Cellocator Wireless Communication Protocol - Cello-CANiQ

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Table of Contents

1 Introduction 9
1.1 About this Document 9
1.2 Abbreviations 10
1.3 References 11
2 Telemetry Channel (Outbound Messages) 12
2.1 Overview 12
2.2 Status/Location Message (Message Type 0) 13
2.2.1 Message Ingredients 13
2.2.2 Byte-Aligned Table 14
2.2.3 Detailed Per-Field Specifications 16
2.2.4 Distress (Emergency) Queue Description 48
2.3 Programming Data (Message Type 3) 49
2.3.1 Message Ingredients 49
2.3.2 Byte-Aligned Table 49
2.3.3 Detailed Per-Field Specifications 50
2.4 Logged Fragment of Forwarded Data from Serial Port to Wireless Channel (Message Type 7) 51
2.4.1 Message Ingredients 51
2.4.2 Byte-Aligned Table 51
2.4.3 Detailed Per-Field Specifications 53
2.5 Real Time Forwarded Data from Serial Port to Wireless Channel (Message Type 8) 57
2.5.1 Message Ingredients 57
2.5.2 Byte-Aligned Table 57
2.5.3 Detailed Per-Field Specifications 59
2.6 Modular Message (Message Type 9) 61
2.6.1 Message Ingredients 61
2.6.2 Byte-Aligned Table 61
2.6.3 Detailed Per-Field Specifications 62
2.6.4 Outbound Sub-Data Types Table 63
2.6.5 Firmware Platform Manifest 64
2.6.6 Time and Location Stamp 66
2.6.7 PSP – UL Messages from Alarm System 68
2.6.8 Usage Counter 68
2.6.9 Authentication Table Update 69
2.6.10 Neighbor list of the Serving GSM Cell 69
2.6.11 Maintenance Server Platform Manifest 71
2.6.12 Message Forwarded from Keyboard 77
2.6.13 3G Cell ID Data 77
2.6.14 Compressed Vector Change Report 79

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2.6.15 Modular Platform Manifest *81*
2.6.16 Pulse Counter Measurement Response *90*
2.6.17 Fleet End of Trip Report *91*
2.6.18 CFE Inputs Status Update *93*
2.6.19 One-Wire Temperature Sensor Measurement *94*
2.6.20 Car Sharing 2 Reservation Entry Response *96*
2.6.21 CDMA Cell ID Data *97*
2.7 Modular Message (Message Type 11) 99
2.7.1 Message Ingredients *99*
2.7.2 Byte-Aligned Table *99*
2.7.3 Detailed Per-Field Specifications *100*
2.7.4 Outbound Type 11 Module Structure *101*
2.7.5 Outbound Type 11 Modules Table *101*
2.7.6 Overview of CelloTrack 4/Nano/Cello with BT Extender Messaging *102*
2.7.7 General Definitions and Data Structures in CelloTrack 4/Nano/Cello with BT Extender *104*
2.7.8 DTC Event *104*
2.7.9 Variables Dump List *105*
2.7.10 OBDII MIL Status *106*
2.7.11 Calibration Data Snap Shot *107*
2.7.12 GPS Location Stamp *107*
2.7.13 GPS Time Stamp *108*
2.7.14 Firmware ID *109*
2.7.15 ACK/NACK *109*
2.7.16 Configuration Memory Write Response *110*
2.7.17 Configuration Memory Read Response *110*
2.7.18 CAN-GPS Speed Calibration Status *111*
2.7.19 Authenticated Features Query Response *112*
2.7.20 CAN Supported Standard Parameters *114*
2.7.21 K-Line Supported Standard Parameters *137*
2.7.22 VIN Read Response *161*
2.7.23 CAN Bus Status *161*
2.7.24 Trigger Event ID *161*
2.7.25 General Status Event *162*
2.7.26 CAN Variables Status Dump *172*
2.7.27 Current J1939 DTC Status *173*
2.7.28 J1939 DTC Appeared/Disappeared *174*
2.7.29 Full System MultiSense Readings *176*
2.7.30 DTCO Connect/Disconnect Event *178*
2.7.31 DTCO Time *180*
2.7.32 DTCO Driver Identification Numbers *181*
2.7.33 DTCO Parameters Change Event *181*
2.7.34 DTCO Periodic Event *190*
3 Command Channel (Inbound Messages) 192

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3.1 Overview 192
3.2 Generic Command (Message Type 0) 193
3.2.1 Message Ingredients 193
3.2.2 Byte-Aligned Table 193
3.2.3 Detailed Per-Field Specifications 194
3.3 Programming Command (Message Type 1) 201
3.3.1 Message Ingredients 201
3.3.2 Byte-Aligned Table 201
3.3.3 Detailed Per-Field Specifications 202
3.4 Generic Acknowledge Message (Message Type 4) 204
3.4.1 Message Ingredients 204
3.4.2 Byte-Aligned Table 204
3.4.3 Detailed Per-Field Specifications 205
3.5 Forward Data Command (Message Type 5) 207
3.5.1 Message Ingredients 207
3.5.2 Byte-Aligned Table 207
3.5.3 Detailed Per-Field Specifications 208
3.6 Modular Message Request (Message Type 9) 210
3.6.1 Message Ingredients 210
3.6.2 Byte-Aligned Table 210
3.6.3 Detailed Per-Field Specifications 211
3.6.4 Inbound Sub-Data Types Table 212
3.6.5 Firmware Platform Manifest Request 213
3.6.6 Time and Location Stamp Request 213
3.6.7 PSP – DL Messages to Alarm System 213
3.6.8 Usage Counter Request 213
3.6.9 Authentication Table Update Command 215
3.6.10 Cell ID Request 216
3.6.11 Forward Data to Keyboard 217
3.6.12 Modular Platform Manifest Request 217
3.6.13 Pulse Counter Measurement Request 219
3.6.14 CFE Inputs Status Update Request 220
3.6.15 One-Wire Temperature Sensor Measurement Request 220
3.6.16 Car Sharing 2 Reservation Command 220
3.7 Modular Message Request (Message Type 11) 222
3.7.1 Message Ingredients 222
3.7.2 Byte-Aligned Table 222
3.7.3 Detailed Per-Field Specifications 223
3.7.4 Inbound Type 11 Module Structure 224
3.7.5 Inbound Type 11 Modules Table 224
3.7.6 ACK/NACK 225
3.7.7 Configuration Memory Write 225

