Wireless Communication Protocol
31p

Cellocator Division
Pointer Telocation Ltd.

Proprietary and Confidential

Version 31p

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1 Introduction

1.1 About this Document

This document explains the unit's wireless communication structure. It describes every byte of the incoming/ outgoing packets, which can be sent or received by the unit over-the-air.

1.2 Abbreviations

Abbreviation	Description
ACK	Acknowledge
CAN	Controller Area Network
CCC	Command and Control Center
DB	Database
FMS	Fleet Management System
OTA	Over the Air
PDU	Protocol Description Unit (Common name for data SMS)
PGN	Parameter Group Number
SMS	Short Message Service (GSM)
PTR	Pointer Telocation Ltd.
PSP	Pointer Serial Protocol, normally refers to a Car Alarm System interfacing through this protocol

1.3 References

All the reference documents listed in the following table can be downloaded from the support section of the Pointer Website (www.pointer.com).

#	Reference	Description
1.	Cello Programming Manual	This document describes the features supported by the Cellocator unit and provides details about the parameters of its configuration.
2.	Cello Hardware Installation Guide	This document provides all necessary information for a technician who is involved in the installation of a Cello-F or Cello-R unit. It describes how to install and verify the proper functioning of the Cello installation kit elements.
3.	Serial Interfaces Specification	This document describes the serial interface (RS232) protocol
4.	Cello AR interface protocol	This document describes 1-Wire interface of Cello-AR unit

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1.4 Revision History

Version	Date	Description
31.6	June 13, 2011	Fixed conversion equation for course field of Compressed Tracking message (Msg type 9 sub-type D)
31c.1	July 28, 2011	Added message type 7, container and updated message type 8.
31c.2	Sept 15, 2011	Added description of programming bitmask Added transmission reasons of coasting (21), input dependent over-speed and additional thresholds of GP frequency input.
31c.31	Oct 18, 2011	STR added for TR46 (Driver ID received): a) Driver / Passanger ID b) Group ID authenticated / not authenticated Driver/Passenger/Group ID description added (bytes 33-38) Added "Business" / "Privet" Mode monitoring bit (byte 11, bit 5) Added TR and STR for "Trailer Connection Status" Added OTA command to query trailer ID Renamed Transmissions reasons: Input A to Lock, Input B to Unlock, Input C to Unlock2
31.d	Jan 25,2012	Consolidation with Compact/CelloTrack version
31e	Apr , 2012	Aligned with released 31e CellAR
31e 2	May 22, 2012	Added CelloTrack Output info
31e 3	June 17, 2012	Added modem Telit V2 version
31h 1	July 17, 2012	Added STR of Towed Mode (start and stop) Added Operational mode 0x10 (Towed mode)
31j 1	Sept 5, 2012	Speed Limiting GeoFence Events (TR,STR) Pulse Counter Modular Req and Response
31G 1	Nov. 7, 2012	Added support for Cellotrack3G
31i.1	Nov. 18, 2012	Added infrastructure for Cellotrack GPS based ignition state. CFE support OTA

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Version	Date	Description
31n.1		CFE GA
31n.2	Dec 27 2012	Cellotrack3G: Charging Power Connect / Disconnected SingleWire Temperature Sensors (Infrastructure) 2.6.16, 2.6.13 : Telit veriosn 10.00.033 coresponds with version code 30. Ersion code 31 is defined as reserved
31p	1.1.2013	CFE Support is defined as infrustructure as it is not supported in 31p Added Trailer status indication: byte 41, bit1 in type 0

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2 Telemetry Channel (Outbound Messages)

2.1 Overview

The telemetry channel comprises four kinds of messages, as described in the following:

- **Status/location message** – the "main" message, which is sent by default, as a reply to a command or as the message of choice when reporting emergency situations. This message has a message type code of 0 (zero).
- **Programming data** – this message is sent as a reply to programming commands, or by request. It contains the new contents of the programmed block, which allows verification of the programming. This message has a message type code of 3 (three).
- **Logged Fragment of Forwarded Data** – this message is sent when the terminal, connected to the serial port of Cellocator unit is forwarding data to the central control through unit's log. This message has a message type code of 7 (seven) and contains a fragment of delivered data.
- **Real Time Forwarded Data** – this message is sent when the terminal, connected to the serial port of Cellocator unit is forwarding data to the central control without logging it. This message has a message type code of 8 (eight).
- **Modular message** – this message is designed to contain different types of data, such as CAN bus sensors, Cell ID, debug data, and more. This message has a message type code of 9 (nine).
- **Self Re-flash Master ACK / NACK message** – a message serving as confirmation of reception data chunk for self-re-flash. Self re-flash process description is outside the scope of this document (See Self Re-flash Appendix for more details).

2.2 Status/Location Message Definition

2.2.1 Byte-Aligned Table

1	System code, byte 1 – ASCII "M"
2	System code, byte 2 – ASCII "C"
3	System code, byte 3 – ASCII "G"
4	System code, byte 4 – ASCII "P"
5	Message type - byte (a value of 0 for status/location message)
6	Unit's ID (total 32 bits)
7	
8	
9	
10	Communication control field

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11	
12	Message numerator (Anti-Tango™)
13	Unit’s hardware version
14	Unit’s software version
15	Protocol Version Identifier
16	Unit’s status + Current GSM Operator (1st nibble)
17	Current GSM Operator (2nd and 3rd nibble)
18	Transmission Reason Specific Data
19	Transmission reason
20	Unit’s mode of operation
21	Unit’s I/O status 1st byte
22	Unit’s I/O status 2nd byte
23	Unit’s I/O status 3rd byte
24	Unit’s I/O status 4th byte
25	Current GSM Operator (4th and 5th nibble)
26	Analog input 1 value
27	Analog input 2 value
28	Analog input 3 value
29	Analog input 4 value
30	Mileage counter (total 24 bits)
31	
32	
33	Multi-purpose field: Driver /Passenger/ Group ID, PSP/Keyboard Specific Data, Accelerometer Status or SIM IMSI
34	
35	
36	
37	
38	
39	Last GPS Fix

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40	
41	Location status (from unit)
42	Mode 1 (from GPS)
43	Mode 2 (from GPS)
44	Number of satellites used (from GPS)
45	Longitude
46	
47	
48	
49	Latitude
50	
51	
52	
53	Altitude
54	
55	
54	
57	Ground speed
58	
59	
60	
61	Speed direction (true course)
62	
63	UTC time – seconds
64	UTC time – minutes
65	UTC time – hours
66	UTC date – day
67	UTC date – month
68	GPS date – year

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69	
70	Error detection code – 8-bit additive checksum (excluding system code)

2.2.2 General Details

Rule of thumb: multiple byte fields are always sent Intel-style, meaning, least significant bytes sent first.

The first 9 bytes / 3 fields (system code, message type and unit ID) are always sent in the beginning of the message, in the specified order, regardless of the message kind. What differentiates the message kinds is the value sent in the message type field. The other fields maintain constant values (system code is a system-wide constant, unit ID is a unique constant value for each Cellocator unit).

2.2.3 Detailed Per-Field Specifications

2.2.3.1 System Code

System code is a 4-byte value, which identifies the Cellocator system. The field is sent as the ASCII values of the letters "M", "C", "G", "P" (for IP messages) or "M", "C", "G", "S" (for SMS messages), in that order.

2.2.3.2 Message Type

Message type identifies the kind of message. It allows the receiver to differentiate between status messages and programming data messages, according to the value sent in this field. Status/location messages contain a value of 0 (zero) in the message type field.

2.2.3.3 Unit ID

This field contains a value that is uniquely assigned for every Cellocator unit during the manufacturing process. All messages sent by the same Cellocator unit contain the same value in the Unit ID field.

2.2.3.4 Communication Control Field

This is a bitmapped field, which contains flags that provide information about the message and the situation in which it was originated. The field is currently defined to have only three flags (stored in bits 0, 1 and 2 – the least significant bits of the LSB byte of the field), which provides "message initiative", "non-distress message" and "tracking" information.

First byte (10th):

CAN originated Odometer[1]	CAN originated Speed [2]	Bytes 33-38 assignment (Dallas, Trailer, PSP,	Message source	Garmin Connected	Garmin Enabled	Message Initiative

---

[1] Only supported by Compact CAN unit, linked to J1939 (and, of course, FMS) CAN bus.

[2] Only supported by Compact CAN unit, linked to J1939 (and, of course, FMS) CAN bus.

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		ACC data or SIM IMSI)					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Second byte (11th):

GSM Hibernation indication bit	Speed in the message: Momentary / Max Speed	"Business" / "Privet" Mode	Firmware Sub-version *				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

"Message initiative" flag states whether the message was "actively" sent (initiated by the unit, based on its logic and decisions), or if the message is a response to a command or a query message received by the unit earlier. The flag is low (contains logical "0") on standard "active" transmissions, and high (logical "1") on "passive" replies/responses.

A Cellocator Unit informs the Central Control about the status of Garmin terminal via the **"Garmin Enabled"** and **"Garmin Connected"** flags.

- The "Garmin Enabled" field monitors the status of the corresponding bit in the configuration memory (1 when enabled).
- The "Garmin Connected" bit monitors the status of the communication between Garmin and Cellocator Unit. This bit is set with the first correct ACK or NACK received from the Garmin Unit and is reset upon three missing responses from the Garmin unit (timeout expiration).

* Refer to "API Garmin Support by Cellocator unit" for more details about Garmin integration.

The **"Message source"** flag indicates that the message was sent through memory. The unit tries to resend the message from the memory until the acknowledge, from the Control center, is received. The flag is low (contains logical "0") on direct messages [3]– not over memory, and high (logical "1") on messages from memory.

The **"Bytes 33-38 assignment (Dallas, PSP or other)"** bits define the data type, provided in bytes 33-38 of this message according to the below table. Value of this field does not affect *CelloTrack/Power.*

Type 0, byte 10		**Description** 4-5 of byte 10
Bit 5	**Bit 4**	
0	0	Backward compatibility mode (to FW 27c and below), Driver ID (Dallas field).

---

[3] The only exception is the "Transmission Reason 32 - IP changed / connection up" message, which always requires acknowledge from central control, even if it was sent as a direct message and not through memory.

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0	1	PSP mode is enabled, external Alarm device data is transmitted in bytes 33-38
1	0	The Keyboard is used, keyboard related data is transmitted in bytes 33-38
1	1	Trailer ID is transmitted in bytes 33-38

Bytes 33-38 will also contain the data of SIM's IMSI (only in "Wake Up" message, transmission reason 0d202), and a debug data of accelerometer (in all the messages from CelloTrack units).

Cello-AR

When the AR keypad is enabled in programming, the unit sets bits 4-5 of byte 10 of OTA Message type 0 to '10' in all the messages except Driver Authentication Update (TR46) and Wake Up (TR202).

"CAN originated Speed" and **"CAN originated Odometer":** These bits are set when the unit is configured to report (in message Type 0) speed and the odometer data taken from the CAN interface and not from the GPS. The flags are informative as the format of Speed and Odometer fields in message type zero remain the same, irrespective of the source of the data.

* Only supported by Compact CAN unit, linked to J1939 (and, of course, FMS) CAN bus.

Firmware Sub-Version: This field (5 bits) defines the firmware sub-version of the Cellocator Unit. The number of Cellocator firmware is built from two parts:

[Firmware version][Firmware sub-version], where firmware version defines the list of supported features and subversion defines the revision.

For instance: 30':

Firmware: 30
Revision: ' (0)

Firmware Sub-version field (decimal value)	Identifier
0	No identifier
1	a
2	b
3	c
~	~
26	z

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GSM hibernation indication bit: The bit monitors hibernation status upon message delivery and not upon message generation. Consequently the bit is set to 1 only when the message is sent during GSM peeking

Speed in the message: The bit indicates whether the speed reported in this message is a Momentary speed (0) / or Maximal Speed recorded from the last event (1).

"Business" / "Privet" Mode: It is possible to enable usage of "Lock input"as a "Private"/"Business" mode toggle.

If enabled every time the Lock input is triggered the unit switches to the opposite mode ("Private"/"Business"/"Private").

The default mode is "Business".

The "Private" mode is finished upon:

1- The active ID is erased from RAM after journey end.
2- Lock Input trigger.

During "Private" mode the unit is continually set bit 5.

2.2.3.5 Message Numerator (Anti-Tango™)

The Message numerator field contains a value that is increased after every self initiated generation of a message (in cases where an acknowledge from Central control was received).

NOTE: The unit assigns different message numerator sequences for the logged events and for real-time events. In passive transmission (reply to command), the value in this field represents the number from the Command Numerator Field in an incoming command. (See Command Channel - Inbound Messages, Section 2.6.14).

When the unit is reset/powered-up, this value is set to zero. This provides a way to chronologically sort incoming messages from a certain unit, in case an anachronistic communication medium is used.

2.2.3.6 Unit's Hardware and Firmware Versions

These fields are aimed to define the numbers of a unit's hardware and firmware version.

The 8-bit "hardware version" field is split into 5 LSBits indicating main **hardware type**, and 3 MSBits indicating a **hardware variant**.

Modem Type / Hardware variant			**Hardware type**				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

The currently defined values for the main hardware type are:

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Value (hex)	Hardware Type
3	Olympic-03GM
4	Compact-01GR Fleet
5	Compact-01GR Security
6	Compact-01GR Low Cost
7	Compact-04CB Fleet/Can Bus
8	Compact-01GR Security/RB
9	370-50 Security
A	Compact-MR V1
B	Compact EDR
C	CelloTrack (no internal charger)
D	Compact Basic
11	Compact Can (25Mhz)
12	CelloTrackCello
13	CelloTrackPowerCello
14	Obsolete
15	Obsolete
16	EOB (Enfora On Board Compact unit)
17	CelloTrack with internal charger
18	Cello Telit
19	Cello Cinterion
1B	Cello Telit enhanced memory
1C	TOB (Telit On Board Compact unit)

In products with internal modems, the currently defined values for the hardware variants are:

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Value	Variant
0	Sony/Erickson GR47
1	Enfora Enabler II-G
2	Telit GE864, old retrofit board (obsolete)
3	Telit GE864, mute support
4	Telit xE910 family
5	Enfora III
6	Telit GE864, automotive
7	Cinterion BGS3

In products with external modems (Olympic-03GM), the currently defined values for the hardware variants are:

Value	Variant
0	Generic GSM
1	TETRA
2	Simple modem (ATD dialup)

If the products are CelloTrackCello (18) or CelloTrackPowerCello (19) the current defined modem versions are:

Modem Code	Modem Type	Generation	Standard
0	Telit GE910	2G	GSM/GPRS
1	Telit CE910	2G	CDMA
2	Telit HE910	3G	UMTS/HSPA+5.76/21.0
3	Telit DE910	3G	CDMA/1x EV-Do Rev.A

2.2.3.7 Unit's Status and Current GSM Operator – 1st

This is a bitmapped field that provides information about current unit status and functionality.

GPS comm.: describes the status of communication with the GPS module (0=available, 1=not available/error).

Home/Roam network: describes in what GSM network the unit is currently registered: (0 – Home network, 1 – Roam network)

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Correct Time: confirms the validity of the timestamp in the message (correct – 0 or estimated/invalid -1)

Source of Speed: 0 – Estimated by GPS; 1 – Pulse frequency input.

