SMS don't need the same syntax as commands sent via UDP, for commands sent via SMS use the same format described in the "ST7200 Command Set" document.

Note: Refer to the "ST7200 Command Set" document, for the response format the device will send for these commands.

Server Response for UDP with ACK

Server response message format when in UDPwAck mode for acknowledging receipt of periodic location and alert messages. No response is used for TCP and UDP (w/o ACK) modes.

The ACK the server must be sent upon receiving an event report. Applicable to 40xx, 60xx events or 7001 and 7005 command responses when in UDPwAck mode

Syntax:

+XT:UDP_ACK,<EV#>,<SEQ>##

Data Format	+XT:UDP_ACK,<EV#>,<SEQ>##
Parameters	Description
<EV#>	Echo of 4 digit event code contained in received msg.
<SEQ>	Echo of sequence number contained in received msg.

UDPwAck Description

The UDPwAck feature provides an application layer acknowledgement/resend protocol for UDP messaging. This mode is selected via SMS network commands (1001, 1010) with TCP/UDP field entry of '3'. The previous UDP mode (field value of "2") is unchanged and does not utilize ACK responses from the server.

Operation:

The UDPwAck consists of two progressive timing back offs:

UDP ACK timeouts: 15 sec, 30 sec

UDP hold-off intervals: 2 min, 4 min, 8 min, 16 min, 32 min, 1hour

The UDP ACK timeouts indicate how long the device will listen for the appropriate ack from the server after a UDP message is sent.

The UDP hold-off intervals indicate how long the device will wait before allowing the re-transmission of pending UDP messages.

Note: that the device does not receive any ACKs sent by the server during the UDP hold-off period, it only listens during the ACK timeout periods.

In normal operation, the device will save an event occurrence (6xxx alert msg, 4xxx periodic msg or 7001/5 cmd responses), send a UDP message to the server and wait for the appropriate ACK back from the server.

No ACK Received:

If no ACK is received with proper syntax within the 15 sec timeout, the same message will be resent with a 30 sec timeout. If the ACK fails after the 30 sec timeout, the device starts a UDP hold-off period before repeating the above two message send/listen process. The UDP hold-off interval starts at 2 min and increases up to a maximum of 1 hour (repeating 1 hour thereafter) on each unsuccessful retransmission attempt (2 messages each). Any new events that occur during the hold-off period will be saved to memory but will not trigger a new transmission. Retransmission attempts (oldest to newest) will remain based on the hold-off period until a successful ACK response is received during a re-transmission period. The oldest events are discarded when the message buffer is full.

ACK Received:

If a proper ACK is received during the UDP transmission attempts, the device will remove the event from memory and send the next event saved, restarting with 15 sec ACK timeout. This will repeat until all stored events are sent with proper ACK responses. The UDP hold-off will be disabled and any new event occurrence will attempt transmission as it occurs. If during the memory cycling (one at a time tx msg, rx ack, clear msg and repeat on next msg) transmissions an event fails the two transmission attempt, that event is not removed from memory and the UDP hold-off will re-start at 2 min. The previous successfully ACKed events are cleared from memory and the next retransmission attempt will start with the failed message.

Additional Notes:

- The sequence number only increments after a successful ACK response from the server. The seq number resets to 000:
 - Wrap after 255 reached
 - Pwr-up/reset of device
 - The device sends at least one message via TCP or UDP (w/o ACK)The sequence number is not unique to the event number.
- 7001,1 and 7005,x,1 command responses also have the seq number field added and use ACK process defined above even though these are user initiated responses rather than device initiated alert/periodic reports. Unlike the alert/periodic reports, receipt of these

commands will force a reset of the UDP hold-off period which allows the server to restart pending transmissions immediately. The re-transmission still starts with oldest saved record and the 7001, 7005 responses are saved with the other event messages as received.

- Sending the 7001,2 or 7005,x,2 SMS cmds for SMS replies does not affect the UDP hold-off and SMS responses are sent upon receipt of the message.
- The device will take no action on a received UDP ACK when configured for TCP or UDP(w/o ACK) mode.
- At device power-up or after 7003 reset cmd, the device will reset the SEQ number to 000 and will reset (disable) the UDP hold off thus permitting immediate transmit attempt of any previously stored msgs. A 7004 erase memory cmd (clears all messages in memory) does not reset the SEQ number to 000 but it does reset (disable) the UDP hold-off since no messages are no longer pending.
- The device listens on the same port as the one used to transmit.
- UDPwACK (TU=3) messages from the device to the server must be ACKed by the server.