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3.7.8 Configuration Memory Read Request 226
3.7.9 Authenticated Features Command 227
3.7.10 VIN String Write 229
3.7.11 VIN String Read Request 229
3.7.12 General Module Query 229
3.7.13 General Command 230
3.7.14 Forwarded CAN Query 231
4 CSA OTA Protocol 234
4.1 Overview 234
4.1.1 CSA (IQ) Features Set 234
4.1.2 CSA Message Types 234
4.2 General CSA Message Structure 237
4.2.1 Message Ingredients 237
4.2.2 Byte-Aligned Table 237
4.2.3 Detailed Per-Field Specifications 238
4.2.4 CSA Modules Table 239
4.2.5 Event ID 241
4.2.6 Driver ID 248
4.2.7 Trip ID 248
4.2.8 Maneuver ID 249
4.2.9 PLMN 249
4.2.10 Memory Usage Status 249
4.2.11 GPS Stamp 250
4.2.12 Time Stamp 251
4.2.13 CSA FW ID 251
4.2.14 ACK 252
4.2.15 Programming Command 252
4.2.16 Programming Response 252
4.2.17 Status Request 253
4.2.18 Driver Feedback Device Control 253
4.2.19 Request Maneuver/Trip Statistics 254
4.2.20 Request Maneuver Raw + Statistics 254
4.2.21 Request Accident Raw Upload 255
4.2.22 Erase Unsent CSA Events 255
4.2.23 Erase Accident Data 255
4.2.24 Calibration/Off Road Ready Mode Command 255
4.2.25 Raw Logger Mode Command 256
4.2.26 Response to Raw Data Control Command 256
4.2.27 CSA Full Event 257
4.2.28 ABC Maneuver Statistics 259
4.2.29 Trip Statistics 260
4.2.30 RPM 262

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4.2.31 EDR Crash Attributes 262
4.2.32 VIN 263
4.2.33 Calibration/Off Road Status 263
4.2.34 Calibration Matrix Set/Read Command 264
4.2.35 Calibration Matrix Response 265
4.2.36 Reserved for Manufacturer Use 265
4.2.37 Off Road Setup Data Set/Read Command 266
4.2.38 Off Road Setup Data Response 266
4.2.39 Real Time Raw Accelerometer Data Control Command 266
4.2.40 Real Time Raw Accelerometer Data 267
4.2.41 Restore Default Vehicle Preset 269
4.2.42 Vehicle Preset Configuration Command 269
4.2.43 Over Speed Maneuver Statistics 277
4.2.44 RPM Continuous Maneuver Statistics 279
4.2.45 Idling Continuous Maneuver Statistics 280
4.2.46 Off Road Continuous Maneuver Statistics 280
4.2.47 General CSA Control Command 281
4.2.48 Crash Maneuver Statistics 281
4.3 FTP/TFTP Files Structure 284
4.3.1 Raw Data Files 284
4.3.2 File Naming Convention 284
4.3.3 File Structure 286
4.3.4 Maneuver File Payload Structure 287
4.3.5 Trip File Payload Structure 290
4.3.6 Crash File Payload Structure 291
4.4 Files Structure Detailed Examples 294
4.4.1 Trip File Structure Detailed Example 294
4.4.2 Crash File Structure Detailed Example 300

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1 Introduction

1.1 About this Document

This document describes the unit wireless communication protocol structure, implemented in Cellocator units. It describes every byte of the inbound/outbound messages, which can be sent/received by the unit over the air.

The document comprises of 2 main parts:

- Telemetry Channel (outbound messages initiated from the unit towards the server)
- Command Channel (inbound messages initiated from the server towards the unit)

Most communication flow scenarios between the unit and the server implement acknowledge from the receiving side to the sending side. Some are done using generic ACK (acknowledge) message, and some are done using other messages dedicated to the specific scenario.

A large portion of the outbound messages from the unit to the server, are initiated by the unit in a response to a certain trigger (e.g. GPIO activation, speed violation, etc.). Those messages are referred as events. The unit supports the following kinds of events:

- **Logged Event:** If the condition for a specific logged event is met, the unit will create an event and store it into its non-volatile memory. The event will be sent to the server only during the GPRS session and will be deleted from the memory of the unit only after reception of acknowledge from the server. Note: Plain events will never be delivered by SMS.
- **Distress Event:** If the condition for a specific distress event is met, the unit will create a series of messages (session). The messages will be sent to the server immediately with the first available communication transport (during GPRS session – over IP, otherwise by SMS). The messages are not stored in the unit memory and if there is no cellular coverage at the moment of sending the message will be lost. Distress events do not require acknowledge from the server.
- **Active Logged Event:** This event is designed to enhance the functionality of legacy logged events. It is important for units such as CelloTrack, which are battery operated and mostly hibernating while periodically communicating with the server. Enabling the Active Logged Event feature changes the behavior of the unit in the following way:
  - During Hibernation
    When a new event is generated, the unit will turn its modem and GPS on, wait for a GPS fix and then queue the event into the event queue. The event will be transmitted to the server, acknowledged by the server and removed from the queue. Active Logged Event turns the unit on from hibernation for up to 2 minutes. If a GPS fix is not detected within 1.5 minutes from the beginning of the session, the event will be queued into the events queue and sent towards the server while giving an extra 30 seconds for the server to acknowledge the event. If a cellular link is not available the unit will be turned off and the message will wait in the queue for later delivery.

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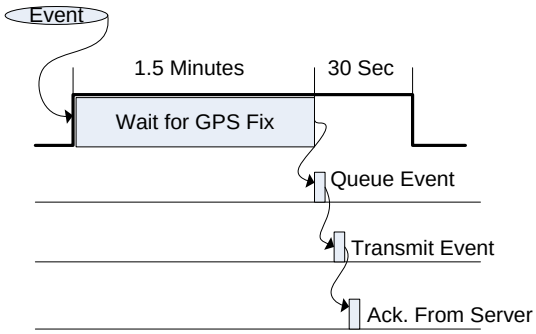

- During Live Tracking
  When a new event is generated, and the GPS is off (in CelloTrack units), the unit will turn the GPS on, wait for a fix and then insert the event into the event queue.

Naturally, the wireless protocol has evolved over the years, to answer the growing needs, and old lean message types are gradually replaced by newer message type (Type 11), which has more robust and modular structure, intended to support longer diverse messages. Thus, it is recommended to implement the complete Type 11 on the server side.

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
NVM	Non Volatile Memory
FW	Firmware
HW	Hardware

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Abbreviation	Description
CSA	Cellocator Safety Application

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	Cellocator Programming Manual	This document describes the features supported by the Cellocator unit and provides details about the parameters of its configuration.
2	Cellocator Hardware Installation Guides	This document provides all necessary information for a technician who is involved in the installation of Cellocator units. It describes how to install and verify the proper functioning of the unit installation kit elements.
3	Cellocator Serial Communication Protocol	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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2 Telemetry Channel (Outbound Messages)

2.1 Overview

The telemetry channel comprises six types of messages, as described in the following:

- **Status/location Message (Message Type 0)** – a legacy message, which is sent by default, as a reply to a command or as the message of choice when reporting events or emergency situations.
- **Programming Data (Message Type 3)** – 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.
- **Logged Fragment of Forwarded Data from Serial Port to Wireless Channel (Message Type 7)** – this message is sent when the terminal, connected to the serial port of the unit is forwarding data to the central control through unit log.
- **Real Time Forwarded Data from Serial Port to Wireless Channel (Message Type 8)** – this legacy message is sent when the terminal, connected to the serial port of the unit is forwarding data to the central control without logging it.
- **Modular Message (Message Type 9)** – this legacy modular message is designed to contain different types of data, such as CAN bus sensors, Cell ID, debug data, etc.
- **Modular Message (Message Type 11)** – this modular message type implements an extended modular protocol, intended to replace older message types (0, 3, and 9). It is currently used for CAN bus applications, CelloTrack Nano, configuration memory programming and uploading of devices with 8 Kbytes of configuration memory, etc.