Current GSM Operator (PLMN), 1st nibble				**Source Of Speed**	**Correct Time**	**Home/ Roam network**	**GPS Comm.**
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.8 Current GSM Operator Report

The current GSM Operator (PLMN) is represented as a 5 character hexadecimal number. After conversion into decimal it represents the MCC-MNC of a cellular operator (country code + network number). The 5 PLMN nibbles (nibble for each character) are provided in the following places:

- Byte 16 (4 MSbits, 1 nibble)
- Byte 17 (2 nibbles)
- Byte 25 (2 nibbles), 5th byte of IO

Byte 16 (4MSbits, 1 nibble)	**Byte 17**		**Byte 25, 5th byte of IO**	
Nibble 1	Nibble 2	Nibble 3	Nibble 4	Nibble 5

2.2.3.9 Byte 17 - Current GSM Operator report (2nd and 3rd)

Current GSM Operator (PLMN), 2nd nibble				**Current GSM Operator (PLMN), 3rd nibble**			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.10 Transmission Reason Specific Data

The second byte (byte 18th of message 0)
Related transmission reasons

Transmission Reason	**Transmission Reason Specific Data Usage (As function of the Transmit reason)**		
8 Towing	0	Location change detected on Ignition is Off	
	1	Towed mode start	
	2	Towed mode stop	
14	Direction: entry to	Exit from Garage reason: 0 - Manual mode change	Reserved

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<table>
<tr><th>Transmission Reason</th><th colspan="4">Transmission Reason Specific Data Usage (As function of the Transmit reason)</th></tr>
<tr><td rowspan="2">Garage Mode</td><td>Garage Mode ("0") exit from Garage Mode ("1")</td><td colspan="2">1 – Timeout expiration
2-3 - Reserved</td><td></td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bits 0 – 4</td></tr>
<tr><td>21
Coasting detection (Speed and RPM)</td><td colspan="4">0 – Stop
1 – Start</td></tr>
<tr><td rowspan="2">22
violation of 1st additional GP frequency threshold</td><td>0</td><td colspan="3">Failing</td></tr>
<tr><td>1</td><td colspan="3">Raising</td></tr>
<tr><td rowspan="2">23
violation of 2nd additional GP frequency threshold</td><td>0</td><td colspan="3">Failing</td></tr>
<tr><td>1</td><td colspan="3">Raising</td></tr>
<tr><td>34
Over-speed start</td><td colspan="4">0 – Plain
1 – Threshold changed by input</td></tr>
<tr><td>42
Over-speed end</td><td colspan="4">0 – Plain
1 – Threshold changed by input</td></tr>
<tr><td>46
Driver ID received</td><td colspan="4">For Callo AR unit only:
0 – Driver ID
1- Code from SPC Keyboard
For other units:<table><tr><td>Group ID status
"1" – authenticated,
"0" – not</td><td>Unused</td><td>User Type
"0" – Driver ID
"1" – Passenger ID</td></tr></table></td></tr>
</table>

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Usage (As function of the Transmit reason)</th></tr>
<tr><td></td><td><table><tr><td>authenticated</td><td></td><td></td></tr><tr><td>Bit 7</td><td>Bits 1-6</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>69
Start Report</td><td><table><tr><th></th><th>Transmission Reason Specific Data Usage (As function of the Transmit reason)</th></tr><tr><td>0</td><td>Normal – Legacy support</td></tr><tr><td>1</td><td>Movement based start event (Cellotrack only)</td></tr></table></td></tr>
<tr><td>91
Message from Keyboard (For Cello AR unit only)</td><td>Description<table><tr><th>STR</th><th>Description</th></tr><tr><td>0</td><td>Keypad Undefined Failure</td></tr><tr><td>1</td><td>Immobilizer device wires disconnection</td></tr><tr><td>2</td><td>Keypad locked</td></tr><tr><td>3</td><td>Relay malfunction</td></tr><tr><td>4</td><td>Ignition wire disconnected</td></tr><tr><td>5</td><td>Starter signal detection</td></tr><tr><td>6</td><td>Starter malfunction</td></tr><tr><td>7</td><td>Hotwiring Detection*</td></tr><tr><td>8</td><td>Primary cut unit failure</td></tr><tr><td>9</td><td>Secondary cut unit failure</td></tr><tr><td>10</td><td>Wrong keyboard ID detected</td></tr><tr><td>11</td><td>Pairing Accomplished</td></tr><tr><td>12</td><td>Keypad flash failed</td></tr><tr><td>13</td><td>Alarm Cadence Activated by Keyb</td></tr><tr><td>14</td><td>Alarm Cadence Deactivated by Keyb</td></tr><tr><td>128</td><td>ECALL Initiated</td></tr></table></td></tr>
</table>

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Transmission Reason	**Transmission Reason Specific Data Usage (As function of the Transmit reason)**							
	129	BCALL Initiated						
191 Geo-Hotspot violation	Direction: entry to hot spot ("1") exit from hot spot ("0") The index of the geo-zone	The index of the geo-zone.						
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
	Bits 0-6 make up the index of the geo-zone. Most significant bit (bit 7) indicates direction: entry to hot spot ("1") or exit from hot spot ("0")							
192 - Frequency Measurement Threshold Violation	Violating input number Door Shock	Violation status 0 – Violation start 1 – Violation End	Violation type 0 – Threshold 1 - Range	Violation direction **In case of Threshold** 0 – Low thresh. 1 –High thresh. **In case of range** 0 –Keep In 1 – Keep Out	Reserved			
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
194 - Analog Measurement Threshold Violation	Violating input number Door Shock	Violation status 0 – Violation start 1 – Violation End	Violation type 0 – Threshold 1 - Range	Violation direction 0 – High thresh. 1 – Low thresh.	Reserved			
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
199	Trailer Connection Status 0 for trailer disconnected, 1 for trailer connected							

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Usage (As function of the Transmit reason)</th></tr>
<tr><td>200
AHR (Auto Hardware Reset)</td><td><table>
<tr><td colspan="4">The AHR reason:
0 - Modem non responsiveness
1 - Registration problem</td><td colspan="4">The number of performed AHR attempts</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table></td></tr>
<tr><td>205 Garmin connection status changed</td><td>0 – Garmin Disconnected
1 – Garmin Connected</td></tr>
<tr><td>206
Jamming Detection</td><td>0 – Jamming Start Detection
1 – Jamming End detection (not jammed)</td></tr>
<tr><td>207 Radio Off Mode</td><td>For CelloTrack:
<table>
<tr><td colspan="6">Not used</td><td>GPS Status
0 – Off
1 - On</td><td>Modem Status
0 – Off
1 - On</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table>
For Cello:
2 - Detection of internal backup battery voltage lower than 3.5V (on any temperature) for longer than 1 second (100 samples) upon sole work from internal backup battery. The unit will switch off the radio 2 seconds after event generation. Once switched off, the modem will be switched back on only upon main power reconnection.
0 - Detection of internal backup battery voltage discharging to 3.25V for longer than 1 second (100 samples). The unit will enter shipment mode only after generation of this event.</td></tr>
<tr><td>212</td><td>The index of the geo-zone indicating Speed limiting Geo-Fence start event.</td></tr>
<tr><td>213</td><td>The index of the geo-zone indicating Speed limiting Geo-Fence End event.</td></tr>
<tr><td>252
COM-Location Glancing (CelloTrack & CelloTrack Power Unit only)</td><td>0 – Plain COM-Location Glancing
1- ST (Specific Time) COM-Location Glancing</td></tr>
<tr><td>253</td><td>The index of the geo-zone.</td></tr>
</table>

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Transmission Reason	Transmission Reason Specific Data Usage (As function of the Transmit reason)
Violation of Keep In Fence	
254 Violation of Keep Out Fence	
255 Violation of Way Point	

2.2.3.11 Transmission Reason

This field contains the reason why the unit is transmitting. Note that this value is valid only for self-initiated active transmissions (i.e. transmissions that the unit generated automatically because of its logics, in contrast to reply transmissions). Reply transmissions (i.e. transmissions where the message initiative flag is turned on) contain the last transmission reason that was used.

Value	Reason	
4	Emergency (Distress) mode by command	
5	Door Opened (Security Event)	
6	Engine Activated (Security Event)	
7	GPS Disconnected	
8	Location change detected on Ignition is Off	See TR specific data section 2.2.3.10 for more details
11	Communication Idle	
12	Disarmed from emergency states	
13	Keypad Locked (wrong codes punched in)	
14	Garage Mode (see Transmission Reason Specific Data (section 2.2.3.10)).	
19	Alarm Triggered by "Lock" input	
21	Coasting detection (Speed and RPM)	
22	Violation of 1st additional GP frequency threshold	
23	Violation of 2nd additional GP frequency threshold	
25	Speed detected when Ignition is Off	
27	GPS connected	
31	Reply to Command	

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Value	Reason
32[4]	IP changed / connection up
33	GPS Navigation Start
34	Over-speed Start
35	Idle Speed Start
36	Distance
37	Engine Start; Ignition Input – active (high)
38	GPS Factory Reset (Automatic only)
40	IP Down
41	GPS Navigation End
42	End of Over-speed
43	End of Idle Speed
44	Timed Event
45	Engine Stop; Ignition Input – inactive (low)
46	Driver Authentication Update / Code received for Cello-AR
47	Driving Without Authentication
48	Door Close Event
49	Unlock2 / Shock Inactive Event
	CelloTrack: GP1 Inactive Event
50	Hood Sensor Inactive Event
	CelloTrack: GP2 Inactive Event
51	Volume Sensor Inactive Event
52	Hotwire Sensor Inactive Event
53	Driving Stop Event
54	Distress Button Inactive Event
55	Unlock Input Inactive event
56	Oil Pressure Sensor Inactive Event

---

[4] Always requires acknowledge from central control, even if it was sent as a direct message and not through memory.

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Value	Reason
57	CFE input 1 inactive (Infrustructure)
58	Lock input inactive event
59	CFE input 2 inactive (Infrustructure)
60	CFE input 3 inactive(Infrustructure)
61	CFE input 4 inactive(Infrustructure)
62	CFE input 5 inactive(Infrustructure)
63	CFE input 6 inactive(Infrustructure)
64	Door Open Event
65	Unlock2 / Shock Active Event
	CelloTrack: GP1 Active Event
66	Hood Sensor Active Event
	CelloTrack: GP2 Active Event
67	Volume Sensor Active Event
68	Hotwire Sensor Active Event (370-50)
69	Driving Start Event
70	Distress Button Active Event
71	Unlock Input Active Event
72	Oil Pressure Sensor Active Event
73	CFE input 1 active Event (Infrustructure)
74	Lock input active event
75	CFE input 2 active Event (Infrustructure)
76	CFE input 3 active Event (Infrustructure)
77	CFE input 4 active Event (Infrustructure)
78	CFE input 5 active Event (Infrustructure)
79	CFE input 6 active Event (Infrustructure)
80	Main Power Disconnected
81	Main Power Low Level
82	Backup Battery Disconnected Cellotrack3G: Charging Power Disconnected

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Value	Reason	
83	Backup Battery Low Level	
84	Halt (movement end) event	
85	Go (movement start) event	
87	Main Power Connected (be unconditionally logged upon an initial power up)	
88	Main Power High Level	
89	Backup Battery Connected Cellotrack3G Power: Charging Power Connected	
90	Backup Battery High Level	
91	Message from SPC Keyboard	Supported by CelloAR system only. See TR specific data section 2.2.3.10 for more details
99	Harsh Braking Sensor Triggered	
100	Sudden Course Change Sensor Triggered	
101	Harsh Acceleration Sensor Triggered	
104	Trigger on General Input	Applicable only for Security Modifications
105	Arm Input triggered	
106	Disarm Input triggered	
107	Remote Controller input trigger	
108	Odometer pulse received	
109	Unlock Pulse trigger	
110	Lock Pulse trigger	
111	Triggers on Blinkers	
112	One of the protected outputs failure	
144	Reset while armed	
145	Wireless Panic button (for RB modification only)	
150	Signal Learned	
151	Learning Failed	
152	Received Signal A	
153	Received Signal B	
154	Car sharing: This TR will be sent when the unit detects main power low or disconnect and hibernation mode “D” starts	

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Value	Reason	
158	Tamper switch Active Event (For CelloTrack only)	
159	Tamper switch Inactive Event (For CelloTrack only)	
161	"Unlock" input triggered	
162	MODECON gas leak start event	
163	MODECON gas leak stop event	
190	No Modem Zone entry	
191	Geo-HOT Spot violation	See Transmission Reason Specific Data (section 2.2.3.10) for more details.
192	Frequency Measurement Threshold Violation	
194	Analog Measurement Threshold Violation	
199	Trailer Connection Status	
200	Modem's Auto Hardware Reset (AHR)	
201	PSP – External Alarm is Triggered	Only for Fleet edition while PSP is enabled. Refer to bytes 33-38 for specific reason of the trigger.
202	Wake Up event	If enabled in the EEPROM, it is sent after Hardware Reset (including AHR) even when active transmissions are disabled. Includes IMSI of SIM card in bytes 33-38.
203	Pre-Hibernation event	If enabled, generated 15 seconds before an expiration of Hibernation Mode Delay timeout.
204	Vector (course) change	Curve smoothing event
205	Garmin connection status changed	See Transmission Reason Specific Data (section 2.2.3.10) for more details.
206	Jamming detection	
207	Radio Off Mode	
208	Header Error	Self Re-flash Processing.
209	Script Version Error	
210	Unsupported Command	

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Value	Reason
211	Bad Parameters
212	Speed limiting Geo-Fence. GeoFence over Speed **Start** Event. See Transmission Reason Specific Data for more details (Section 2.2.3.10).
213	Speed limiting Geo-Fence. GeoFence over Speed **End** Event. See Transmission Reason Specific Data for more details (Section 2.2.3.10).
232	External EEPROM Error
239	Max Error
245	Upload Mode
246	Execute Mode
247	Finish Mode
248	Post Boot Mode
252	COM-Location Glancing (CelloTrack Unit only)
253	Violation of Keep In Fence. See Transmission Reason Specific Data (section 2.2.3.10) for more details.
254	Violation of Keep Out Fence. See Transmission Reason Specific Data (section 2.2.3.10) for more details.
255	Violation of Way Point. See Transmission Reason Specific Data (section 2.2.3.10) for more details.

2.2.3.12 Unit’s Mode of Operation

The functioning of the Cellocator unit can be generalized as a finite state machine model, with a few “stages” of operation. The “current stage” is referred to as “unit mode”, or “mode of operation”. Every possible stage is assigned a certain value, which is transmitted in this field:

Value	Meaning
0x00	Standby Engine On
0x01	Standby Engine Off
0x02	Passive Arming (For Security modifications)
0x03	Pre-Arming (For Security modifications)
0x04	Alarm Armed (For Security modifications)

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Value	Meaning
0x05	Silent Delay (For Security modifications)
0x07	Alarm Triggered (For Security modifications)
0x0E	Garage Mode
0x0F	Transmissions Delay (for older versions FW25 and below)
0x10	Towed mode (same as Standby Engine On, except the fact that the ignition switch remains off)

2.2.3.13 Unit’s I/Os Status

The Cellocator unit is provided with many I/Os (inputs/outputs). Each I/O may be “high” or “low” at a given moment. The I/O status field is a bitmapped representation of all of the I/Os levels.

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First 2 bytes byte of I/O status field (sensors inputs):

GP Input ♥ Unlock (11/20) ♣ ■	Panic ♠ ♣ ♥ ♦ ■	Driving Status (Ignition or accelerometer based) ■ Ignition ♠ ♣ ♥ ♦ Movement Sensor ● ◇	CFE In 1 (Infrustructure)	Volume ♥ GP1 Input2 ●	Hood ♥ GP1 Input1 ● ◇	Shock / Unlock 2 (15/20) ♠ ♥ ♦ ■ ♣ Distress input ● ◇	Door ♠ ♣ ♥ ■ Tamper Switch ● ◇
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Second byte:

Ignition port status ■	Accelerometer status ■	External Alarm Status ♦ CFE IN 6 (Infrustructure)	External Alarm Trigger ♦ CFE IN 5 (Infrustructure)	Odometer ♥ CFE IN 4 (Infrustructure)	RC data ♥ Lock (5/20) ♣■	Disarm ♥ IN 3 (Infrustructure)	Arm ♥ CFE IN 2 (Infrustructure)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Legend:

♠ - Compact Fleet (4 inputs variants)	**♣ - Compact Security (and 6 inputs fleet, TOB and EOB)**
♥ - 370-50	**♦ - Olympic**
● – CelloTrack/Cellotrack Power	**■ - Cello**
◇ – CelloTrack Output	

Third byte of I/O status field (Compact and Cello)

CFE OUT 5 (Infrustructure)	**CFE OUT 4** (Infrustructure)	**CFE OUT 3** (Infrustructure)	**CFE OUT 2** (Infrustructure)	**GPS power** (Infrustructure)	**Grad. Stop**	**Siren Control**	**CFE OUT 1** (Infrustructure)

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Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Fourth byte of I/O status field (Compact and Cello)

Charger status: 0 – not charging 1- charging	**CFE OUT 6** (Infrustructure)	**Standard Immobilizer**	**Unused**	**Blinkers (Global output) / CelloTrack Output**	**Unused**		**LED out**
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Third byte of I/O status field (370-50 only)

GSM Wake	**Sensors Voltage**	**General Output**	**Hood Lock**	**GPS Power**	**PWM Immob.**	**Siren Out**	**Modem DTR out**
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Fourth byte of I/O status field (370-50 only)

Hands-free Control	**Unlock Out**	**Unused**	**Door Lock Out**	**Blinkers Out**	**Buzzer Out**	**Stop Lights Out**	**LED out**
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.14 Byte 25: Current GSM Operator (4th and 5th)

Current GSM Operator (PLMN), 4th nibble				**Current GSM Operator (PLMN), 5th nibble**			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.15 Analog Inputs

The Cellocator unit may handle up to 4 discrete analog inputs. These inputs are multiplexed and sampled with a 10-bit deep analog/digital converter (in Cello 14 bits). 2 (or, in case of Cello - 6) bits of the conversion results are stripped, according to the input, and the result for each channel is sent in this field.