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2.2 Status/Location Message (Message Type 0)

The message is used for reporting most of the basic unit events. It contains basic status data and location of the unit.

2.2.1 *Message Ingredients*

- Message Header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Communication Control Field – 2 bytes
  - Message Numerator – 1 byte
- Unit Hardware Version – 1 byte
- Unit Firmware Version – 1 byte
- Protocol Version and Unit Functionalities – 1 byte
- Unit Status – 1 byte
- Current GSM Operator – 2 bytes
- Transmission Reason Specific Data – 1 byte
- Transmission Reason – 1 byte
- Unit Mode of Operation – 1 byte
- Unit I/O status – 4 bytes
- Analog Input Values – 4 bytes
- Mileage Counter (Odometer) – 3 bytes
- Multi-Purpose Field – 6 bytes
- Last GPS Fix – 2 bytes
- Service and Status – 1 byte
- Mode 1/2 – 2 bytes
- Number of Satellites Used – 1 byte
- Longitude – 4 bytes
- Latitude – 4 bytes
- Altitude – 4 bytes
- Ground Speed – 4 bytes
- Speed Direction (True Course) – 2 bytes

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- Time and Date – 7 bytes
- Error Detection Code – 1 byte

2.2.2 *Byte-Aligned Table*

Byte	Description
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 (0)
6	Unit ID
7	
8	
9	
10	Communication Control Field
11	
12	Message Numerator (Anti-Tango™)
13	Unit Hardware Version
14	Unit Firmware Version
15	Protocol Version and Unit Functionalities
16	Unit Status and Current GSM Operator (1st Nibble)
17	Current GSM Operator (2nd and 3rd Nibbles)
18	Transmission Reason Specific Data
19	Transmission Reason
20	Unit Mode of Operation
21	Unit I/O Status 1st byte
22	Unit I/O Status 2nd byte
23	Unit I/O Status 3rd byte
24	Unit I/O Status 4th byte
25	Current GSM Operator (4th and 5th Nibbles)

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26	Analog Input 1 Value
27	Analog Input 2 Value
28	Analog Input 3 Value
29	Analog Input 4 Value
30	Mileage Counter (Odometer)
31	
32	
33	Multi-Purpose Field (Driver/Passenger/Group ID, PSP/Keyboard Specific Data, Accelerometer Status, SIM IMSI)
34	
35	
36	
37	
38	
39	Last GPS Fix
40	
41	Service and Status
42	Mode 1
43	Mode 2
44	Number of Satellites Used
45	Longitude
46	
47	
48	
49	Latitude
50	
51	
52	
53	Altitude
54	

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55	
56	
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	UTC Date – Year (-2000) (e.g. value of 7 = year 2007)
69	
70	Error Detection Code (8-bit additive checksum, excluding system code)

Multiple byte fields are sent Intel style (i.e. least significant bytes sent first).

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 the message. It allows the receiver to differentiate between different messages types, 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 unit contain the same value in the Unit ID field.

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2.2.3.4 Communication Control Field

This is a bitmapped field, providing information about the message and the situation in which it was originated.

First byte (10th):

CAN Originated Odometer[1]	CAN Originated Speed [2]	Multi-Purpose Field (Bytes 33-38) assignment		Message Source	Garmin Connected	Garmin Enabled	Message Initiative
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Second byte (11th):

GSM Hibernation	Momentary /Max Speed	Business/ Private Mode	Firmware Sub-Version				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Message initiative

0 – Active transmissions (initiated by the unit, based on its logic and decisions)

1 – Passive responses (response to a command or a query message)

Garmin Enabled

0 – Garmin disabled in the unit configuration

1 – Garmin enabled in the unit configuration

Garmin Connected

0 – Garmin Not Connected (upon three missing responses from the Garmin unit (timeout expiration))

1 – Garmin Connected (upon first correct ACK or NACK received from the Garmin Unit)

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

Note: The Communication Control Field is sent also in other (than 0) message types. In those message types the Garmin Enabled/Connected indication is a "don't care".

Message Source

0 – Direct message (not from memory)[3]

1 – Message from memory (the unit tries to resend the message from the memory, until ACK from the server is received)

Multi-Purpose Field (Bytes 33-38) Assignment

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

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

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

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This 2 bits, along with bit 7 in byte 41 of this message (Service and Status), define the data provided in bytes 33-38 of this message according to the following table:

Byte 41	Byte 10		Data in Bytes 33-38
Bit 7	Bit 5	Bit 4	
0	0	0	Driver ID/Keyboard Code (for AR units)
0	0	1	External alarm device data (PSP mode is enabled)
0	1	0	Keyboard related data, when AR keyboard is enabled (will not be sent in Driver Authentication Update event (TR 46) and Wake Up event (TR 202))
0	1	1	Trailer ID
1	0	0	IMEI
X	X	X	IMSI (in Wake Up event (TR 202))

Note: The Communication Control Field is sent also in other (than 0) message types. In those message types the Multi-Purpose Field (Bytes 33-38) Assignment indication is a don't care.

CAN Originated Speed/Odometer

0 – The unit is configured to report speed/odometer taken from GPS

1 – The unit is configured to report speed/odometer taken from CAN

Firmware Sub-Version

This field (5 bits) defines the firmware sub-version of the unit. The number of Cellocator firmware is built from two parts: [Firmware version][Firmware sub-version], where firmware version usually defines the unit family and the sub-version defines the list of supported features.

For example, 30a:

- Version – 30
- Sub-Version – a (1)

Firmware Sub-Version Value (decimal)	Firmware Sub-Version Identifier
0	No identifier
1	a
2	b

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3	c
…	…
26	z

Business/Private 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 Lock input trigger, or when the active ID is erased from RAM after trip end.

0 – Bussiness

1 – Private

Momentary/Max Speed

0 – Momentary speed

1 – Max speed recorded from last event

Note: The Communication Control Field is sent also in other (than 0) message types. In those message types the Momentary/Max Speed indication is a "don't care".

GSM Hibernation

0 – Unit is not in GSM hibernation

1 – Unit is in GSM hibernation (message sent during GSM peeking)

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 ACK from server was received).

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.

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.

2.2.3.6 Unit Hardware Version

This field defines the unit HW (PCB) version and the ID of the modem embedded in it.

The legacy addressing scheme defined 5 bits for HW (PCB) ID and 3 bits for Modem Code. This limited the number of products to 32 products.

For new products (starting from CelloTrack Nano), an alternative backwards compatible approach will be used, in which each unit HW will be uniquely defined by a complete byte (8 bits).