In all the Cellocator units except Cello the allocation of the measurements is fixed in the message as follows:

In all units except Cello

The first byte in the field represents the main supply voltage. The main supply voltage is continuously monitored, and this field represents the current updated measured voltage.

This value should be multiplied by the following number to get a value in Volts:

- Compact: 0.1217320

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- CelloTrack: 0.01953125[5]
- 370-50: 0.1212565

The second byte in the field represents backup battery voltage, when it was last tested. Unlike the main supply voltage, this input is not constantly monitored. It is tested only when the backup battery is not being charged: in Standby Engine Off mode. If "Low Backup battery" event was not previously detected the unit constantly charges Backup battery during Standby Engine On.

This value should be multiplied by the following number to get a value in Volts:

- Compact:0.0474599
- 370-50: 0.0472745
- CelloTrack – not used

The third byte monitors either the Main Power regulated voltage (backward compatibility) or the 2nd Analog input (on pin 14), as per setting in EEPROM (byte 465, bit 2). This byte is not used in CelloTrack and CelloTrack Power.

If set as Main Power regulated voltage, it monitors an internal voltage of the unit, used mainly for debugging reasons. It should be multiplied by 0.01953125 to get the voltage in Volts.

If set as a second analog input – it monitors a voltage measured on pin 14 of the interface connector, if measurement is enabled in the EEPROM. (Refer to the Programming Manual document, Events masking section – Analog Input Measurement Mask, 2nd Analog input). The measured signal is between 0 and 2.5 Volts, resolution of 9.8mV.

The source of the 3rd byte of analog inputs measurement (regulated voltage or second analog input) is monitored in bit 0 of byte 41. Please refer to Section 2.2.3.19.

The fourth byte [6]represents voltage on the first optional analog input (pin 15) in the event that measuring is enabled in the EEPROM (Refer to the Programming Manual Document, Events masking section, Analog Input Measurement Mask, Optional Analog input). The Measured signal is between 0 and 2.5 Volts, resolution of 9.8mV.

This byte is not used in CelloTrack, but in CelloTrack Power it is monitoring the temperature of the battery as 2's compliment hexadecimal value. Effective measurement range from -20°C to 55°C, measurement error ±1.5°C

In Cello units

In all the Cellocator units except Cello the allocation of the measurements in the message is NOT fixed and controlled in programming:

Field Name	**Default value**	**Byte number in OTA Message type 0**

---

[5] For CelloTrack the Main Power field contains a Li-Polymer internal battery measurement.

[6] For CelloTrack Power it is monitoring the temperature of the battery as 2's compliment hexadecimal value. Effective measurement range from -20°C to 55°C, measurement error ±1.5°C

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Measurement 1	9 (Vin)	26
Measurement 2	6 (Vbat)	27
Measurement 3	7 (Bat. NTC)	28
Measurement 4	2 (Shock)	29

Available inputs for mapping

Measurement source number	Input source Name	Coefficient (for discrete and analog inputs only)	Remark
0	No source	-	The application shall ignore the value of the corresponding byte in the message as it might include random data.
1	Door[7]	1.0	Can report either analog (either in 9.8mA or 117.6mA resolution, as per programming) or frequency measurement as per corresponding input's type
2	Shock	1.0	
3	Panic	-	Infrastructure only, not currently supported
4	Unlock		
5	Lock		
6	V bat	0.01647058823	Battery voltage
7	Bat. NTC	Temperature conversion formula: t°C=0.4314x-40; 0 ≤x≤255 (-40°C ≤t ≤70°C) (where x is the measurement	The NTC received value Note that the accuracy of the measurement is ±3°C
8	V main	0.0176470588235	Regulated voltage
9	V in	0.1176470588235	Input voltage

In CelloTrack3G

In Cellotrack3G like in Cello the analog measurements sources are programmable. The default sources are described in the following table:

---

[7] The analog inputs measurement resolution is variable (either in 9.8mA or 117.6mA resolution), and controlled by programmable parameter

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Field Name	Default value	Byte number in OTA Message type 0
Measurement 1	6 (Battery Voltage)	26
Measurement 2	8 (Vmain Voltage)	27
Measurement 3	1 (GPIO1)	28
Measurement 4	7 (NTC)	29

Available inputs for mapping

Measurement source number	Input source Name	Coefficient (for discrete and analog inputs only)	Remark
0	No source	-	The application shall ignore the value of the corresponding byte in the message as it might include random data.
1	GPIO1	0-2.5V: 0.0078125 0-30: 0.117647058	Can report either analog (either in 9.8mA or 117.6mA resolution, as per programming) or frequency measurement as per corresponding input's type
2	GPIO2	0-2.5V: 0.0078125 0-30: 0.117647058	
3	No source	-	Infrastructure only, not currently supported
4	No source		
5	No source		
6	Battery Voltage	0.01647058823	Battery voltage
7	Bat. NTC	Temperature conversion formula: t°C=0.4314x-40; 0 ≤x≤255 (-40°C ≤t ≤70°C) (where x is the measurement	The NTC received value Note that the accuracy of the measurement is ±3°C
8	Vmain Voltage	0.0176470588235	Regulated voltage

2.2.3.16 Mileage Counter

The Cellocator unit is provided with a distance accumulator feature. The unit counts “distance base units” programmed in the EEPROM.

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By synchronizing the accumulator value with the vehicle's odometer reading and setting the "distance base units" to one kilometer/mile, this counter provides the ability to remotely "read" the vehicle's odometer. The programming and synchronizing is only needed once – during the installation.

The mileage counter field contains the current 24-bit value of this accumulator.

2.2.3.17 Multi-purpose field on bytes 33-38

The bytes 33-38 may carry different information as per bits 4 and 5 in Communication Control byte (10): Driver ID/Code update/PSP Data/Acc. Status/IMSI/Trailer ID

Driver ID / Passenger ID/ Group ID Code Update

If bits 4 and 5 of the Communication Control LSByte are both 0.

Every Cellocator unit (except CelloTrack and CelloAR) can provide 6 bytes of last received Dallas button in every message if that feature is enabled in EEPROM (Mask of Authentication Events).

If no Dallas code is received since the initiation of the last Start Event, this field includes 0.

The code can carry Driver ID or Passenger ID and Group ID, depends on the type of the attached button and the configuration.

Group ID

The Group ID is an additional driver authentication method, used when there are too many drivers to be programmed into unit's memory.

The length of Group ID varies from 1 to 9 bytes length but shorter than 10 digits. The unit supports multiple groups, while all Group IDs are from the same length.

Note: Group ID number shall never begin from zero.

The first number in Dallas codes array, shorter than 10 digits is considered as group ID and his length is considered length of group ID. Any additional number, shorter than 10 digits but with length different from the first Group ID length, is considered a driver id.

Example: Dallas code 1234567890, when group ID is 4 digits

Driver/Passenger ID 567890			Group ID 1234		
90	78	56	34	12	00
Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38

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The Keyboard

In case of CelloAR this field is used to report the code received by The Keyboard (when bits 4 and 5 of the Communication Control LSByte are both 0).

The message from CelloAR contains the received code and recognition status as it received from the keyboard.

Code Recognition Status	**Spare**	**Received Code (32 bits)**			
Byte 38	Byte 37	Byte 36	Byte 35	Byte 34	Byte 33

Code Recognition Status (Byte 38)

Reserved	Immobilizer Status 0 – off 1- on	Ignition Status 0 – off 1- on	Authentication (multi-code) Code status 0- OK 1- Wrong	Code status 0- OK 1- Wrong	Code type 0- Standard 1- Authentication 2- C&L 3- 7 - reserved		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Received Code (Bytes 33-36)

Master code, only in case of reply to access code request, otherwise sent as zeros				LSB char of the code	3rd char of the code	2nd char of the code	MSB char of the code
LSB char of Master code	3rd char of the Master code	2nd char of the Master code	MSB char of Master code				
Nibble 8	Nibble 7	Nibble 6	Nibble 5	Nibble 4	Nibble 3	Nibble 2	Nibble 1
7th byte of response		6th byte of response		5th byte of response		4th byte of response	

PSP – External Alarm status (If bits 4 and 5 of Communication Control LSByte = 01)

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Reserved			**Latest Valid External Alarm Status** (Refer to an external alarm protocol for statuses list)		**Com. Status**
Nibbles 6-11			Nibbles 1-5		Nibble 0
Byte 38	Byte 37	Byte 36	Byte 35	Byte 34	Byte 33

Keyboard status (If bits 4 and 5 of Communication Control LSByte = 10)

Reserved			**Latest Valid Keyboard Status** (Refer to an external alarm protocol for statuses list)		**Com. Status**
Nibbles 6-11			Nibbles 1-5		Nibble 0
Byte 38	Byte 37	Byte 36	Byte 35	Byte 34	Byte 33

Com. Status Table

Value	**Description**
0	The Keyboard status in following 5 nibbles
1	If Pairing is enabled (Address 1710 bit 5) The unit will send OTA event/distress message type 0 with TR 201, STR 0. The Com. Status in byte 33 of OTA Msg type 0 will contain 1 (Communication Loss or pairing Failed). If pairing is disabled (Address 1710 bit 5): The unit will send OTA event/distress message type 0 with TR 201, STR 0. The Com. Status in byte 33 of OTA Msg type 0 will contain 1 (Communication Loss only).
2-15	Reserved

Latest Valid Keyboard Status

The value of the following bits is updated every time when:

1) The code is received.
2) Operational mode changed.
3) Ignition Change detected.

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D19	D18	D17	D16	D15	D14	D13	D12	D11	D10	D9	D8	D7	D6	D5	D4	D3	D2	D1	D0
High Nibble				Low Nibble				High Nibble				Low Nibble				High Nibble			
Byte 35								Byte 34								Byte 33 (high nibble)			

Bit	**Name**	**Description**
D0	Door (from Cello unit)	Contains Logical Door Input (of Cello unit) status (inverted and filtered)
D1	Volume Meter	
D2		
D3	Ignition	SPC Keyboard Ignition input status
D4	Alarm Armed ON	Represents Immobilizer bit received from Keyboard. Same as D8.
D5	Not available, sent as zero	
D6		
D7		
D8	Immobilizer Armed ON	Represents Immobilizer bit received from Keyboard. Same as D4.
D9	Not available, sent as zero	
D10	Hot Wiring	Set Hotwiring detected by SPC Keyboard, reset upon entrance of Operational State 0 or 1.
D11	Service	Set when Operational State = 4 Reset in any other Operational State
D12	Keypad Wrong Code	Updated upon reception of the corresponding message from keyboard. Set when: bit 3 or bit 4 of code recognition status byte is 1 Reset when both bit 3 and bit 4 of code recognition status byte are 0
D13-D19	Zeros	

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In case of CelloTrack

The 6 bytes of Dallas are used to monitor debug information, used by Cellocator for troubleshooting:

Last Rcon	**Resets Counter**	**Last Stack pointer**	**Checksum Error Counter**	**GPRS Failures counter**	**Debug Reset Reason**
Byte 38	Byte 37	Byte 36	Byte 35	Byte 34	Byte 33

IMSI: In case of a "Wake Up" Message (Transmission reason 0d202), the unit reports 6 bytes (12 first characters) of the SIM's IMSI converted to hex (Little Endian).

The IMSI number consists of up to 15 numerical characters (0-9). An IMSI consists of a three digit mobile country code (MCC, which is not reported by Cellocator Protocol) and a variable length national mobile station identity (NMSI).

The NMSI consists of two variable length parts: the mobile network code (MNC) and the mobile station identification number (MSIN). A Class 0 IMSI is 15 digits in length. A Class 1 IMSI is less than 15 digits in length.

Example:

IMSI: 425020315229000 **(Cellcom IL)**

MCC	425	Israel
MNC	02	Cellcom IL
MSIN	0315229000	

The Hex value received in bytes 33-38:

Value (hex)	00	5A	16	0F	03	02
Location in message type 0	Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38

Conversion table:

In wireless protocol (little-endian)	00	5A	16	0F	03	02
Big-endian (HEX values)	02	03	0F	16	5A	00
DEC values	02	03	15	22	90	00
NMSI (MNS + MSIN)	020315229000					

Trailer ID

The 6 bytes of Dallas are used to monitor the Dallas ID of the connected or disconnected Trailer.

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2.2.3.18 Last GPS Fix

This field monitors a timestamp, when the GPS was last in navigation mode.

Structure:

Byte 40								**Byte 39**							
Day of Month					**Hours**					**Minutes**					
Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

NOTE: The easiest way to define if the GPS data in the message is valid and updated, or historical, is to compare between the time of the timestamps and UTC time (see below).

2.2.3.19 Service and Location Status Byte

Unused			CFE Type (Infrustructure)			Trailer status indication: 0-Trailer Disconnected 1-Trailer Connected	**For all the devices except Cello:** The 3rd Byte of Analog Inputs Source selection represents '0' – Main Power regulated voltage (backward compatibility '1' – The 2nd Analog input (on pin14)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

CFE Type connected to Cello (Infrustructure)

CFE Type	**Bit 4**	**Bit 3**	**Bit 2**
Not Applicable (Legacy state)	0	0	0
CFE is not connected	0	0	1
CFE BT is connected	0	1	0
CFE Basic is connected	0	1	1
CFE I/O is connected	1	0	0
CFE premium is connected	1	0	1
Undefined CFE Type	1	1	1

2.2.3.20 MODE 1 from GPS

This field is generated by the GPS and transparently monitored in the outgoing message from the unit. The field defines the validity of GPS data in the message.

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It is a bitmapped field of flags, defined in the following manner:

The unit considers the valid fix according to the GPS Filter settings in the EEPROM. If the “Enable Tide GPS filter” flag in EEPROM is enabled, the unit considers the GPS data as valid only if:
Mode 1 = 3 or 4
AND
Mode 2 = 2
otherwise, if “Enable Tide GPS filter” flag in EEPROM is disabled, a fix, with the value of Mode 1 =2, 3, 4, 5 and 6, is considered as valid.

2.2.3.21 MODE 2 from GPS

This field is generated by the GPS. It is a hexadecimal value, defined in the following manner:

The unit considers the valid fix according to the GPS Filter settings in the EEPROM. If the “Enable Tide GPS filter” flag in EEPROM is enabled, the unit considers the GPS data as valid only if:
Mode 1 = 3 or 4
AND
Mode 2 = 2
otherwise, if “Enable Tide GPS filter” flag in EEPROM is disabled, a fix with the value of Mode 1 =2, 3, 4, 5 and 6 is considered as valid.

2.2.3.22 Number of Satellites Used

Number of satellite measurements used for current position fix. Possible values are 0 to 12.

2.2.3.23 Longitude, Latitude

Longitude and latitude coordinates of current position fix. Both coordinates are sent as 32-bit signed integers, representing the coordinates in 10^{-8} radian resolution. Possible values are $-\pi$ to $+\pi$ for longitude, or $-\pi/2$ to $+\pi/2$ for latitude. The coordinates refer to WGS-84 map datum and ellipsoid.

2.2.3.24 Altitude

Altitude of current position fix. Represented as a 32-bit signed integer, in 10^{-2} meter resolution (altitude is represented in centimeters).

2.2.3.25 Ground Speed

Current speed (absolute value of the vector). Represented as a 32-bit unsigned integer, in 10^{-2} meter/sec resolution (speed is represented in centimeters/sec).

2.2.3.26 Heading/Speed Direction (True Course)

Direction (angle) of the speed vector. Represented as 16-bit unsigned integer, in 10^{-3} radian resolution. Possible values are 0 to 2π.

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2.2.3.27 System Time

Universal coordinated time of the position fix, represented in seconds (0-59), minutes (0-59) and hours (0-23).