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The table for **legacy products**, which will be identified by the **Legacy HW ID** is detailed below:

New HW ID (8 Bits)	Legacy HW ID (5 Bits)	Product Name	Modem Code (3 Bits)	Modem Type
225	1	CR300	7	GE864-QUAD-V2
2	2	CFE	0	No Modem
170	10	CelloTrack 1 Output	5	Enfora 3
235	11	CR300B	7	GE864-QUAD-V2
172	12	CelloTrack	5	Enfora 3
78	14	Cello-IQ GNSS	2	GE910 QUAD V3
18	18	CelloTrack T (2G)	0	Telit GE910 QUAD (V2) (V3)
82	18	CelloTrack T (3G)	2	Telit HE910 NAD
114	18	CelloTrack T (3G)	3	Telit UE910 EUD
19	19	CelloTrackPower T (2G)	0	Telit GE910 QUAD (V2) (V3)
83	19	CelloTrackPower T (3G)	2	Telit HE910 NAD
115	19	CelloTrackPower T (3G)	3	Telit UE910 EUD
20	20	Cello-CANiQ (NA)	0	UE910 NAR
52	20	Cello-CANiQ (EU)	1	UE910 EUR
84	20	Cello-CANiQ (2G)	2	GE910 QUAD V3
183	23	CelloTrack Power	5	Enfora 3
216	24	Cello-F (Telit)	6	Telit GE864, automotive
249	25	Cello-F Cinterion	7	Cinterion BGS3
221	29	CR200	6	Telit GE864, automotive
222	30	CR200B	6	Telit GE864, automotive
223	31	Cello-IQ	6	Telit GE864, automotive

The table for **new products**, which will be identified by the **New HW ID** is detailed below:

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New HW ID (8 Bits)	Legacy HW ID (5 Bits)	Product Name	Modem Code (3 Bits)	Modem Type
38	6	Cello-D	1	UE910 NAR
70	6	Cello-D	2	UE910 EUR
136	8	CelloTrack Nano 10 GNSS	4	Cinterion BGS2-W
168	8	CelloTrack Nano 10 3G GNSS	5	Cinterion EHS6A
9	9	Cello-CANiQ CR (NA)	0	UE910 NAR
41	9	Cello-CANiQ CR (EU)	1	UE910 EUR
73	9	Cello-CANiQ CR (2G)	2	GE910 QUAD V3
105	9	Cello-CANiQ CR (2G) – Car Sharing	3	GE910 QUAD V3
169	9	Cello-CANiQ CR (3G) – Car Sharing	5	UE910 NAR
201	9	Cello-CANiQ CR (NA) – Aux	6	UE910 NAR
233	9	Cello-CANiQ CR (EU) – Aux	7	UE910 EUR
43	11	CR300B 3G NA GNSS	1	UE910 NAD
75	11	CR300B 3G EU GNSS	2	UE910 EUD
107	11	CR300B 2G	3	GE910 QUAD V3
139	11	CR300B 2G SIRFV	4	GE910 QUAD V3
77	13	Cello-IQ CR GNSS	2	GE910 QUAD V3
15	15	CelloTrack LL	0	Cinterion ELS61-US
143	15	CelloTrack Solar	4	Cinterion ELS61-US
116	20	Cello-CANiQ (2G) – Car Sharing	3	GE910 QUAD V3
212	20	Cello-CANiQ CV	6	CE910 Dual V
244	20	Cello-CANiQ CS	7	CE910 Dual S
53	21	PointerCept Base Station	1	No Modem
88	24	Cello-CANiQ India (2G)	2	GE910 QUAD V3
26	26	CelloTrack Nano 20	0	Cinterion BGS2-W

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New HW ID (8 Bits)	Legacy HW ID (5 Bits)	Product Name	Modem Code (3 Bits)	Modem Type
122	26	CelloTrack Nano 20 3G Worldwide	3	Cinterion EHS6A

2.2.3.7 Unit Firmware Version

This field defines the firmware version of the unit. The number of Cellocator firmware is built from two parts: [Firmware version][Firmware sub-version], where firmware version usually defines the unit family and the sub-version defines the list of supported features.

For example, 30a:

- Version – 30
- Sub-Version – a (1)

2.2.3.8 Protocol Version and Unit Functionalities

This is a bitmapped field, providing information about protocol version and other unit functionalities (AR, IQ).

Feature Package 0 – Old/Legacy 1 – IQ30 2 – IQ40 3 – IQ50			AR Functionality 0 - Fleet base 1 - AR functionality added to Fleet	Protocol Version			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.9 Unit Status and Current GSM Operator (1st Nibble)

This is a bitmapped field, providing information about unit statuses and current GSM operator.

Current GSM Operator (PLMN), 1st nibble				Source of Speed Car Sharing 2 Reservation Mode	Correct Time	Home/ Roam Network	GPS Comm.
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

GPS Comm.

0 – Communication with GPS is available

1 – Communication with GPS is not available

Home/Roam Network

0 – Home network

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1 – Roam network

Correct Time

0 – Valid time stamp

1 – Invalid/estimated time stamp

Source of Speed

0 – GPS

1 – Pulse frequency input

Current GSM Operator

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:

Nibble 1	Nibble 2	Nibble 3	Nibble 4	Nibble 5
Byte 16 (4MSbits)	Byte 17		Byte 25	

2.2.3.10 Current GSM Operator (2nd and 3rd Nibbles)

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

2.2.3.11 Transmission Reason Specific Data

Additional information Related to the transmission reason (specified in byte 19)

Transmission Reason	Transmission Reason Specific Data Description	
8 Towing	0	Location change detected during ignition off
	1	Towed mode start
	2	Towed mode stop

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td>9
Robbery</td><td>Robbery Mode
<table>
<tr><td>Reserved</td><td>Stationary Robbery session suspended</td><td>Immobilization session ended</td><td>Immobilization session started</td><td>Near Driver Door Robbery Event</td><td>Driver Door Robbery Event</td><td>Stationary Robbery Event</td><td>Robbery while Driving Event</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>12
1-Wire Temperature Sensor Measurement Event</td><td>
<table>
<tr><td colspan="4">0 - Low
1 - High</td><td colspan="4">Sensor ID (0-3)</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>15
Crash detection</td><td>
<table>
<tr><td colspan="2">Reserved</td><td>Light crash event</td><td>Heavy crash event</td><td colspan="4">Peak RMS value of the impact in 1g resolution minus 1g
(16g=0xF, 1g=0x0)</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
Function button pressed</td><td>
<table>
<tr><td colspan="3">Reserved</td><td colspan="2">Input Entry:
0=Door
1=Shock
2-3= Reserved</td><td colspan="3">Button ID:
0=Reserved
1=Button 1
2=Button 2
3=Button 3
4=Button 4
5-7= Reserved</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>
</table>

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td>18
Voice call</td><td>0 – Stop incoming voice call
1 – Start incoming voice call
2 – Stop outgoing voice call
3 – Start outgoing voice call</td></tr>
<tr><td>21
Coasting detection (speed and RPM)</td><td>0 – Stop
1 – Start</td></tr>
<tr><td>22
Violation of 1st Additional GP Frequency Threshold</td><td>0 – Falling
1 – Rising</td></tr>
<tr><td>23
Violation of 2nd Additional GP Frequency Threshold</td><td>0 – Falling
1 – Rising</td></tr>
<tr><td>34
Over speed start</td><td>0 – Plain
1 – Threshold changed by input</td></tr>
<tr><td>42
Over speed end</td><td>0 – Plain
1 – Threshold changed by input</td></tr>
<tr><td>46
Driver authentication update</td><td>For Cello-AR unit only:
0 – Driver ID
1 – Code from SPC Keyboard
For other units:
<table>
<tr><td>Group ID status
0 – Not Authenticated
1 – Authenticated</td><td>Unused</td><td>Unused</td><td>User Type
0 – Driver ID
1 – Passenger ID</td></tr>
<tr><td>Bit 7</td><td>Bits 2-6</td><td>Bit 1</td><td>Bit 0</td></tr>
</table></td></tr>
</table>

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td></td><td>NOTE: If "Enable Pre-defined driver ID list" parameter (address 123, bit 2) is enabled and the ID is not authenticated, The 6 bytes Dallas field must be ignored.
For Car Sharing 2 only:
<table>
<tr><td>Reserved</td><td>User Type
0 – Driver ID
1 – Passenger ID</td><td>Driver Authentication State code:
1 - Driver ID in the reserved list
2 - Driver ID in the Master List
16 - Driver ID not in the Master List
17 - Driver ID not in Master list and not reserved
19 - Wrong Time Access</td></tr>
<tr><td>Bits 6-7</td><td>Bit 5</td><td>Bits 0–4</td></tr>
</table></td></tr>
<tr><td>47
Driving without authentication</td><td>0 - Legacy logics</td></tr>
<tr><td>Door
48 - Close
64 - Open</td><td>0 – Normal
1 – Robbery Event
2 – Car Sharing 2: End Of Reservation</td></tr>
<tr><td>Shock/Unlock 2

49 - Inactive
65 - Active</td><td>0 – Normal
1 – Car Sharing 2: Modem Off Ended
2 – Car Sharing 2: Modem Off Started
3 – Car Sharing 2: Business Mode started
4 – Car Sharing 2: Private Mode started</td></tr>
<tr><td>53
Driving stop</td><td>0 – Accelerometer based</td></tr>
<tr><td>69
Driving start</td><td>0 – Accelerometer based
1 – GPS based (CelloTrack family only)</td></tr>
</table>

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Transmission Reason	Transmission Reason Specific Data Description
91 Message from Keyboard	0 – Keypad undefined failure 1 – Immobilizer device wires disconnection 2 – Keypad locked 3 – Relay malfunction 4 – Ignition wire disconnected 5 – Starter signal detection 6 – Starter malfunction 7 – Hotwiring Detection 8 – Primary cut unit failure 9 – Secondary cut unit failure 10 – Wrong keyboard ID detected 11 – Pairing Accomplished 12 – Keypad flash failed 13 – Alarm Cadence Activated by keypad 14 – Alarm Cadence Deactivated by keypad 128 – ECALL Initiated 129 – BCALL Initiated
92 Satellite communication	0 – Reserved 1 – Health status report failure 2 – Health status report restore 3 – Periodic distress event
158 Tamper active	1 – Reserved 2 – Nano and PointerCept: Tilt tamper
159 Tamper inactive	1 – Reserved 2 – Spare
160 CFE event	0 – CFE disconnected 1 – CFE connected 2 – CFE reprogramming success 3 – CFE reprogramming failure

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td>167
CAN-GPS speed calibration mode</td><td>0 – CAN-GPS calibration start
1 – CAN-GPS calibration accomplished
2 – CAN-GPS calibration failed
3 – CAN-GPS calibration status unknown</td></tr>
<tr><td>191
Geo hotspot violation</td><td>
<table>
<tr><td>Direction
0 – exit from hot spot
1 – entry to hot spot</td><td colspan="7">The index of the geo-fence</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>192
Frequency measurement threshold violation</td><td>
<table>
<tr><td rowspan="2">Violating input number

0 – Door
1 – Shock</td><td rowspan="2">Violation status

0 – Violation start
1 – Violation End</td><td rowspan="2">Violation type

0 – Threshold
1 – Range</td><td>Violation direction

In case of Threshold
0 – Low threshold
1 – High threshold</td><td colspan="4" rowspan="2">Reserved</td></tr>
<tr><td>In case of range
0 – Keep In
1 – Keep Out</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>
</table>

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td>194
Analog measurement threshold violation</td><td>
<table>
<tr><td>Violating input number

0 – Door
1 – Shock</td><td>Violation status

0 – Violation start
1 – Violation End</td><td>Violation type

0 – Threshold
1 – Range</td><td>Violation direction

0 – Low threshold
1 – High threshold</td><td colspan="4">Reserved</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>199
Trailer connection status</td><td>Trailer Connection Status
0 – Trailer disconnected
1 – Trailer connected</td></tr>
<tr><td>200
AHR (Auto Hardware Reset)</td><td>
<table>
<tr><td colspan="4">AHR reason
0 – Modem non responsiveness
1 – Registration problem
2 – GPS AHR</td><td colspan="4">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</td><td>0 – Garmin disconnected
1 – Garmin connected</td></tr>
</table>

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<table>
<tr><th>Transmission Reason</th><th>Transmission Reason Specific Data Description</th></tr>
<tr><td>206
Jamming detection</td><td>
<table>
<tr><td colspan="5">Not used</td><td>GSM jamming ignition state
0 – Legacy (Not associated with Ignition state)
Advanced Jamming Mode:
1 – Ignition Off
2 – Ignition On</td><td>GSM jamming state
0 – GSM jamming detection start
1 – GSM jamming detection end</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>207
Radio off mode</td><td>
<table>
<tr><td colspan="4">Spare</td><td>Airplane Mode</td><td>Early Radio Off Event</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>
<table>
<tr><th>Airplane Mode
(Bit 3)</th><th>Early Radio Off Event
(Bit 2)</th><th>GPS Status
(Bit 1)</th><th>Modem Status
(Bit 0)</th><th>Description</th></tr>
</table>
</td></tr>
</table>

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Transmission Reason	Transmission Reason Specific Data Description				
	0	0	0	0	Detection of internal backup battery voltage discharging to 3.25V or below for longer than 1 second (100 samples). The unit will enter shipment mode only after generating this event.
	0	0	0	1	N/A
	0	0	1	0	Detection of internal backup battery voltage lower than 3.46V (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	0	1	1	N/A
	0	1	0	0	N/A
	0	1	0	1	N/A
	0	1	1	0	N/A

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Transmission Reason	Transmission Reason Specific Data Description
	<table><tr><td>0</td><td>1</td><td>1</td><td>1</td><td>N/A</td></tr></table>
212 Geo-fence over speed start	Index of the geo-fence
213 Geo-fence over speed end	
222 PointerCept beacon	0 – Reserved 1 – PointerCept operational beacon transmission start 2 – PointerCept operational beacon transmission stop 3 – PointerCept OTA command initiated beacon transmission start 4 – PointerCept OTA command initiated beacon transmission stop 5 – PointerCept periodic beacon transmission start 6 – PointerCept periodic beacon transmission stop
252 Com location glancing / Offline tracking	3 – logged events upload due to timer expiration 4 – logged events upload due to full memory 5 – logged events upload due to events amount 6 – logged events upload due to end of trip 7 – logged events upload due to input activation 8 – Car Sharing 2: No-show-up glancing 9 – Offline tracking local timer glancing

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Transmission Reason	Transmission Reason Specific Data Description
253 Violation of keep in fence	Index of the geo-fence
254 Violation of keep out fence	
255 Violation of waypoint	

2.2.3.12 Transmission Reason

This field contains the reason for the message transmission. Note that this value is valid only for self-initiated active transmissions, i.e. transmissions that the unit generated because of its logics, in contrast to reply transmissions. Reply transmissions contain the last transmission reason that was used.