Note that the system time and date fields are monitoring system time, based on the internal timer of the unit. The internal timer synchronizes with GPS time when the GPS fix is considered as valid (or always as per configuration flag).

2.2.3.28 System Date

Universal coordinated date of the position fix, represented in days (1-31), months (1-12) and years (1980-2079).

Note that the system time and date fields are monitoring system time, based on the internal timer of the unit. The internal timer synchronizes with GPS time when the GPS fix is considered as valid (or always as per configuration flag).

2.2.3.29 Checksum

The checksum is a last byte of sum of all bytes in a message, excluding the 4 bytes of System Code and the Checksum itself.

Example:
The message:
*4D434750*0006000000081A02021204000000210062300000006B00E10000000000000
0000000E5A100040206614EA303181A57034E1200000000000000001525071403D607
CS

Calculation of the CS=>

00+06+00+00+00+08+1A+02+02+12+04+00+00+00+21+00+62+30+00+00+00+
6B+00+E1+00+00+00+00+00+00+00+00+00+00+E5+A1+00+04+02+06+61+4E+
A3+03+18+1A+57+03+4E+12+00+00+00+00+00+00+00+00+15+25+07+14+03+
D6+07=0x749

=>CS=0x49

2.3 Programming Data Message Definition

2.3.1 Message Ingredients

The programming status message has a predefined length of 31 bytes. It contains the following data (listed in the actual transmitted order):

Message header
- System code – 4 bytes
- Message type – ("3") 1 byte
- Unit ID – 4 bytes
- Communication Control Field – 2 bytes
- Message numerator – 1 byte
- Spare byte – 1 byte

Memory data
- Block code – 1 byte

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- Block data – 16 bytes

Error detection code – 8-bit additive checksum (excluding system code)

2.3.2 Detailed Per-Field Specifications

2.3.2.1 Message header

The message header is identical to the message header of message type 0, except the message type field set as "3" in programming messages.

2.3.2.2 Block Code

OTA (over the air) parameter programming is done in blocks. The entire parameter memory is partitioned to 16-bytes long blocks. Each of those blocks is identified with a block code. The block code field contains the code of the block whose data is sent in this message (in the block data field).

2.3.2.3 Block Data

Contains the actual data programmed in the specified block of the parameter memory.

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2.4 Logged Fragment of Data Forwarded From Serial Port to Wireless Channel

The message contains a fragment of payload forwarded from the COM port of the unit, optionally escorted by fleet management data (as per unit's configuration).

The forwarded content is fragmented by chunks of 54 bytes long (last one is zero-padded); chunks are enumerated and equipped by fragmentation control fields, stored in an events log memory and then uploaded as message type 7.

Same as message type 0 and 9, message type 7:

- Continues the Message Numerator used by other logged messages
- Requires acknowledge from the server (Message type 4) in order to erase the specific message from the log.
- The message 7 utilizes the same retransmission algorithms as other logged message types.

2.4.1 The Container

The container is a data structure, created by the unit in its RAM buffer upon reception of the data for forwarding from COM port (in enabled in a configuration).

The forwarded payload in escorted by 48 bytes of FM data (attached after the last byte of payload) and total length of payload + FM data (first 2 bytes of the container, before the first byte of payload).

Every container is assigned by 6 bits numerator (increased every data packet received from COM port), used in fragmentation process and reported with the container.

Forwarded Message Code
A sequential 7 bits ID of the container + indication bit (Single byte)

The Container							
Length of container (2 bytes)		The payload of forwarded data X			48 bytes of fleet management data		
Byte 1	Byte 2	Byte 3			Byte 3 + X		Byte 3+ X+48

2.4.1.1 The byte structure of a container

The data structure to be fragmented and forwarded:

Forwarded Message Code							
Container (1) / Simple payload – 0	In case of container: sequential 7 bits ID of the container, otherwise - sequential 7 bits ID of the forwarded packet.						
Bit 7	Bit 6	Bit 6	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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1	Payload length (X)	2 bytes containing the length of the container starting from byte 3.
2		
3	The payload, X bytes (up to 512 bytes)	Data as it is received from 3rd party or Garmin Packet
3+X		
4+X	Unit’s status + Current GSM Operator (1st nibble) (same as byte 16 of Msg type 0)	
5+X	Current GSM Operator (2nd and 3rd nibble) (same as byte 17 of Msg type 0)	
6+X	Current GSM Operator (4th and 5th nibble) (same as byte 25 of Msg type 0)	
7+X	Unit’s mode of operation (same as byte 20 of Msg type 0)	
8+X	Unit’s I/O status 1st byte (same as byte 21 of Msg type 0)	
9+X	Unit’s I/O status 2nd byte (same as byte 22 of Msg type 0)	
10+X	Unit’s I/O status 3rd byte (same as byte 23 of Msg type 0)	
11+X	Unit’s I/O status 4th byte (same as byte 24 of Msg type 0)	
12+X	Analog input 1 value (same as byte 26 of Msg type 0)	
13+X	Analog input 2 value (same as byte 27 of Msg type 0)	
14+X	Analog input 3 value (same as byte 28 of Msg type 0)	
15+X	Analog input 4 value (same as byte 29 of Msg type 0)	
16+X	Mileage counter (total 24 bits) (same as bytes 30-32 of Msg type 0)	
17+X		
18+X		
19+X	Driver ID, PSP/SPC Specific Data, Accelerometer Status or SIM IMSI (same as bytes 33-38 of Msg type 0)	
20+X		
21+X		
22+X		
23+X		
24+X		
25+X	Time of last GPS Fix (same as bytes 39-40 of Msg type 0)	
26+X		
27+X	Location status (flags) (same as Sub-Type 4 of Msg type 9)	

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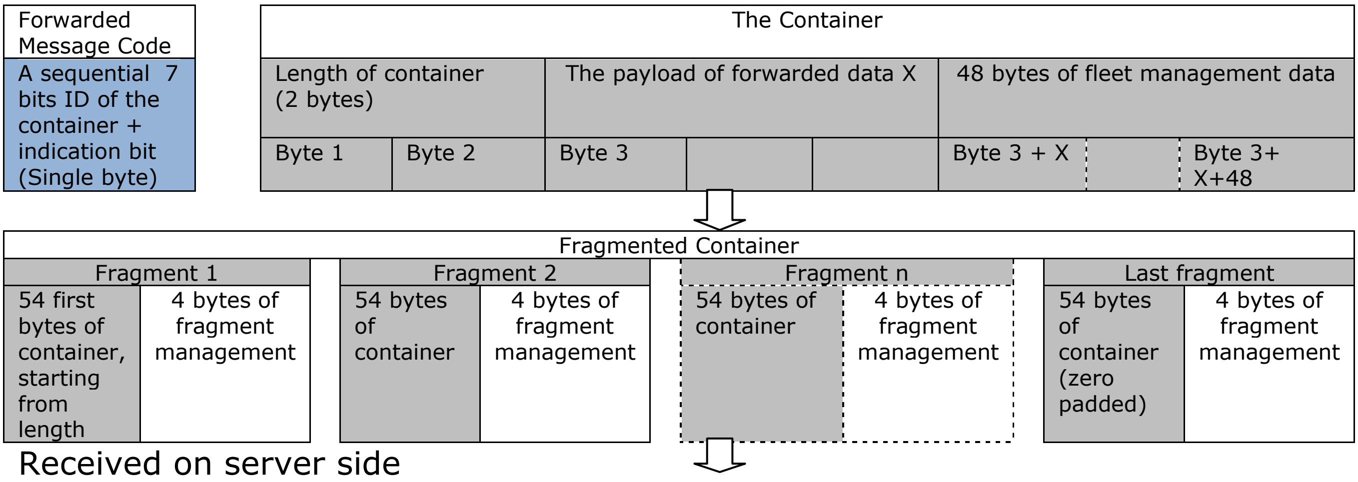
28+X	Mode 1 (from GPS)
29+X	Mode 2 (from GPS)
30+X	Number of satellites used (from GPS)
31+X	Longitude
32+X	
33+X	
34+X	
35+X	Latitude
36+X	
37+X	
38+X	
39+X	Altitude
40+X	
41+X	
42+X	Ground speed
43+X	
44+X	Speed direction (true course)
45+X	
46+X	UTC time – seconds
47+X	UTC time – minutes
48+X	UTC time – hours
49+X	UTC date – day
50+X	UTC date - month
51+X	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)

2.4.2 Data path chart



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Header of OTA Msg type 7 (12 bytes)	Static byte containing 0x07	Message numerator (Y)	Forwarded Message Code	Fragment control byte	54 first bytes of container (starting from length filed) in Fragment 1	CS
Header of OTA Msg type 7	Static byte containing 0x07	Message numerator (Y+1)	Forwarded Message Code	Fragment control byte	54 bytes of container in Fragment 2	CS
Header of OTA Msg type 7	Static byte containing 0x07	Message numerator (Y+2)	Forwarded Message Code	Fragment control byte	54 bytes of container (zero padded) in last Fragment	CS

2.4.3 Byte-Aligned Table

<table>
<tr><td>Byte no.</td><td>Description</td><td>Containing</td></tr>
<tr><td>1</td><td>System code, byte 1</td><td>ASCII “M”</td></tr>
<tr><td>2</td><td>System code, byte 2</td><td>ASCII “C”</td></tr>
<tr><td>3</td><td>System code, byte 3</td><td>ASCII “G”</td></tr>
<tr><td>4</td><td>System code, byte 4</td><td>ASCII “P”</td></tr>
<tr><td>5</td><td>Message type</td><td>7</td></tr>
<tr><td>6</td><td rowspan="4">Unit’s ID
(total 32 bits)</td><td rowspan="4"></td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td rowspan="2">Communication Control field (same as in MSG Type 0)</td><td rowspan="2"></td></tr>
<tr><td>11</td></tr>
<tr><td>12♠</td><td>Message Numerator</td><td>Sequential numerator of messages, used by ACK</td></tr>
<tr><td>13♠</td><td colspan="2">Static byte containing value 0x07</td></tr>
<tr><td>14♠</td><td colspan="2">Forwarded Message Code
Sequential 7 bits ID of the Container+ container indication bit (MSB)
Assigned for each container
<table>
<tr><td>Container (1) / Simple payload – 0</td><td colspan="7">sequential 7 bits ID of the cont□iner</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 6</td><td>Bit 4</td><td>B□t 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table></td></tr>
<tr><td>15♠</td><td colspan="2">Fragment Control Byte
<table>
<tr><td>First Frame</td><td>Last Frame</td><td colspan="6">Fragment No (starting from 1)</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table></td></tr>
<tr><td>16♠</td><td colspan="2" rowspan="2">54 bytes of container in fragment
(first one begins with two bytes of length of container starting from byte 3;
last one is zero padded)</td></tr>
<tr><td>69♠</td></tr>
<tr><td>70</td><td>Check Sum</td><td></td></tr>
</table>

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2.4.3.1 Fragment Control Byte

- **First Frame**

This bit contains "1" if the packet carries the first frame of the container, otherwise zero.

- **Last Frame**

This bit contains "1" if the packet carries the last frame of the container, otherwise zero.

- **Fragment number**

Contains sequential number of the fragment, carried in the packet (starting from 1)

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2.5 Real Time Data Forwarded From Serial Port to Wireless Channel (Msg 8)

The message contains a payload forwarded from the COM port of the unit, optionally escorted by fleet management data (as per unit's configuration, refer to a Container definition above in this document).

The message contains data of variable length up to 562 bytes.

2.5.1 Message Ingredients

Message header

- System Code – 4 bytes
- Message Type – 1 byte
- Destination Unit ID – 4 bytes
- Command Numerator – 1 byte
- Spare – 4 bytes

Message payload

- Message Code – 1 byte
- Fragment Control Byte – 1 byte
- Payload Length – 2 bytes
- Payload - variable length
- Error Detection Code – 8 bit additive checksum

2.5.2 Byte-Aligned Table

1	System code, byte 1 – ASCII “M”
2	System code, byte 2 – ASCII “C”
3	System code, byte 3 – ASCII “G”
4	System code, byte 4 – ASCII “P”
5	Message type-byte (a value of 8 for a forwarded data)
6	Target Unit’s ID (total 32 bits)
7	
8	
9	
10	Command Numerator Field
11	Spare (sent as zeros)
12	
13	
14	

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15	Forwarded Message Code	
16	Fragment Control Byte – Constant value of 0XC0	
17	Length of Payload (or container)	
18		
19	Payload First Byte	First Byte of payload of forwarded data in a container
	Payload Last Byte	Last byte of the container (of 48 bytes of escorting fleet management data)
	Checksum	

2.5.3 Detailed Per-Field Specifications

2.5.3.1 Message header

The message header is identical to the message header of message type 0, except the message type field set as "8" in data forwarding messages.

2.5.3.2 Forwarded Message Code

A counter of forwarded messages, changes every time message is forwarded from the terminal.

Container (1) / Simple payload – 0	In case of container: sequential 7 bits ID of the container, otherwise - sequential 7 bits ID of the forwarded packet.						
Bit 7	Bit 6	Bit 6	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.5.3.3 Fragment Control Byte

That field defines, to the control center application, how many fragments are transferred for the same data block.

Bit 7	**Bit 6**	**Bit 5**	**Bit 4**	**Bit 3**	**Bit 2**	**Bit 1**	**Bit 0**
Unit Originated Bit	Last Fragment Bit	Fragment Index					

- Last Fragment Bit – set to "1" if the fragment is the last one.
- Unit Originated Bit – set to "1" if the message origin is a unit and "0" if the message origin is an application.]

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- Fragment Index – fragment number.

In case of MSG type 8 will always contain 0xC0

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2.6 Modular Message (Msg 9)

The modular data packet is designed to provide different data types in the same packet. The modular data packet contains the following bytes (listed in the actual transmitted order):

2.6.1 Message Ingredients

Message Header

- System Code – 4 bytes
- Message Type – 1 byte
- Unit ID – 4 bytes
- Communication Control Field – 2 bytes
- Message Numerator (Anti-TangoTM) – 1 byte

Packet Control Field – 1 byte

Total Length – 1 byte

First Sub-Data Type– 1 byte

First Sub-Data Length – 1 byte

First Sub-Data– variable length, depends on Data Type

……

Nth Sub-Data Type – 1 byte (option)

Nth Sub-Data Length – 1 byte

Nth Sub-Data– variable length, depends on Data Type N

Error Detection Code – 8 bit additive checksum

Byte-Aligned Table

1	System code, byte 1 – ASCII “M”
2	System code, byte 2 – ASCII “C”
3	System code, byte 3 – ASCII “G”
4	System code, byte 4 – ASCII “P”
5	Message type byte (a value of 9 for a modular packet)
6	Target Unit’s ID (total 32 bits)
7	
8	
9	
10	Communication Control field

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11	
12	Message Numerator
13	Packet Control Field
14	Total Data length
15	First Sub-data Type
16	First Sub-data Length
17	First Sub-data The Data
	Nth Sub-data Type
	Nth Sub-data Length
	Nth Sub-data The Data
	Checksum

2.6.2 Detailed Per-Field Specifications

2.6.2.1 System Code

System code is a 4-bytes value, which identifies the Cellocator GSM-SMS system. The field is sent as the ASCII values of the letters "M", "C", "G", "P", in that order.

2.6.2.2 Message Type

Message type identifies the type of message. It allows the receiver to distinguish between status messages, programming and other data messages, according to the value sent in this field. Modular messages contain a value of 9 (nine) in the message type field.

2.6.2.3 Unit ID

Refer to Section 2.2.3.3.

2.6.2.4 Communication Control Field

Refer to Section 2.2.3.4.

2.6.2.5 Message Numerator (Anti-Tango™)

Refer to Section 2.2.3.5.

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2.6.2.6 Packet Control Field

Bit 7	Bit 6	Bits 5-0
Direction	Out of space indication	unused

Direction

0 – Data from the unit

1 – Request (unit-bound)

Out of Space Indication

0 – All the requested data present in the message

1 – Some Sub-Data was not returned due to data size

2.6.2.7 Total Length

That field includes the number of data bytes with their types and lengths. It includes the number of bytes from byte 15 to the byte of the checksum, which is not included.

2.6.2.8 Sub-Data Types List

0	Unused
1	Firmware Platform Manifest
2	CAN data
3	CAN Trigger data
4	Time & Location Stamp data
5	Accelerometer Data
6	PSP – UL messages from Alarm system
7	Usage Counter update
8	Command Authentication table update
9	Neighbor list of the serving GSM cell
A	Maintenance Server Platform Manifest
B	Data forwarded from the Keyboard
D	Compressed vector change report
12	Modular Platform Manifest
13	Reserved
14	Pulse Counter OTA request command and response
15-EF	Reserved
F0	Reserved – Infrustructure
F1	Reserved– Infrustructure
F2	Reserved– Infrustructure
F3	Reserved– Infrustructure

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F4	Reserved– Infrustructure
F5-FF	Empty

2.6.3 The Firmware Platform Manifest (Sub-Data Type 1)

This type is generated as a reply to a Firmware Platform Manifest request (see Command Channel (Section 2.6.14).

Byte number	Description	Value
1-14	Standard header (as described above)	
15	Sub-data type	0x01
16	Sub-data length	0x12
17	Processor family identifier	0x01 – PIC18Fx520/620/720 0x02 – PIC18Fx621/525 0x03 – PIC18Fx527/622/627/722 (x=6/8) 0x04– STM32F101RCT6
18	Hardware interface and peripherals identifier	0x01 – 40/44 pin micro, peripherals as per family. 0x02 – 64 pin micro, peripherals as per family. 0x03 – 80 pin micro, peripherals as per family. 0x04– 64 pin STM32 101 RTC6
19	Size of program memory (in 1024 words units) (LSB).	In blocks of 1024 words
20	Size of program memory (in 1024 words units). (MSB)	
21-22	Size of volatile memory (LSB)	Divided by 128 bytes and rounded up/down to the closest integer
	Size of volatile memory (MSB)	
23-24	Size of internal non-volatile memory (LSB)	Divided by 128 bytes and rounded up/down to closest integer
	Size of internal non-volatile memory (MSB)	
25-26	Size of external non-volatile memory (LSB)	In blocks of 1024 words units
	Size of external non-volatile memory (MSB)	
27	External non-volatile memory type	0x01 – I^{2}C generic NVRAM (most EEPROMs).

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Byte number	Description	Value
		0x02 – SPI generic NVRAM.
28	Hardware Version	Same as reported in OTA status
29-30	Reprogramming facility identifier (LSB)	0x01
	Reprogramming facility identifier (MSB)	0x00
31-32	Script language version (LSB)	0x01
	Script language version (MSB)	0x00
33-34	Current Firmware ID (LSB)	Note that this is in fact not a descriptor of the firmware platform per se, but rather a descriptor of the actual firmware running on the platform. However, it is a valuable field when a re-flash is considered.
	Current Firmware ID (MSB)	
35	Checksum	

2.6.4 The CAN Data (Sub-Data Type 2)

The CAN data module includes data from all the CAN sensors, defined in the unit's EEPROM. Each CAN sensor is represented by 6 (six) bytes of data as defined below:

Options – 1 byte

Spare – 1 byte

CAN sensor value – 4 bytes (little Endian)

Can Sensor 0	0	Options byte
	1	Spare
	2	CAN Sensor Value
	3	
	4	
	5	
Can Sensor N	6n	Options byte
	6n+1	Spare
	6n+2	CAN Sensor Value
	6n+3	
	6n+4	
	6n+5	

Options byte definition

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Data receiving flag	Spare	Sensor data effective bit length
Bit 7	Bit 6	Bit 5 - 0

2.6.4.1 CAN Sensor Value

The CAN sensor value contains the actual data, as it is reported from the defined sensors reported in Little Endian style (LSB first).

2.6.5 CAN Trigger Module (Sub-Data Type 3)

The packet is sent as a result of a trigger caused by one of the CAN sensors or by a Complex Trigger. The length of the sub-data type is variable.

2.6.5.1 Module Data

CAN trigger index/ First CAN Trigger Index – 1 byte

This value contains the index of the CAN trigger record (or the first trigger from the Complex Trigger) that caused the transmission. The index of every CAN sensor is set in the EEPROM of the unit during programming.

Complex trigger	CAN trigger index / First CAN trigger index (if Complex Trigger bit =1)
Bit 7	Bits 6-0

Second CAN Trigger Index of Complex Trigger – 1 byte

This value contains the index of the second CAN trigger (from the Complex Trigger) that caused the transmission.

2nd sensor in complex trigger	Second CAN trigger index (if “2 sensors in Complex trigger” bit =1), otherwise spare
Bit 7	Bits 6-0

Included CAN Sensors Count – 1 byte

This value is the number of CAN sensors included in the module.

CAN Sensors Data – 7·n bytes

“n” is number of included CAN sensors, in accordance with the information in the previous paragraph.

The list is composed of the following fields, repeated for each included sensor:

Sensor index – 1 byte

Options byte – 1 byte (see description in sub-type 2)

Spare – 1 byte

CAN sensor value – 4 bytes

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NOTE: Complex triggers will always be generated as a message, containing values of both sensors of the complex trigger, and, optionally, the third sensor (additional one, configurable) and the GPS (see below).

2.6.6 Logged CAN Trigger Module (Sub-Data Type 3)

Up to codebase 27e, the logging infrastructure of the Cellocator unit was only applicable to position messages (type 0). Each event was inserted into an external EEPROM as a 58-bytes record, and 12 more bytes were added at delivery time (synchronization string, unit's ID, communication control field and checksum).

From fw28, the same logging mechanism was applied to messages type 9, specifically to actively generated messages, triggered by CAN bus management routines.

In order to simplify the development it has been decided to use the same logging procedure, which means that the length of a CAN logged message will always be 58 bytes, similarly to position message.

The message numerator of such a type 9 logged event will maintain the same sequence as other logged position events (type 0).

The message will require an acknowledgement identical to the acknowledge sent for message type 0 (and message type 8).

Due to the above-mentioned logging size limitation the "Specific data – logged" CAN event will include (up to) 3 CAN sensors and a GPS sub-data packet (sub-data 4).

2.6.6.1 Packet Specification

The 58 bytes, which are actually logged are marked by the "♠" icon, the rest are added at delivery time.

Byte no.	Description	Containing
1	System code, byte 1	ASCII "M"
2	System code, byte 2	ASCII "C"
3	System code, byte 3	ASCII "G"
4	System code, byte 4	ASCII "P"
5	Message type	9
6	Unit's ID (total 32 bits)	As explained above
7		
8		
9		
10	Communication Control field	
11		

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Byte no.	Description	Containing	
12♠	Message Numerator		
13♠	Packet Control Field	0x00	
14♠	Total Data length	0d55	
15♠	Sub-Data Type	3	
16♠	Sub-Data Length	0d24	
17♠	Index of triggered CAN sensor	Complex Trigger	CAN trigger index / First CAN trigger index (if Complex Trigger bit =1)
		Bit 7	Bits 6-0
18♠	Spare (or Second CAN trigger index)	2nd sensor in Complex trigger	Second CAN trigger index (if “2 sensors in Complex trigger” bit =1), otherwise spare
		Bit 7	Bits 6-0
19♠	Number of included sensors	Between 1 and 3	
20-26♠	First included sensor	Sensor index	
		Options byte	
		Spare	
		4 bytes of CAN sensor value	
27-33 ♠	Second included sensor	Same as first included sensor	
34-40♠	3rd included sensor	Same as first included sensor	
41♠	Sub-data Type	4	
42♠	Sub-data Length	0d25	
43♠	Location status (flags)	See the following description of sub-data type 4 in this document.	
44♠	Mode 1 (from GPS)		
45♠	Mode 2 (from GPS)		
46♠	Number of satellites used (from GPS)		
47-50♠	Longitude		
51-54♠	Latitude		
55-57♠	Altitude		

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Byte no.	Description	Containing
58-59♠	Ground speed	
60-61♠	Speed direction (true course)	
62♠	UTC time – seconds	
63♠	UTC time – minutes	
64♠	UTC time – hours	
65♠	UTC date – day	
66♠	UTC date - month	
67♠	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)	
68-69♠	Spare	zeros
70	Check Sum	

If there are less than 3 sensors defined for the specific trigger, the unit sends the associated fields as zeros. The message length will remain constant.

NOTE: A logging frequency limitation exists: the unit will not log more than 1 message per 4 seconds.

2.6.7 Time and Location Stamp Module (Sub-Data Type 4)

The module is designed to provide the time and location information as a part of modular message. The module can be requested with the modular request command. It is also automatically added to the self-initiated modular messages generated by the unit.

	Sub-data type=4
	Length = 25
	Location status (flags)
	Mode 1 (from GPS)
	Mode 2 (from GPS)
	Number of satellites used (from GPS)
	Longitude
	Latitude

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	Altitude
	Ground speed
	Speed direction (true course)
	UTC time – seconds
	UTC time – minutes
	UTC time – hours
	UTC date – day
	UTC date - month
	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)

2.6.7.1 Location Status

Most significant bit (bit 7) – time inaccuracy flag.
"1" indicates time is inaccurate, either because time was never acquired, or because accuracy is doubtful due to hibernation.

Bit 6 – GPS disconnected indication (0=connected, 1=not connected/error).

2.6.7.2 MODE 1 from GPS

Refer to Section 0.

2.6.7.3 MODE 2 from GPS

Refer to Section 2.2.3.21.

2.6.7.4 Number of Satellites Used

Refer to Section 2.2.3.22.

2.6.7.5 Longitude, Latitude

Refer to Section 2.2.3.23.

2.6.7.6 Altitude

Refer to Section 2.2.3.24.

2.6.7.7 Ground Speed

This indicates the current speed (absolute value of the vector). It is represented as a 16-bit unsigned integer, in 10^{-2} meter/sec resolution (speed is represented in centimeters/second).

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The source of speed data is either the GPS, the vehicle's CAN bus or frequency metering input as per unit's type, installation and configuration.

The reported value may monitor the immediate value of speed recorded upon generation of the message or the maximum value of speed from last report (as per the configuration). Byte 10, bit 6 of the message is monitoring the actual reported type.

2.6.7.8 Heading/Speed Direction (True Course)

Refer to Section 2.2.3.26

2.6.7.9 UTC Time

Refer to Section 2.2.3.27.

2.6.7.10 UTC Date

Refer to Section 2.2.3.28.

2.6.8 Accelerometer Response Module (Sub-Data Type 5)

Note this is supported by EDR only (Refer to an appropriate documentation)

2.6.9 PSP – UL Messages from Alarm System (Sub-Data Type 6)

This message contains encapsulated data forwarded from a CE8 (or CE8 compatible) Car Alarm System. Refer to the Corresponding Car Alarm protocol for more details.

2.6.9.1 Message Structure

Byte Number		Data
N	Sub-data type	6
N+1	Sub-data length	Variable
N+2..... N+X	Payload: data forwarded from car alarm system	Spare

2.6.10 Usage Counter Update Packet (Sub-Data Type 7)

The message is generated per request (Sub-Data type 7, as described in the Command Chanel definition of this document) or as a periodical update. In the latter case, it is merged with the GPS time/location stamp (Sub-Data type 4).

2.6.10.1 Message Structure

Byte Number		Data
N	Sub-Data type	7
N+1	Sub-Data Length	9

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N+2	Spare	Spare
(N+3)-(N+6)	Counter 1 value	See the following description.
(N+7)-(N+10)	Counter 2 value	

Counters Data Field Definition

Counter 2 value, minutes (0-0xFFFFFF)			Counter 2 input's number	Counter 1 value, minutes (0-0xFFFFFF)			Counter 1 input's number
Byte N+10	Byte N+9	Byte N+8	Byte N+7	Byte N+6	Byte N+5	Byte N+4	Byte N+3

Input's Numbers Definition

Hardware: Olympic	
Input's name	Input's number (dec)
Shock	1
Ignition	5
Panic	6
Ext. Alarm Triggered	12
Ext. Alarm Armed	13
Hardware: Compact CAN	
Input's name	Input's number (dec)
Door	0
Shock	1
Ignition	5
Panic	6
Hardware: Compact Security/6 inp. fleet	
Input's name	Input's number (dec)
Door	0
Unlock2 Input	1
Ignition	5
Panic	6
Unlock Input	7

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Lock Input	10
Hardware: Compact Fleet/LC	
Input's name	Input's number (dec)
Door	0
Shock	1
Ignition	5
Panic	6
COM RTS (pin 11)	7
Hardware: 370-50	
Input's name	Input's number (dec)
Door	0
Shock	1
Hood	2
Volume	3
Ignition	5
Panic	6
GP1	7
Arm	8
Disarm	9
Odometer	11
Unlock	12
Lock	13
Unlock2	14
Hardware: CelloTrack	
Input's name	Input's number (dec)
Tamper Switch	0
Push Button	1
GP input 1	2

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GP input 2	3
Movement Sensor (Ignition)	5

2.6.11 Command Authentication Update (Sub-Data Type 8)

This packet is sent as a response to an Authentication Table Update command. Refer to the description of Command Channel

Description	**Value**	
Sub-data type	0x08	
Sub-data length	0x09	
Spare	0x00	
8 bytes of authentication table	Auth. Table Index 0	Auth. Table Index 1
	Auth. Table Index 14	Auth. Table Index 15

2.6.12 Neighbor list of the serving GSM cell (Sub-Data Type 9)

This packet will be sent:

- Passively, as a response to a Neighbor list of the serving GSM cell request. In this case the packet will be sent using the same communication transport as the request.
- Actively, if enabled in unit's configuration, separately for home and roam GSM networks, on address dec 202 and 204 respectively, bits 6 and 7.

Description		**Value**	
Sub-data type		0x09	
Sub-data length		0x35	
Spare		0x00	
Timestamp - UTC time	seconds	0-59	The UTC time is logged upon Cell ID (AT+MONI) query (not the transmission time)
	minutes	0-59	
	hours	0-23	
	day	1-31	
	month	1-12	
	year	Actual year minus 2000 – 1 byte (e.g. value of 7 = year 2007)	
S e	BSIC	Base station identification code. The data can be request	

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		from the Telit modem using #MONI=7, Enfora using an engineering mode AT commands.
	LAC (LSB)	Localization area code
	LAC (MSB)	
	CellID (LSB)	Cell Id
	CellID (MSB)	
	Power	Received signal strength in dBm (hex); the sign is not saved, this value is always representing a negative number
Neighbor cell 1	bsic	Base station identification code
	LAC (LSB)	Localization area code
	LAC (MSB)	
	CellID (LSB)	Cell Id
	CellID (MSB)	
	Power	Received signal strength in dBm (hex)
Neighbor cell 2	bsic	Base station identification code
	LAC (LSB)	Localization area code
	LAC (MSB)	
	CellID (LSB)	Cell Id
	CellID (MSB)	
	Power	Received signal strength in dBm (hex)
Neighbor cell 6	bsic	Base station identification code
	LAC (LSB)	Localization area code
	LAC (MSB)	
	CellID (LSB)	Cell Id
	CellID (MSB)	
	Power	Received signal strength in dBm (hex)
Zero Padding	00	Zero Padding to fulfill the 56 bytes assigned for single event
	00	
	00	

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	00	

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2.6.13 Maintenance Server Platform Manifest (Sub-Data Type A)

Periodically (or upon command from the CCC) the unit connects to a maintenance server in order to check for the latest firmware and /or programming update. Auto connection to the maintenance server can be enabled upon power up and upon firmware upgrade.

Upon connection the unit generates a packet which is described below. An acknowledge (OTA message type 4) is received with a timeout defined in the EEPROM. If this is not the case, the platform manifest should be resent.

If the unit cannot establish a connection to the maintenance server while the GPRS is available, it uses the dial up retry algorithm defined in the EEPROM Allocation (refer to the Anti-Flooding section).

If all the retries fail, the unit ceases to try and reconnects to an operational server (instead of entering Anti-Flooding, as it would do while connected to an operational server).