Transmission Reason Value	Transmission Reason Description
4	Emergency (Distress) mode by command
6	Engine activated (security event)
8	Towing
9	Robbery
11	Communication idle
13	Keypad locked (wrong codes punched in)
15	Crash detection
16	Function button pressed
18	Voice call
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 during ignition off

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Transmission Reason Value	Transmission Reason Description
31	Reply to command
32[4]	IP changed/connection up
33	GPS navigation start
34	Over speed start
35	Idle speed start
36	Distance event
37	Engine start; ignition input – active (high)
38	GPS factory reset (automatic only)
41	GPS navigation end
42	Over speed end
43	Idle speed end
44	Timed event[5]
45	Engine stop; ignition input – inactive (low)
46	Driver authentication update
47	Driving without authentication
48	Door close
49	Shock/Unlock2 inactive
50	CFE input 6 inactive
51	Volume sensor inactive event
53	Driving stop
54	Distress button inactive
55	Unlock input inactive
57	CFE input 1 inactive
58	Lock input inactive
59	CFE input 2 inactive

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

[5] In Cello-CANiQ, this event is used also for the 1 second GPS data reporting.

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Transmission Reason Value	Transmission Reason Description
60	CFE input 3 inactive
61	CFE input 4 inactive
62	CFE input 5 inactive
63	Ignition input inactive
64	Door open
65	Shock/Unlock2 active
66	CFE input 6 inactive
67	Volume sensor active
69	Driving start
70	Distress button active
71	Unlock input active
73	CFE input 1 active
74	Lock input active
75	CFE input 2 active
76	CFE input 3 active
77	CFE input 4 active
78	CFE input 5 active
79	Ignition input active or CFE input 6 active
80	Main power disconnected
81	Main power low level
82	Backup battery disconnected
83	Backup battery low level
84	Halt (movement end)
85	Go (movement start)
87	Main power connected (unconditionally logged upon an initial power up)
88	Main power high level
89	Backup battery connected

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Transmission Reason Value	Transmission Reason Description
90	Backup battery high level
91	Message from keyboard
92	Satellite communication
99	Harsh braking sensor triggered
100	Sudden course change sensor triggered
101	Harsh acceleration sensor triggered
154	Main power low/disconnect and hibernation mode "D" starts (associated with PL address 1, bit 0)
158	Tamper Active
159	Tamper inactive
160	CFE vent
161	Unlock input triggered
166	Orientation Change
167	CAN-GPS speed calibration mode
190	No Modem zone entry
191	Geo hotspot violation
192	Frequency measurement threshold violation
194	Analog measurement threshold violation
199	Trailer connection status
200	AHR (Auto Hardware Reset)
201	PSP – External Alarm is Triggered
202	Wake Up event
203	Pre-hibernation event
204	Vector (course) change (curve smoothing event)
205	Garmin connection status
206	Jamming detection
207	Radio off mode
208	Header error (self re-flash processing)

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Transmission Reason Value	Transmission Reason Description
212	Geo-fence over speed start
213	Geo-fence over speed end
222	PointerCept beacon start/stop
223	PointerCept CPIN error event
224	OTA command initiated PointerCept beacon (will be transmitted via RF only)
225	PointerCept periodic beacon transmission (will be transmitted via RF only)
247	Finish mode
252	Com location glancing / Offline tracking
253	Violation of keep in fence
254	Violation of keep out fence
255	Violation of waypoint

2.2.3.13 Unit Mode of Operation

The functioning of the 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", as following:

Unit Mode Value	Unit Mode Description
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)
0x05	Silent Delay (for security modifications)
0x07	Alarm Triggered (for security modifications)
0x10	Towed mode (same as Standby Engine On, but with ignition off)

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2.2.3.14 Unit I/O Status

The 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 the I/Os physical levels. Note that the I/Os that have been configured to be inverted will affect the application but will not be shown in this field, as it only represent the raw physical signals read from the HW.

1st Byte of I/O Status

Cello	Unlock (pin 11/20)	Panic	Driving Status (physical ignition or accelerometer based)	CFE In 1			Shock	Door
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Note: Driving Status (bit 5) provides indication if the unit is in logical Ignition On/Off, according to the configuration of the detection source (physical ignition or accelerometer). It will indicate "1" when logical Ignition On is detected, and "0" when logical Ignition Off is detected.

2nd Byte of I/O Status

Cello	Ignition port status	Accelerometer status	CFE In 6	CFE In 5	CFE In 4	Lock (pin 5/20)	CFE In 3	CFE In 2
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Notes: Accelerometer Status (bit 6) provides indication if the accelerometer has detected Ignition On/Off, **regardless** of the configuration of the detection source (physical ignition or accelerometer). It will indicate "1" when accelerometer Ignition On is detected, and "0" when accelerometer Ignition Off is detected. Ignition Port Status (bit 7) provides indication if the physical ignition input is high/low, **regardless** of the configuration of the detection source (physical ignition or accelerometer). It will indicate "1" when the ignition input is high, and "0" when the ignition input is low.

3rd Byte of I/O Status

Cello	CFE OUT 5	CFE OUT 4	CFE OUT 3	CFE OUT 2	GPS Power	Grad. Stop	Siren Control	CFE OUT 1
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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4th Byte of I/O Status

Cello	Charger status	CFE OUT 6	Standard Immobilizer		Blinkers	D8 DTCO Connected		LED out
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

2.2.3.15 Current GSM Operator (4th and 5th Nibbles)

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

2.2.3.16 Analog Inputs

The unit may handle up to 4 analog inputs. These inputs are multiplexed and sent as 8 bit samples each.

The allocation of measurements to the bytes of the message is configurable (PL addresses 1620-1623).

For Cello/CR300 unit:

Field name	Default value	Byte number in the message
1st analog measurement	9 (Vin)	26
2nd analog measurement	6 (Vbat)	27
3rd analog measurement	7 (Bat. NTC)	28
4th analog measurement	2 (Shock)	29

Available inputs for mapping:

Measurement source number	Measurement source name	Coefficient	Comment
0	No source		
1	Door[6]		Can report either analog or frequency measurement as per corresponding input type
2	Shock		
3	Panic		Infrastructure only, not currently supported
4	Unlock		
5	Lock		

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

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Measurement source number	Measurement source name	Coefficient	Comment
6	V bat	0.01647058823	Battery voltage
7	Bat. NTC	Temperature conversion formula: T=0.4314x-40; 0≤x≤255 (-40ºC≤T≤70ºC)	Note that the accuracy of the measurement is ±3°C
8	V main	0.0176470588235	Regulated voltage
9	V in	0.1176470588235	Input voltage
10	CFE in 1	0-2.5V: 0.009801587 0-30V: 0.117619048	
11	CFE in 2		
12	CFE in 3		
13	CFE in 4		
14	CFE in 5		
15	CFE in 6		
17	1-Wire temperature sensor 2	Signed 8	
18	1-Wire temperature sensor 3	Signed 8	
19	1-Wire temperature sensor 4	Signed 8	
20	RSSI		
21	RPM	32	RPM resolution diluted to 32 RPM/bit, due to transition from native 2 bytes to 1 byte

2.2.3.17 Mileage Counter (Odometer)

The unit is provided with a distance accumulator feature. The unit counts distance "base units" programmed in the PL.