Byte number	**Description**	**Value**
1-14	Standard header (as described above)	
15	Sub-data type	0x0A
16	Sub-data length	0x22
17	Processor family identifier	0x01 – PIC18Fx520/620/720 0x02 – PIC18Fx621/525 0x03 – PIC18Fx527/622/627/722 (x=6/8)
18	Hardware interface and peripherals identifier	0x01 – 40/44 pin micro, peripherals as per family. 0x02 – 64 pin micro, peripherals as per family. 0x03 – 80 pin micro, peripherals as per family.
19	Size of program memory (in 1024 words units) (LSB)	In 1024 words
20	Size of program memory (in 1024 words units) (MSB)	
21-22	Size of volatile memory (LSB)	Divided by 128 bytes and rounded up/down to closest integer
	Size of volatile memory (MSB)	
23-24	Size of internal non-volatile memory (LSB)	Divided by 128 bytes and rounded up/down to closest integer
	Size of internal non-volatile memory (MSB)	

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<table>
<tr><th>Byte number</th><th>Description</th><th colspan="3">Value</th></tr>
<tr><td rowspan="2">25-26</td><td>Size of external non-volatile memory (LSB)</td><td colspan="3" rowspan="2">1024 words units</td></tr>
<tr><td>Size of external non-volatile memory (MSB)</td></tr>
<tr><td>27</td><td>External non-volatile memory type</td><td colspan="3">0x01 – I2C generic NVRAM (most EEPROMs).
0x02 – SPI generic NVRAM.</td></tr>
<tr><td>28</td><td>Hardware Version</td><td colspan="3">Same as reported in OTA status</td></tr>
<tr><td rowspan="2">29-30</td><td>Reprogramming facility identifier (LSB)</td><td colspan="3">0x01</td></tr>
<tr><td>Reprogramming facility identifier (MSB)</td><td colspan="3">0x00</td></tr>
<tr><td rowspan="2">31-32</td><td>Script language version (LSB)</td><td colspan="3">0x01</td></tr>
<tr><td>Script language version (MSB)</td><td colspan="3">0x00</td></tr>
<tr><td rowspan="2">33-34</td><td>Current Firmware ID (LSB)</td><td colspan="3" rowspan="2">Note that this is not a descriptor of the firmware platform per se, but rather a descriptor of the actual firmware running on the platform. However, it is a valuable field when a re-flash is considered.</td></tr>
<tr><td>Current Firmware ID (MSB)</td></tr>
<tr><td rowspan="2">35-36</td><td>Current PL ID (LSB)</td><td colspan="3" rowspan="2">Infrastructure only, currently not supported</td></tr>
<tr><td>Current PL ID (MSB)</td></tr>
<tr><td>37-44</td><td>International mobile subscriber identity of the SIM (IMSI)</td><td colspan="3">Reference to GSM 07.07, 15 chars maximum</td></tr>
<tr><td>45-47</td><td>Modem's firmware revision</td><td colspan="3">* See the following description</td></tr>
<tr><td rowspan="2">48</td><td rowspan="2">Maintenance Configuration</td><td>Spare</td><td>Firmware upgrade enabled
Disabled – 0
Enabled - 1</td><td>Programming enabled
Disabled – 0
Enabled - 1</td></tr>
<tr><td>Bits 2-7</td><td>Bit 1</td><td>Bit 0</td></tr>
<tr><td>49-50</td><td>Spare</td><td colspan="3"></td></tr>
<tr><td>51</td><td>Checksum</td><td colspan="3"></td></tr>
</table>

Modem's Revision Stamp in the "Maintenance Platform Manifest" Packet

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Bytes 45-47 of the Maintenance Platform Manifest contain the value of the modem's revision. The modem type is recorded in a hardware byte. This field provides an additional definition.

Modem's type extension (Extra byte, addition to the 3MSBits in the hardware byte of message type 0)	Modem revision ID, as presented in the following table	Reserved (sent as zero)
Byte 47	Byte 46	Byte 45

Modem revision ID

ID (Dec)	**Revision**	**Modem**
0	Unknown	All
1	0.7.6	Enfora II
2	0.7.8	
3,4	reserved	
5	1.0.5	Enfora III
6	6.1.1 (Beta)	
7	1.1.1PKG30	
8	1.1.1PKG41	
9	D31.1.2 PKG47	
10	D41.1.2 PKG47	
11	D10.1.1.2	
12-20	reserved	
21	7.02.002	Telit II
22	7.02.100	
23	7.02.002	Telit III
24	7.02.003	
25	7.02.004	
26	7.03.000	
27	7.03.030 (Automotive)	
28	7.03.002	
29	7.03.032	

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ID (Dec)	Revision	Modem
30	10.00.033	Telit V2
31	Reserved	
32	10.00.035	
33	10.00.016	
34-40	reserved	
41	GLM-4-0610-000	Motorola 24L
41-50	Reserved for Motorola	
51	01.000	Cinterion
52-70	reserved	
71		Telit HE910-G
72		Telit HE910-NAD
73		
74		
75		
76		
77		
78-255	reserved	

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2.6.14 Message Forwarded from Keyboard (Sub Data type 0xB)

This message is forwarded from SPC Keyboard. Refer to 1-Wire Interface Protocol.

58 bytes, which are actually logged are marked by the "◇" icon (58 bytes), the rest are added at delivery time.

Byte no.	**Description**	**Containing**
1	System code, byte 1	ASCII "M"
2	System code, byte 2	ASCII "C"
3	System code, byte 3	ASCII "G"
4	System code, byte 4	ASCII "P"
5	Message type	9
6	Unit's ID (total 32 bits)	Same as in Msg type 0
7		
8		
9		
10	Communication Control field	
11		
12◇	Message Numerator	
13◇	Packet Control Field	0x00
14◇	Total Data length	0d55
15◇	Sub-Data Type	B
16◇	Sub-Data Length	0d26
17◇	Length of actual data forwarded from 1-Wire channel	Length of Message code + Specific message code data In case of response to Keyboard ID request - 6
18◇	Spare	
19-42◇	Message code + Specific message code data + Zero padding	Refer to 1-Wire Interface Protocol The data length is normally shorter than 24 bytes; the extra bytes are zero padded. In case of response to Keyboard ID request the

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Byte no.	Description	Containing
		bytes 19-24 contains the Keyboard ID, the rest is zero padding
43◇	Sub-data Type	4
44◇	Sub-data Length	0d25
45◇	Location status (flags)	See the following description of sub-data type 4 in Wireless protocol.
46◇	Mode 1 (from GPS)	
47◇	Mode 2 (from GPS)	
48◇	Number of satellites used (from GPS)	
49-52◇	Longitude	
53-56◇	Latitude	
57-59◇	Altitude	
60-61◇	Ground speed	
62-63◇	Speed direction (true course)	
64◇	UTC time – seconds	
65◇	UTC time – minutes	
66◇	UTC time – hours	
67◇	UTC date – day	
68◇	UTC date - month	
69◇	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)	
70	Check Sum	

2.6.15 Compressed vector change report (Sub-Data Type D)

Note this is supported by Cello only, and will NEVER be generated as real-time or distress event, only as logged event.

If a corresponding functionality is enabled in programming the compressed vector change data will be sent by the unit in the following cases:

- Upon detection of 6th vector change detection occurrence - in this case the system will generate a Msg type 9 containing all 6 vector change detection occurrences.

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- Timeout - if at least one vector change event is stored in unit's memory and no other vector changes were generated by the unit during the pre-programmed period, the system will generate Msg type 9 containing all previous vector change detection occurrences.
- Upon Stop - Msg type 9 containing all previous vector change detection occurrences (if any) will be generated immediately upon stop report.
- Upon reset command - the Msg type 9 containing all previous vector change detection occurrences (if any) will be generated.

Byte no.	Description	Containing
1	System code, byte 1	ASCII “M”
2	System code, byte 2	ASCII “C”
3	System code, byte 3	ASCII “G”
4	System code, byte 4	ASCII “P”
5	Message type	9
6	Unit’s ID (total 32 bits)	As usual
7		
8		
9		
10	Communication Control field	
11		
12♠	Message Numerator	
13♠	Packet Control Field	0x00
14♠	Total Data length	0d55
15♠	Sub-Data Type	0x0D
16♠	Sub-Data Length	
17♠	Number of included vector change detections	
18-21♠		vector change detection 1

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Byte no.	Description	Containing
	Longitude	
22-25♠	Latitude	
26-28♠	Odometer	
29♠	Spare	
30♠	Course	
31♠	Speed	
32-34♠	Time	
35-41♠	vector change detection 2	
42-48♠	vector change detection 3	
49-55♠	vector change detection 4	
56-62♠	vector change detection 5	
63-69♠	vector change detection 6	
70	Check Sum	

Each message will contain up to 6 vector change occurrences, while the first one is reported in its full format, the rest are reported as a delta relative to the last point (see full message format on the next page).

Each vector change detection occurrence (except the first one) consumes 8 bytes containing a data of location change from the last vector change (or from the start event), time from the last event and speed.

Vector change detection 2-6

Delta Longitude (from last vector change)		Delta latitude (from last vector change)		Time from vector change (seconds)		Speed
Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0

The latitude, longitude and time of the first vector detection will be stored in its full format.

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True course of the first location is reported as 8-bit unsigned integer. The conversion to degrees is according the equation below:

$$Course\ [degr] = \frac{Received\ value * 360}{255}$$

Possible values are 0 to 2п.

Timestamp of the first Vector change

Minutes (LSB)		Seconds					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Hours (LSB)				Minutes (MSB)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Spare		Days					Hours
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Delta Longitude and latitude (from last vector change) both are stored as signed integers, in 10-8 radian resolution. Possible values are $-\pi$ to $+\pi$ for longitude, or $-\pi/2$ to $+\pi/2$ for latitude.

Time from last vector change is recorded in seconds.

Speed is represented in KM/H.

The reported value of speed may monitor the immediate value of speed recorded upon generation of the message or the maximum value of speed from the last report (as per the configuration). Byte 10, bit 6 of the message is monitoring the actual reported type.

The 58 bytes which are actually logged are marked by the "♠" icon, the rest are added at delivery time.

If there is less than 6 vector change detections in this message, the unit fulfills unused bytes of missing occurrences by zeros. The message length will remain constant.

Number of included vector change detection

					Number of included vector change detections		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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2.6.16 Modular Platform Manifest (Sub. Data 0x12)

Note that this is supported by Cellocator Cello only.

Generated as a reply to a Modular Platform Manifest request (see Command channel)

Byte	Description
Sub Data Type	0x12
Sub Data Length	Variable, depends on the content
Field 1 - Identifier	
Field 1 – Length of payload	
Field 1 - Payload	
…	
Field X - Identifier	Field 1 - Identifier
Field X – Length of payload (bytes)	Field 1 – Length of payload
Field X - Payload	Field 1 - Payload

Fields definition

Processor family identifier

Field ID – 00	0x00– PIC18F6722 0x01 – STM32F101RCT6

Accelerometer identifier

Field ID – 01	0x00 – MMA7260QT 0x01 – ST LIS331DL 0x02 - LIS331DLH (12bit)

Size of internal non-volatile memory

Field ID – 02	Number in kBytes Default 256 (dec)

Amount of non-volatile memory used by application (f.ex. configuration)

Field ID – 03	Number in Bytes Default 0 (N.A)

Size of internal RAM

Field ID – 04	Number in kBytes Default – 32 (dec)

Size of external non-volatile memory

Field ID – 05	Number in kBytes Default – 512 (dec)

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Amount of ext. non-volatile memory used by application (f.ex. configuration)

Field ID – 06	Number in kBytes Default – 4096 (dec)

Size of external RAM

Field ID – 07	Number in Bytes Default - 0 (N.A)

Current Firmware ID number

Field ID – 08	Same as in wireless protocol

Current Hardware ID number

Field ID – 09	Same as in wireless protocol MSG type 0 (without modem field)

Modem type

Field ID – 0A	0 Sony/Erickson GR47 1 Enfora Enabler II-G 2 Telit GE864 old retrofit 3 Telit GE864 4 Motorola G24 5 Enfora III 6 Telit GE864 Automotive 7 Cinterion BGS3

Modem firmware

Field ID – 0B	3 bytes as listed below

Bytes 45-47 of Maintenance Platform Manifest contain the value of modem's revision. The modem type is declared in a hardware byte; this field provides an additional definition.

Reserved (sent as zero)	Modem revision ID, as per table below	Reserved (sent as zero)
Byte 2	Byte 1	Byte 0

Modem revision ID

ID (Dec)	Revision	Modem
0	Unknown	All
1	0.7.6	Enfora II
2	0.7.8	
3,4	reserved	
5	1.0.5	Enfora III
6	6.1.1 (Beta)	
7	1.1.1PKG30	
8	1.1.1PKG41	

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ID (Dec)	Revision	Modem
9	D31.1.2 PKG47	
10	D41.1.2 PKG47	
11-20	reserved	
21	7.02.002	Telit II
22	7.02.100	
23	7.02.002	Telit III
24	7.02.003	
25	7.02.004	
26	7.03.000	
27	7.03.030 (Automotive)	
28	7.03.002	
29	7.03.032	
30	10.00.033	Telit V2
31	Reserved	
32	10.00.035	
33-40	reserved	
41	GLM-4-0610-000	Motorola 24L
41-50	Reserved for Motorola	
51	01.000	Cinterion
52-70	Reserved for Cinterion	
71		Telit HE910-G
72		Telit HE910-NAD
73		
74		
75		
76		
77		
78-255	reserved	

GPS Type

Field ID – 0C	00 –CEL3535 01 – CEL1500 02 – CEL1500L 03 – CEG-1000 (Internal)

GPS Firmware

Field ID – 0D	String as returned by GPS to revision request command

First Activation Date/Time

Field ID – 0E	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0

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Data length – 6 bytes	hour	min	sec	day	month	year

FW. Upgrade Date/Time

Field ID – 0F	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Data length – 6 bytes	hour	min	sec	day	month	year

Last Configuration Change Date/Time

Field ID – 0x10	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Data length – 6 bytes	hour	min	sec	day	month	year

Firmware name (string)

Field ID – 0x11	String (40 chars max)

System ID (STM ID in case of STM controller)

Field ID – 0x12	12 bytes hexadecimal

Boot Loader ID

Field ID – 0x13	Contains 1 byte indicating Boot Loader's version number

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2.6.17 Pulse Counter Measurement Response (Sub. Data 0x14)

Will be sent by the unit as a result of [Modular Pulse Counter Measurement request (Sub. Data 0x14)]

Byte no.	Description	Containing
1	System code, byte 1	ASCII “M”
2	System code, byte 2	ASCII “C”
3	System code, byte 3	ASCII “G”
4	System code, byte 4	ASCII “P”
5	Message type	9
6	Unit’s ID (total 32 bits)	Same as in Msg type 0
7		
8		
9		
10	Communication Control field	
11		
12◊	Message Numerator	
13◊	Packet Control Field	0x00
14◊	Total Data length	0x37
15◊	Sub-Data Type	0x14
16◊	Sub-Data Length	0d26
17◊	Spare	
18◊		
19◊	Liter counter 1	LSByte
20◊		
21◊		

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Byte no.	Description	Containing
22◊		MSByte
23◊	Liter Counter 2	LSByte
24◊		
25◊		
26◊		MSByte
27◊	Spare	
28◊		
29◊		
30◊		
31◊		
32◊		
33◊		
34◊		
35◊		
36◊		
37◊		
38◊		
39◊		
40◊		
41◊		
42◊		
43◊	Sub-data Type	4
44◊	Sub-data Length	0d25

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Byte no.	Description	Containing
45◊	Location status (flags)	See the following description of sub-data type 4 in Wireless protocol.
46◊	Mode 1 (from GPS)	
47◊	Mode 2 (from GPS)	
48◊	Number of satellites used (from GPS)	
49-52◊	Longitude	
53-56◊	Latitude	
57-59◊	Altitude	
60-61◊	Ground speed	
62-63◊	Speed direction (true course)	
64◊	UTC time – seconds	
65◊	UTC time – minutes	
66◊	UTC time – hours	
67◊	UTC date – day	
68◊	UTC date - month	
69◊	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)	
70	Check Sum	

Fields definition

Litter Counter 1 , Litter Counter 2

The following description is common for both "Litter Counter 1" and "litter Counter 2":

4 bytes forming unsigned 32 bits value representing the amount of litters consumed from the last pulse counter reset. The value is a multiplication of the Pulse counter value by the scaling factor value (PL address 2442-2443 for Door input and 2444-2445 for shock input).

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Note: Litters are only one example for volume measurement units. Actually the real measurement units are defined by the measuring device and its Fuel volume vs pulses relation.