By synchronizing the accumulator value with the vehicle odometer reading and setting the distance base units to one kilometer/mile, this counter provides the ability to remotely read the vehicle 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.

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2.2.3.18 Multi-Purpose Field (Bytes 33-38)

This field may carry different information as per bits 4, 5 in Communication Control Field (byte 10) and bit 7 in Service and Status (byte 41):

Byte 41	Byte 10		Data in Bytes 33-38
Bit 7	Bit 5	Bit 4	
0	0	0	Driver ID/ Keyboard Code (for AR units)
0	0	1	External Alarm device data (PSP mode is enabled)
0	1	0	Keyboard related data, when AR keyboard is enabled (will not be sent in Driver Authentication Update event (TR 46) and Wake Up event (TR 202))
0	1	1	Trailer ID
1	0	0	IMEI
X	X	X	IMSI (in Wake Up event (TR 202))

Driver ID/Passenger ID/Group ID Code Update

The unit can provide 6 bytes of last received Dallas button in every message if that feature is enabled in PL (Mask of Authentication Events).

If no Dallas code is received since the initiation of the last Start Event, this field will be 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 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 will never begin from zero.

The first number in Dallas codes array, shorter than 10 digits is considered as group ID and its 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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DTCO DIN (Driver Identification Number) 1/2

If DTCO (Digital Tachograph) is connected to the unit and enabled, and "Use DTCO as Driver ID Source" parameter (address 247, bit 4) is enabled, then bytes 33-38 will replicate the last 12 digits (BCD coded) of DIN 1/2 received from D8 DTCO.

Keyboard Code

In case of Cello-AR this field is used to report the code received by the keyboard.

The message from Cello-AR 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 Standard Authentication C&L 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	

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External alarm device data (PSP)

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

Comm. Status

Value	Description
0	External Alarm status in following 5 nibbles
1	No communication with External Alarm
2-15	Reserved

Keyboard related data

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

Comm. Status

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).

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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.

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

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Bit	Name	Description
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	

Trailer ID

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

IMEI

Will be sent on bytes 33-38 with its 2 MS-Bits sent in bits 5, 6 in byte 41 of this message (Service and Status).

IMEI is defined as 15 decimal digits. Converting the maximal IMEI number 999999999999999 to hexadecimal we get: 38D7EA4C67FFF. The maximal number will occupy 50 bits which will be sent as follows:

0x03	0xFF	0x7F	0xC6	0xA4	0x7E	0x8D
Byte 41, bits 5, 6	Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38

Note: for CDMA devices, the IMEI is replaced with MEID, which is 18 decimal digits long. Thus, MEID will not be transmitted in these bytes (only in Type 9, sub data 0x12).

IMSI

In case of a Wake Up event (TR 202), the unit reports the 12 first characters of the SIM 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: 425020315229000 (Cellcom IL)

MCC	425	Israel
MNC	02	Cellcom IL
MSIN	0315229000	

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The Hex value received in bytes 33-38:

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

Conversion table:

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

2.2.3.19 Last GPS Fix

This field provides a timestamp when which the GPS was last in navigation mode.

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
Byte 40								Byte 39							

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).

2.2.3.20 Service and Status

MSB of Multi-Purpose field (bytes 33-38) assignment (with bits 4, 5 of byte 10)	IMEI Bit 49	IMEI Bit 48	CFE Type			Trailer status indication 0 – Trailer Disconnected 1 – Trailer Connected	Actual GNSS antenna selected 0 – Internal 1 – External (Relevant only for Cello GNSS variants)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 4	Bit 3	Bit 2	CFE Type
0	0	0	Not Applicable (Legacy state)
0	0	1	CFE is not connected

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Bit 4	Bit 3	Bit 2	CFE Type
0	1	0	CFE BT is connected
0	1	1	CFE Basic is connected
1	0	0	CFE I/O is connected
1	0	1	CFE premium is connected
1	1	1	Undefined CFE Type

2.2.3.21 MODE 1 and Mode 2

These fields are generated by the GPS and transparently monitored in the outgoing message from the unit. The fields define the validity of GPS data in the message.

The unit considers the valid fix according to the "Enable Tight GPS PMODE Filter" parameter (address 509, bit 7):

- If "Enable Tight GPS PMODE Filter" is enabled, the unit considers the GPS data as valid only if Mode 1 = 3 or 4 AND Mode 2 = 2
- If "Enable Tight GPS PMODE Filter" is disabled, the unit considers the GPS data as valid only if Mode 1 =2, 3, 4, 5 and 6

2.2.3.22 Number of Satellites Used

Number of satellite measurements used for current position fix. Possible values are 0 to 20 (GNSS modules).

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 Error Detection Code

The error detection code (checksum) is a last byte of sum of all bytes in a message, excluding the 4 bytes of System Code and the Error Detection Code itself.

Example:
The message:
*4D434750*0006000000081A02021204000000210062300000006B00E1000000000000000000E5A100040206614EA303181A57034E120000000000000000001525071403D607*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

2.2.4 *Distress (Emergency) Queue Description*

There is a dedicated queue in size of 5 for distress (emergency) messages.

In this queue, if new emergency events with the same TR which exist in the queue occur, the older event is replaced by the new one.

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2.3 Programming Data (Message Type 3)

This message is sent as a reply to programming commands, or by request. It contains the new contents of the programmed block.

NOTE: For configuration spaces larger than 4K (Typically in Cello-IQ and Cello-CANiQ units) it is mandatory to use Type 11 programming command (modules 10, 11).

2.3.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Communication Control Field – 2 bytes
  - Message Numerator – 1 byte
- Spare – 1 byte
- Block Code – 1 byte
- Block Data – 16 bytes
- Error Detection Code – 1 byte

2.3.2 *Byte-Aligned Table*

Byte	Description
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 (3)
6	Unit ID
7	
8	
9	
10	Communication Control Field
11	

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12	Message Numerator (Anti-Tango™)
13	Spare
14	Block Code
15-30	Block Data
31	Error Detection Code (8-bit additive checksum, excluding system code)

2.3.3 *Detailed Per-Field Specifications*

2.3.3.1 System Code

Refer to Section 2.2.3.1

2.3.3.2 Message Type

Programming Data messages contain a value of 3 (three) in the message type field.

2.3.3.3 Unit ID

Refer to Section 2.2.3.3

2.3.3.4 Communication Control Field

Refer to Section 2.2.3.4

2.3.3.5 Message Numerator (Anti-Tango™)

Refer to Section 2.2.3.5

2.3.3.6 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).