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3 Command Channel (Inbound Messages)

3.1 Overview

The telemetry channel comprises several kinds of messages, as described below:

- **Generic Command Message (message code 0) –** most commands are sent using this message. This message is always replied to with a status/location message from the target unit (if the command is received successfully). A status/location message, which is sent as a response to a command, has one of its flags (the message initiative flag) raised to indicate a reply.
- **Programming Command (message code 1) –** this message provides OTA programming capabilities, and is always replied to with a programming status message from the target unit, when received correctly.
- **Acknowledge Message (Message Code 4) -** sent by central control to verify reception of outbound status, telemetry or transparent data messages.
- **Forward Data Command (message code 5) –** this message allows the sending of data to the terminal attached to the unit.
- **Modular message request (Message code 9) –** this message is designed to request the unit to send types of data, defined in Modular Message packet like CAN bus sensors, Cell ID, debug data, and more. The description of the message is outside the scope of this document.
- **Self Re-flash Chunks (Message code 10) –** a message that forwards firmware file data chunks for the self-re-flash process of the unit. The Self re-flash process description is outside of the scope of the current document (see Self Re-flash Appendix for more details).

3.2 Generic Command Message Definition

3.2.1 General Details

The generic command message is the main command interface to the Cellocator unit. The message is defined to have a constant length (25 bytes), regardless of the actual command that is being sent. All fields are defined and when not being used by a certain command, they still must be sent (containing a zero value).

3.2.2 Message Ingredients

Message header

- System code – 4 bytes
- Message type – 1 byte
- Destination Unit ID – 4 bytes
- Command Numerator Field

Authentication code – 4 bytes

Command data

- Command code field – 1 byte repeats twice
- 1st Command data field – 1 byte repeats twice
- 2nd Command data field – 1 byte repeats twice

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- 4 bytes reserved for future use

Error detection code – 8-bit additive checksum (excluding system code)

3.2.3 Byte-Aligned Table

1	System code, byte 1 – ASCII “M”
2	System code, byte 2 – ASCII “C”
3	System code, byte 3 – ASCII “G”
4	System code, byte 4 – ASCII “P”
5	Message type byte (a value of 0 for a generic command message)
6	Target Unit’s ID (total 32 bits)
7	
8	
9	
10	Command Numerator Field
11	Authentication Code
12	
13	
14	
15	Command code field
16	Command code field (repetition)
17	1st Command data field
18	1st Command data field (repetition)
19	2nd Command data field
20	2nd Command data field (repetition)
21	Command Specific Data field
22	
23	
24	
25	Error detection code – 8-bit additive checksum (excluding system code)

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3.2.4 Detailed Per-Field Specifications

3.2.4.1 System Code

The same system code constant that is sent on every message – ASCII “M”, “C”, “G”, “S” or “M”, “C”, “G”, “S”, in this order.

3.2.4.2 Message Type

Message type field for generic command messages contains a zero value.

3.2.4.3 Target Unit’s ID

This field should contain the unique unit ID of the target Cellocator unit. The unit ignores all received commands that do not contain the appropriate unit ID number.

3.2.4.4 Command Numerator Field

This field should contain the number of the command. This number appears in the “Message numerator” field in the unit’s reply message, enabling the user to easily distinguish between acknowledged commands and un-acknowledged ones.

3.2.4.5 Authentication Code

This field contains a 4-byte unique authentication code, which is verified by the unit, in order to provide protection against unapproved command attempts (from fw27p). For example: an attempt to change the traffic destination IP by unauthorized personnel.

If the code is not verified as authentic – the unit will not perform / acknowledge the command.

The feature should be switched on in the unit's configuration (refer to Programming Manual for more details).The feature is switched off by default.

The 4 bytes authentication code is generated as a function of two variables:

- Unit’s ID
- 8 bytes Auth Table, stored in the EEPROM of the unit and concurrently in the Communication Center application (refer to Modular Message Definition for modification instructions to this table).

The OTA Auth. table modification will be only be accepted by the unit if the Command Authentication feature is **DISABLED**.

The following are default values of the Auth. table.

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value	2	15	7	9	12	1	4	6	8	3	11	14	0	5	10	13

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3.2.4.6 Command Code

As the generic command message mold is relevant for all kinds of commands, it is necessary to specify the actual command that is desired. Each different command is therefore assigned a unique command code, which is used in the command code field, to specify the command to be executed.

See the Commands table for command codes.

3.2.4.7 Command Data Fields (1st and 2nd)

The command data fields contain further information, which is needed by some of the commands.

3.2.4.8 Command Specific Data Field

The command data field (4 bytes) contains additional information, specified separately for each Command Code.

See the Commands table for more information.

3.2.4.9 Commands Supported by the Cellocator Unit

Command Code	Meaning, Data Fields assignments
0x00	Immediate status request Data field: don't care
0x02	Unit state change. Data field value: meaning 0x00: Go to Standby 0x01: Go to Emergency mode This command sets the unit to start transmitting emergency messages according to the command configuration. The command is sent with two parameters, the interval between each emergency transmission and how many transmissions to send to the operator. If the number of transmissions chosen is 0, the unit sends the emergency transmission constantly. If the time between transmissions is set to 0, the unit sends the emergency transmission according to the pre-programmed definition of the Distress Mode in the EEPROM. The emergency command is meant to emulate the action of a driver pressing on the emergency button. It uses the same mechanism. If an emergency command is sent and the driver simultaneously presses on the emergency button, the emergency function that the driver initiated stops the command sent by the operator and starts its own emergency session. Here is an example of the emergency command sent to a unit: Number of distress trans.=2

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Command Code	Meaning, Data Fields assignments
	Time between distress trans. events=5sec 4D 43 47 50 00 4B 01 00 00 1C 6E DF DD DD 02 02 01 01 00 00 02 05 00 00 7C 0x02: Reset • The following fields will be reset: The "Garmin Enabled", "Garmin Connected" and GSM hibernation indication bit flags, Message numerator, Unit's status, Current GSM operator report, Unit's mode of operation, I/O, Analog inputs, Driver ID /PSP Specific Data/Accelerometer Status, Last GPS Fix, Number of satellites, Longitude, Latitude, Altitude, Speed, Course, System time, System date. • The modem will be re-initialized, the GPRS connection restored. • The RAM buffer used for data forwarding will be reset. • Configuration parameters will be reloaded from Configuration memory. 0x03: Enter Garage Mode (Security unit only) 0x04: Arm Alarm (Security unit only) 0x05: Release from Emergency mode (does not stop the Siren, only stops emergency transmissions) Command Specific Data field: don't care
0x03	Output state change. Data field should contain output change information, according to this table: Data field 1 value: function 00h / 10h: Siren (off / on) 01h / 11h: Hood lock (off / on), in 370-x0 only 02h / 12h: SP1W (off / on,) in 370-x0 only 03h / 13h: Ext Immobilizer (Same output as Gradual Stop) (off / on) 04h / 14h: Blinkers (off / on) 05h / 15h: Standard immobilizer 1 (off / on) 06h / 16h: Speaker phone voltage (off / on), in 370-x0 only 07h / 17h: Internal lights (off / on), in 370-x0 only 08h / 18h: LED (off / on), in 370-x0 only 09h / 19h: General Output (off / on), in 370-x0 only 0Ah / 1Ah: Windows (off / on), in 370-x0 only 0Bh / 1Bh: Stop Light (off / on), in 370-x0 only 0Ch / 1Ch: Buzzer (off / on), in 370-x0 only 0Eh: Lock (performs pulse), in 370-x0 and Olympic modifications only 0Fh: Unlock (performs pulse),), in 370-x0 and Olympic modifications only Data field 2 and 2 bytes of Command Specific Data field: Contain time of the output activation with one second resolution. Value of 0

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Command Code	Meaning, Data Fields assignments
	cause permanent output change. Example: Activate Siren for 5 minutes (300 seconds). MCGP 00 ID ID ID ID 00 00 00 00 00 03 03 10 10 2C 2C 01 01 00 00 CS Nested output activation: If the MSBit of the 3rd byte of command specific data field is set, the command will be executed only after the vehicle stops, e.g. after Ignition off or after 10 (by default) valid GPS packets showing speed lower than 1 km/h). Example: Activate Siren Nested for 5 minutes (300 seconds). MCGP 00 ID ID ID ID 00 00 00 00 00 03 03 10 10 2C 2C 01 01 80 00 CS
0x04	Disable Active Transmissions. This command will control the corresponding bit in the unit's configuration (address 6, bit 1) and immediately stop or restore active transmissions generated by the end unit. The existing GPRS session will be disconnected upon "disable command" or restored upon "Enable command". Data field: 0 – Disable active transmissions 1 – Enable active transmissions Command Specific Data field: don't care
0x05	Tracking control command (Based on Time Events). Data field: zero to stop tracking, non zero sets the resolution of time events and immediately implements it. Refer to Programming Manual for values. Command Specific Data field: don't care
0x06	Alarm Cadence Control command (supported only by CelloAR unit) Data field 1 – '1' to activate, '0' to deactivate. Data field 2 – don't care.
0x07	Commence gradual engine stop (PWM Immobilizer - from 100% to 0% duty cycle). Data field must contain zero (a non-zero value stops Immobilizer). Command Specific Data field: don't care
0x0C	Initiate CSD session Data field: don't care
0x0D	Erase tracking Log from EEPROM memory Data field: don't care
0x0E	Reset GPS receiver Data field: a) zero for standard reset (by On/Off pin) b) 1st = 0x5A 2nd =0xA5

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<table>
<tr><th>Command Code</th><th>Meaning, Data Fields assignments</th></tr>
<tr><td></td><td>For Factory GPS reset command. Note, that the unit can (configurable) perform GPS reset automatically in the following cases:
1. Standard reset (by On/Off pin) on ignition off.
2. If the GPS is communicating, but not navigating and MODE1=0, MODE2=16 for 10 minutes the unit performs a factory GPS reset.
3. If the GPS is not communicating, or communicating but not navigating and MODE1≠0, MODE2≠16 for 15 minutes the unit performs standard GPS reset.
4. If same condition as in item 3 remains true for the next 15 minutes the unit performs a factory GPS reset.</td></tr>
<tr><td>0x0F</td><td>Lock /Unlock sequence detection learn (for Security unit’s only)
Data field value: Function
00h: Learn Lock sequence
01h: Learn Unlock sequence
02h: Learn additional unlock sequence
FFh: Erase learned sequences from memory
Command Specific Data field: don't care</td></tr>
<tr><td>0x10</td><td>Force GPS energizing (Not supported by Cello family)
The command allows maintaining GPS activated, regardless of hibernation logic.
Warning: Note that only GPS is affected by this command! If GPS is forced active, there is no way to send a command to revert the GPS back to automatic behavior while communication is down (due to the hibernation mask or due to shutdown of the modem as a result of the full hibernation).
1st + 2nd command data fields:
• A value of 1 (one) to force energizing of GPS.
• A value of 0 (zero) for automatic GPS behavior (according to normal logic).</td></tr>
<tr><td>0x12</td><td>Connect to server (from FW28)
0 – Main server
1 – Secondary server (provisioning)
2 – Maintenance Server</td></tr>
<tr><td>0x13</td><td>Reserved for manufacturer use</td></tr>
<tr><td>0x14</td><td>Calibrate frequency counters
Data field 1 contains description of the calibration type:
<table>
<tr><td>Reserved</td><td>Source type

0 – GP Freq. (RPM)
1 – Speed</td><td>Calibrated input

0 – pin 14
1 – pin 15</td></tr>
</table>
</td></tr>
</table>

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<table>
<tr><th>Command Code</th><th>Meaning, Data Fields assignments</th></tr>
<tr><td></td><td><table><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table>
Data field 2:
In case of GP Frequency contains percent of maximum engine load (i.e 10 for 10%)
In case of speed – required distance in hundred's meters (recommended value 5km).
Command Specific Data field
N/A</td></tr>
<tr><td>0x15</td><td>Control of transparent mode over COM (independent from control by Door input (pin 14)).
Command ID 0x15
Data field 1 contains action code:
0 - deactivate, 1- activate
Data field 2 contains activation time (in seconds)
1 to 255 seconds, 0 - permanent activation
If activation by Door input (pin 14) is enabled:
The OTA command overwrites input setting.</td></tr>
<tr><td>0x16</td><td>Query connected trailer ID
Data field don’t care.</td></tr>
</table>

3.3 Programming Command Definition

3.3.1 Message Ingredients

The programming command has a predefined length of 34 bytes. It contains the following data (listed in the actual transmitted order):

Message header

- System code – 4 bytes
- Message type – 1 byte
- Target Unit's ID – 4 bytes
- Command Numerator Field

Authentication code – 4 bytes

Memory data

- Block code – 1 byte
- Programming "masking" bitmap – 2 bytes
- Block data – 16 bytes

Error detection code – 8-bit additive checksum (excluding system code)

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3.3.2 Detailed Per-Field Specifications

3.3.2.1 Message Header

Identical to Message header of Command type 0, except the Message type field sent as 1 (one).

3.3.2.2 Block Code

OTA (over the air) parameter programming is done in blocks. The entire EEPROM parameter memory is partitioned to 16-bytes long blocks. Each of those blocks is uniquely identified with a block code. The block code field contains the code of the block whose data is sent in this message (in the block data field).

3.3.2.3 Programming "Masking" Bitmap

The bitmap allows programming of only part of the parameters in a block, while leaving the other parameters with their previous values.

Each bit in the 16-bit wide value represents a byte in the parameters memory block. The LSbit of the bitmap represents the byte with the lowest offset in the program block. A value of "1" in a certain bit enables programming to the corresponding byte in the parameter’s memory, whereas a value of "0" prohibits programming of that byte.

3.3.2.4 Block Data

Contains the actual data programmed in the specified block of the parameter memory.

<table>
<tr><td colspan="16">Bitmask bytes (Each bit is an index of a corresponding byte in a block)</td><td colspan="6">Block of EEPROM</td></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td><td>15</td><td>14</td><td>13</td><td>12</td><td>11</td><td>10</td><td>9</td><td>8</td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="8">Byte 0 of Bitmask</td><td colspan="8">Byte 1 of Bitmask</td><td>Byte 0</td><td>Byte 1</td><td></td><td></td><td>Byte 14</td><td>Byte 15</td></tr>
</table>

3.4 Generic Acknowledge Message Definition

3.4.1 General Details

The generic acknowledge message is an inbound message sent by central control to verify reception of outbound status (type 0) and data forward (type 8) messages. The message is defined to have a constant length (28 bytes), all fields are defined and when not being used, they still must be sent (containing a zero value).

3.4.2 Byte-Aligned Table

1	System code, byte 1 – ASCII “M”
2	System code, byte 2 – ASCII “C”

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3	System code, byte 3 – ASCII “G”
4	System code, byte 4 – ASCII “P”
5	Message type byte (a value of 4 for acknowledge message)
6	Target Unit’s ID (total 32 bits)
7	
8	
9	
10	Command Numerator Field
11	Authentication Code Field
12	
13	
14	
15	Action code
16	Main Acknowledge number – LSB (this field shall include the value received in Message Numerator field of the acknowledged transmission)
17	Reserved for Main Acknowledge number – MSB (sent as zeros)
18	Reserved for Secondary acknowledge number – LSB (sent as zeros)
19	Reserved for Secondary acknowledge number – MSB (sent as zeros)
20	Reserved for future use (sent as zeros)
21	
22	
23	
24	
25	
26	
27	
28	Error detection code – 8-bit additive checksum (excluding system code)

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3.4.3 Detailed Per-Field Specifications

3.4.3.1 Message header

Identical to Message header of Command type 0, except the Message type field sent as 4 (four)

3.4.3.2 Action Code

Set to zero.

3.4.3.3 Main Acknowledge Number

The Message Numerator filed of the acknowledged outbound message.

3.4.3.4 Secondary Acknowledge Number

Currently not used and sent as zero.

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3.5 Forward Data Command Definition

3.5.1 Message Ingredients

The forward data command has a varying length up to 217 bytes. It contains the following data (listed in the actual transmitted order):

Message header

- System code – 4 bytes
- Message type – 1 byte
- Target Unit's ID – 4 bytes
- Command numerator – 1 byte

Authentication code – 4 bytes

Settings Byte – 1 byte

Data length – 1 byte

Data to Forward – variable up to 199 bytes

Error detection code – 8-bit additive checksum (excluding system code)

3.5.2 Detailed Per-Field Specifications

3.5.2.1 Message header

Identical to Message header of Command type 0, except the Message type field sent as 5 (five)

3.5.2.2 Settings Byte

This byte is used for different system indications.

Reserved, should be sent as zero							**Packet to Garmin (compatible to Garmin's serial protocol)**
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Packet to Garmin – set to"1" if the packet should be forwarded to Garmin terminal.

3.5.2.3 Data Length

This field should contain a number of bytes to forward (up to 199 bytes).

3.5.2.4 Data to Forward

This is the data that is forwarded to the terminal attached to the unit. This field must be an exact number of bytes long, as listed in the Data Length field.

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3.6 Modular Message Request Definition

The modular data packet request is designed to provide different data types in the same packet. The modular data request contains the following bytes (listed in the actual transmitted order).

3.6.1 Message Ingredients

Message header

- System Code – 4 bytes
- Message Type – 1 byte
- Destination Unit ID – 4 bytes
- Command Numerator – 1 byte
- Spare – 4 bytes

Packet Control Field – 1 byte

Total Length – 1 byte

First Sub-Data Type– 1 byte

First Sub-Data Length – 1 byte

First Sub-Data– variable length, depends on Data Type

……

Nth Sub-Data Type – 1 byte (option)

Nth Sub-Data Length – 1 byte

Nth Sub-Data– variable length, depends on Data Type N

Error Detection Code – 8 bit additive checksum

Byte-Aligned Table

1	System Code, byte 1 – ASCII “M”
2	System Code, byte 2 – ASCII “C”
3	System Code, byte 3 – ASCII “G”
4	System Code, byte 4 – ASCII “P”
5	Message Type byte (a value of 9 for Modular Data Packet)
6	Destination Unit’s ID (total 32 bits)
7	
8	
9	
10	Command Numerator
11	Spare (sent as 0)
12	
13	
14	

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15	Packet Control Field
16	Total Length
17	First Sub-data Type
18	First Sub-data Length
	First Sub-data The Data
	Nth Sub-data Type
	Nth Sub-data Length
	Nth Sub-data The Data
	Error Code Detection – 8-bit additive checksum (excluding system code)

3.6.2 Detailed Per-Field Specifications

3.6.2.1 System Code

Refer to Section 3.2.4.1

3.6.2.2 Message Type

Message type identifies the type of the message. It allows the receiver to distinguish between status messages, programming and other data messages, according to the value sent in this field. Modular messages contain a value of 9 (nine) in the message type field.

3.6.2.3 Unit ID

Refer to Section 3.2.4.3

3.6.2.4 Command Numerator (Anti-Tango™)

Refer to Section 3.2.4.4

3.6.2.5 Packet Control Field

Bit 7	Bit 6	Bits 5-0
Direction	Out of space indication	unused

Direction

0 – Data from the unit

1 – Request (unit-bound)

Out of Space Indication

0 – All the requested data is present in the message.

1 – Some Sub-data was not returned due to data size.

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3.6.2.6 Total Length

That field includes the number of data bytes with their types and lengths. It is the number of bytes from byte 17 to the byte of the checksum, which is not included.

3.6.2.7 Sub-Data Types Table

0x00	Unused
0x01	Firmware Platform Manifest
0x02	CAN data
0x05	Accelerometer Data
0x06	PSP – DL messages to Car Alarm
0x07	Usage Counter Request / Command
0x08	Command Authentication Table Modification command
0x09	Neighbor list of the serving GSM cell request
0x0B	Forward Data To Keyboard
0x12	Modular Platform Manifest
0x14	Modular Pulse Counter Measurement request (Sub. Data 0x14)
0x18	CFE Inputs Update message (Msg type 9, sub-data type 0x18) Cello to Server / Server to Cello (Infrustructure)
0x19	SingleWire Temperature Sensors (Infrastructure)

3.6.3 For Sub-Data Type 1 (Firmware Manifest)

This message serves as a Firmware manifest request, therefore a Sub-data of N Length is sent as 0, and, as a result, the Sub-data N field is not sent at all.

3.6.4 For Module Type 2 (CAN Data)

This message serves as a CAN data request, therefore a Sub-data N Length is sent as 0, and, as a result, the Sub-data N field is not sent at all.

3.6.5 For Module Type 4 (Time and Location Stamp Module)

This message serves as a Time and Location Stamp Module request, therefore a Sub-data N Length is sent as 0, and, as a result, the Sub-data N field is not sent at all.

3.6.6 For Module Type 5 (Accelerometer Data)

Note this is supported by EDR unit only, refer to an appropriate documentation

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3.6.7 Module Type 6 (PSP – UL Messages from CCC to Alarm System)

This message contains encapsulated data forwarded from the CCC to the CE8 (or CE8 compatible) Car Alarm System. Refer to Corresponding Car Alarm protocol for more details.

The Cellocator unit acknowledges, by a regular status message (Outbound message type 0, refer to Cellocator OTA protocol) with bit0 = '1' (Reply to command) in the communication control filed (Byte 10).

The message numerator of the Ack message is identical to the numerator of the command reaching from the CCC.

3.6.7.1 Message Structure

Byte number		**Data**
N	Sub-data type	6
N+1	Sub-data Length	Variable
N+2..... N+X	Payload: Data forwarded from Car Alarm system	Spare

3.6.8 For Module Type 7: Usage Counter Write/Request Command

The purpose of this feature is to count the "high state" time of a pair of inputs, for example, to report the total engine hours of a machine.

The inputs whose "high state" time is counted are selectable by programming.

Two timers can be assigned to a specific input, including the option to assign both timers to the same input. Each input, including ignition, supports this "high state" time calculation.

The value of the measured time from each input is stored in RAM (protected, not erased on software reset, 24 bits for each parameter, not part of configuration memory), with a resolution of minutes.

The unit rounds off partial minutes: (1:29 is regarded as 1 minute and 1:30 and above as 2 minutes).

Once a day, the content of both usage counters is backed up on the dedicated address in non-volatile memory.

The timer proceeds with time counting (from the value stored in RAM) each time the logical level of the appropriate input changes from "low to high".

The timer stops counting each time the logical level of the input changes from "high" to "low".

The RAM values of usage counter is automatically updated on each RS232 and OTA “Counter’s Set” command.

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3.6.8.1 Command Structure

Byte Number	Byte Data	
N	Sub-data type	7
N+1	Sub-data length	9
N+2	Control byte	Bitmap
N+3	Update period	Time
N+4	Spare	Spare
(N+5)-(N+7)	Usage counter 1	Refer to bitmap
(N+8)-(N+10)	Usage counter 1	Minutes

Control Byte Definition – Structure

Unused	Enable periodical update	Action bits	
Bits 3-7	Bit 2	Bit 1	Bit 0

Action Bits Definition

	Bit 1	Bit 0
Read counters data	0	0
Write counter 1	0	1
Write counter 1	1	0
Write counter 1 and 2	1	1

Enable Periodic Update flag Definition

If this bit is set (1) the unit starts generating packets 9 (with Sub-data field 7, refer to Inbound Channel in this document) periodically. Each packet includes a module of GPS (Sub-data 4). The period of the packet generation is defined in byte N+3 of this command.

A value of zero cancels periodic message generation.

3.6.8.2 Update Period Definition

The value defines the rate of the periodic update of usage counters. The value of the counter is stored in the corresponding address on the EEPROM and implemented immediately.

The byte is only used when the “Enable Periodic Update” flag in the Control byte of this command is set.

Data format: 1 byte, 1 minute resolution, from 1 minute to 255 minutes. Zero value cancels timers reporting.

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Counters Data Field Definition

Counter 2 value			Counter 1 value		
Byte N+10	Byte N+9	Byte N+8	Byte N+7	Byte N+6	Byte N+5

NOTE: If both Action bits are zero (request command) the "Counters data" field is "don't care" and is sent as zeros.

3.6.9 For Module Type 8: Command Authentication Table Change

The system provides protection against unapproved command attempts. For example, it provides protection against an attempt to change traffic destination IP by an unauthorized person. Every incoming message to the unit (such as command, acknowledge and so on) is provided a unique code, which is verified by the unit. If the code is not verified as authentic, the unit does not perform / acknowledge the command.

If Command Authentication is enabled in the unit's programming, the unit checks a valid 4-byte authentication code in bytes 11-14 of every inbound message. An inbound message with an invalid authentication code is declined by the unit. The unit does not respond to such a command and does not perform it. The 4 bytes authentication code in bytes 11-14 is generated as a function of two variables:

- Unit's ID.
- 8 bytes Authentication Table, stored in the EEPROM of the unit and concurrently in the Communication Center application.

NOTE: The OTA Authentication table modification will be accepted by the unit only if the Command Authentication feature is DISABLED in the unit's programming.

Default values of the Authentication Table are as follows:

Authentication Table (8 bytes, 16 nibbles):

Index	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Value	2	15	7	9	12	1	4	6	8	3	11	14	0	5	10	13

3.6.9.1 Authentication Table write/read command (Sub-Data type 8)

This packet is sent to the unit in order to access an Authentication Table values OTA (read, write or modify):

Description	Value
Sub-data type	0x08

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Sub-data length	0x0A	
Action byte	Bitmap, see the following description.	
Spare	0x00	
8 bytes of Authentication table	Authentication table Index 0	Authentication table Index 1
	Authentication table Index 14	Authentication table Index 15

3.6.9.2 Action Byte

Value	Description	Remarks
0	Read Authentication table from EEPROM	Bytes 11-18 of the command are don't care
1	Write Authentication table to EEPROM (supported only when the Authentication command is disabled).	Bytes 11-18 contain the new values to be programmed.
2-7	Reserved	

NOTE: Reset is required in order to apply OTA Authentication table modification.

3.6.10 For Module Type 9: Neighbor list of the serving GSM cell request

This packet will cause the unit to generate a packet, containing last knows GSM related information (updated every 60 seconds) from the whole set of seven cells in the neighbor list of the serving cell.

Field	Description
Length	2
Neighbor list of the serving GSM cell	9
	0 - Spare

The unit responds with neighbor list of the serving GSM cell (Sub-Data Type 9)

3.6.11 Forward Data To Keyboard (Sub Data Type 0xB)

The unit responds with neighbor list of the serving GSM cell (Sub-Data Type 9)

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Byte Number	**Byte Data**	
N	Sub-data type	B
N+1	Sub-data length	Variable (Refer to table below). If this field is 0, the unit will respond by Keyboard ID
N+2	Length of data to be forwarded to 1-Wire port	Actually (Sub-data length-2)
N+3	Length of expected reply from the Keyboard to be forwarded back from 1-Wire port	Refer to 1-Wire Interface Protocol
N+4	Command Type	Refer to table below
N+5 – N+x	Command Data (optional, variable length, in some cases missing)	Refer to 1-Wire Interface Protocol

3.6.11.1 Command Type (Refer to Cello AR 1-Wire Interface Protocol)

Command name	Command Type	Data
Reset keyboard	[80H]	1 byte
Keyboard id request (read rom)	[33H]	No Data
Feedback to driver	[81H]	3 bytes
Set operational state	[82H]	2 bytes
Time Update	[83H]	4 bytes
Access Code Programming	[85H]	3 bytes
System Code (Multicode) Programming	[87H]	3 bytes
Status request	[89H]	1 byte
Code request	[8AH]	2 bytes
Driver Code Control Command	[8CH]	4 bytes

3.6.12 For Modular Platform Manifest request (Sub. Data 0x12)

This command causes the unit to generate an OTA Modular Platform Manifest message. The message will contain the data fields as per the specification in a command

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Data part: The data part of this packet has a size of 6 bytes. Each byte contains a bitmask as described below. Setting bit to "1" causes the unit to add a corresponding field to the Modular Platform Manifest.

Byte	**Description**
Sub Data Type	0x12
Sub Data Length	0x06
Byte 0	Bitmap
Byte 1	Bitmap
Byte 2	Bitmap
Byte 3	0
Byte 4	0
Byte 5	0

Byte 0

Size of external RAM	Amount of ext. non-volatile memory used by application (f.ex. configuration)	Size of external non-volatile memory	Size of internal RAM	Amount of non-volatile memory used by application (f.ex. configuration)	Size of internal non-volatile memory	Accelerometer identifier	Processor identifier
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Byte1

FW Upgrade Date/Time	Initial Power up Date/Time	GPS firmware	GPS Type	Modem firmware	Modem type	Current Hardware ID number	Current Firmware ID number
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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Byte 2

Spare (unassigned)				Boot loader ID	System ID (STM ID in case of STM controller)	Firmware name (string)	Last Configuration Change Date/Time
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bytes 3-5 are currently unassigned and should be sent as zeros.

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3.6.13 Modular Pulse Counter Measurement request (Sub. Data 0x14)

Fuel consumption measurement Request (as from the last time the counter was reset)

Byte	**Description**
Sub Data Type	0x14
Sub Data Length	2
Spare	0
Spare	0

[Pulse Counter Measurement Response](#)

3.6.14 CFE Inputs Update message (Msg type 9, sub-data type 0x18) Cello to Server (Infrustructure)

Byte no.	Description	Containing
1	System code, byte 1	ASCII “M”
2	System code, byte 2	ASCII “C”
3	System code, byte 3	ASCII “G”
4	System code, byte 4	ASCII “P”
5	Message type	9
6	Unit’s ID (total 32 bits)	Same as in Msg type 0
7		
8		
9		
10	Communication Control field	
11		
12	Message Numerator	
13	Packet Control Field	0x00

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Byte no.	Description	Containing
14	Total Data length	0d55
15	Sub-Data Type	0x18
16	Sub-Data Length	0d26
17	Spare	
18		
19	Pin 14 / Door Type / Assigned function (same as in a configuration) Since Legacy Cello doesn't support 8/12 bit ADC resolution this message will always send 8 bit resolution.	
20	Measurement LSB Door (In case of discrete 0 for 0, 255 for 1)	
21	Measurement MSB Door	
22	Pin 15 / Shock Type / Assigned function (same as in a configuration) Since Legacy Cello doesn't support 8/12 bit ADC resolution this message will always send 8 bit resolution.	
23	Measurement LSB Shock (In case of discrete 0 for 0, 255 for 1)	
24	Measurement MSB Shock	
25	Input1 Type / Assigned function (same as in a configuration)	
26	Measurement LSB In1 (In case of discrete 0 for 0, 255 for 1)	
27	Measurement MSB In1	
28	Input2 Type / Assigned function In2 (same as in a configuration)	
29	Measurement LSB In2 (In case of discrete 0 for 0, 255 for 1)	

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Byte no.	Description	Containing
30	Measurement MSB In2	
31	Input3 Type / Assigned function In3 (same as in a configuration)	
32	Measurement LSB In3 (In case of discrete 0 for 0, 255 for 1)	
33	Measurement MSB In3	
34	Input4 Type / Assigned function In4 (same as in a configuration)	
35	Measurement LSB In4 (In case of discrete 0 for 0, 255 for 1)	
36	Measurement MSB In4	
37	Input5 Type / Assigned function In5 (same as in a configuration)	
38	Measurement LSB In5 (In case of discrete 0 for 0, 255 for 1)	
39	Measurement MSB In5	
40	Input6 Type / Assigned function In6 (same as in a configuration)	
41	Measurement LSB In6 (In case of discrete 0 for 0, 255 for 1)	
42	Measurement MSB In6	
43	Sub-data Type	4
44	Sub-data Length	0d25
45	Location status (flags)	See the following description of sub-data type 4 in Wireless protocol.
46	Mode 1 (from GPS)	
47	Mode 2 (from GPS)	
48	Number of satellites used (from GPS)	

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Byte no.	Description	Containing
49-52	Longitude	
53-56	Latitude	
57-59	Altitude	
60-61	Ground speed	
62-63	Speed direction (true course)	
64	UTC time – seconds	
65	UTC time – minutes	
66	UTC time – hours	
67	UTC date – day	
68	UTC date - month	
69	UTC date - year minus 2000 – 1 byte (e.g. value of 7 = year 2007)	
70	Check Sum	

3.6.15 Request Analog measurements (Msg type 9, sub-data type 0x18) Server to Cello

Byte no.	Description	Containing
1	System code, byte 1	ASCII “M”
2	System code, byte 2	ASCII “C”
3	System code, byte 3	ASCII “G”
4	System code, byte 4	ASCII “P”
5	Message type	9
6	Unit’s ID (total 32 bits)	Same as in Msg type 0
7		

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Byte no.	Description	Containing
8		
9		
10	Communication Control field	
11		
12	Message Numerator	
13	Packet Control Field	0x00
14	Total Data length	0d55
15	Sub-Data Type	0x18
16	Sub-Data Length	0d2
17	Spare	
18		
19	Check Sum	

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