2.3.3.7 Block Data

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

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2.4 Logged Fragment of Forwarded Data from Serial Port to Wireless Channel (Message Type 7)

The unit can forward data from its serial port to the OTA channel in a logged or in real time manner.

If the unit is configured to work with logged forwarding ("Enable Data forwarding through log" parameter (address 285, bit 7) is enabled), message type 7 will be used. Message type 7 contains fragments (up to 54 bytes each) of payload forwarded from the unit serial port.

If the unit is configured to work with real time forwarding ("Enable Data forwarding through log" parameter (address 285, bit 7) is disabled), message type 8 will be used. Message Type 8 contains a complete payload (up to 512 bytes) forwarded from the unit serial port.

The forwarded payload may be escorted by fleet management data (as per unit configuration).

Like other message types which are utilizing log memory (e.g. 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.
- Utilizes the same retransmission algorithms as other logged message types.

2.4.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Communication Control Field – 2 bytes
  - Message Numerator – 1 byte
- Serial Port Source – 1 byte
- Forwarded Message Code – 1 byte
- Fragment Control Byte – 1 byte
- Container Fragment – 54 bytes
- Error Detection Code – 1 byte

2.4.2 *Byte-Aligned Table*

Byte	Description
1	System Code, byte 1 – ASCII “M”

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>2</td><td>System Code, byte 2 – ASCII “C”</td></tr>
<tr><td>3</td><td>System Code, byte 3 – ASCII “G”</td></tr>
<tr><td>4</td><td>System Code, byte 4 – ASCII “P”</td></tr>
<tr><td>5</td><td>Message Type (7)</td></tr>
<tr><td>6</td><td rowspan="4">Unit ID</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</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td><td>Message Numerator (Anti-Tango™)</td></tr>
<tr><td>13</td><td>Serial Port Source
<table>
<tr><td colspan="3">Source of Payload
0 – N/A
1 – N/A
2 – COM2 (BT)
3 – COM3
4 – COM4
5 – COM5
6 – CFE Micro
7 – N/A</td><td>CFE Connected
0 – Not connected
1 – Connected</td><td colspan="4">Static nibble containing value 0x07</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>14</td><td>Forwarded Message Code
Sequential 7 bits ID of the container + container indication bit (MSB)
Assigned for each container
<table>
<tr><td>0 – Simple payload
1 – Container</td><td colspan="7">In case of container: sequential 7 bits ID of the container In case of simple payload: sequential 7 bits ID of the forwarded packet</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 6</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>
</table>

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>15</td><td>Fragment Control Byte
<table>
<tr><td>First Fragment
0 – Not first
1 - First</td><td>Last Fragment
0 – Not last
1 - Last</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>16-69</td><td>Container Fragment
(first fragment begins with two bytes of length of container, last one is zero padded)</td></tr>
<tr><td>70</td><td>Error Detection Code (8-bit additive checksum, excluding system code)</td></tr>
</table>

2.4.3 *Detailed Per-Field Specifications*

2.4.3.1 System Code

Refer to Section 2.2.3.1

2.4.3.2 Message Type

Logged Fragment of Forwarded Data from Serial Port to Wireless Channel messages contain a value of 7 (seven) in the message type field.

2.4.3.3 Unit ID

Refer to Section 2.2.3.3

2.4.3.4 Communication Control Field

Refer to Section 2.2.3.4

2.4.3.5 Message Numerator (Anti-Tango™)

Refer to Section 2.2.3.5

2.4.3.6 Serial Port Source

This field provides information about the source of data connected to the unit serial port.

2.4.3.7 Forwarded Message Code

This field provides information about the container in the message.

If the unit is configured to work with container ("Forward Data as Container" parameter (address 285, bit 6) is enabled), the payload will be in a form of a container: forwarded

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payload from serial port is escorted by 48 bytes of FM (fleet management) data, and 2 bytes of total length of payload + FM data.

If the unit is configured to work with simple payload ("Forward Data as Container" parameter (address 285, bit 6) is disabled), the payload will be in a form of a simple payload: forwarded payload from serial port only.

In addition, this byte includes a container/simple payload sequential ID.

2.4.3.8 Fragment Control Byte

This field provides information about the current payload fragment.

2.4.3.9 Container Fragment

The container is a data structure, created by the unit in its RAM buffer upon reception of the data for forwarding from the unit serial port (if enabled in "Forward Data as Container" parameter (address 285, bit 6)).

The forwarded payload from serial port is escorted by 48 bytes of FM (fleet management) data, and 2 bytes of total length of payload + FM data.

Every container is assigned by 7 bits numerator (increased every data packet received from the serial port), used in fragmentation process and reported with the container.

The container data structure is as following:

Byte	Description
1	Payload length (X)
2	
3	Forwarded Payload from serial port, X bytes (up to 512 bytes)
3+X	
4+X	Unit Status + Current GSM Operator (1st nibble) (same as byte 16 of type 0)
5+X	Current GSM Operator (2nd and 3rd nibbles) (same as byte 17 of type 0)
6+X	Current GSM Operator (4th and 5th nibbles) (same as byte 25 of type 0)
7+X	Unit Mode of Operation (same as byte 20 of type 0)
8+X	Unit I/O Status 1st byte (same as byte 21 of type 0)
9+X	Unit I/O Status 2nd byte (same as byte 22 of type 0)
10+X	Unit I/O Status 3rd byte (same as byte 23 of type 0)
11+X	Unit I/O Status 4th byte (same as byte 24 of type 0)
12+X	Analog Input 1 value (same as byte 26 of type 0)

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13+X	Analog Input 2 Value (same as byte 27 of type 0)
14+X	Analog Input 3 Value (same as byte 28 of type 0)
15+X	Analog Input 4 Value (same as byte 29 of type 0)
16+X	Mileage Counter (Odometer) (same as bytes 30-32 of type 0)
17+X	
18+X	
19+X	Multi-Purpose Field (Driver/Passenger/Group ID, PSP/Keyboard Specific Data, Accelerometer Status, SIM IMSI) (same as bytes 33-38 of type 0)
20+X	
21+X	
22+X	
23+X	
24+X	
25+X	Last GPS Fix (same as bytes 39-40 of type 0)
26+X	
27+X	Location Status (flags) (same as sub type 4 of type 9)
28+X	Mode 1
29+X	Mode 2
30+X	Number of Satellites Used
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	

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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 (-2000) (e.g. value of 7 = year 2007)

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2.5 Real Time Forwarded Data from Serial Port to Wireless Channel (Message Type 8)

The unit can forward data from its serial port to the OTA channel in a logged or in real time manner.

If the unit is configured to work with logged forwarding ("Enable Data forwarding through log" parameter (address 285, bit 7) is enabled), message type 7 will be used. Message type 7 contains fragments (up to 54 bytes each) of payload forwarded from the unit serial port.

If the unit is configured to work with real time forwarding ("Enable Data forwarding through log" parameter (address 285, bit 7) is disabled), message type 8 will be used. Message Type 8 contains a complete payload (up to 512 bytes) forwarded from the unit serial port.

The forwarded payload may be escorted by fleet management data (as per unit configuration).

2.5.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Message Numerator – 1 byte
- Spare – 2 bytes
- Serial Port Source – 1 byte
- Spare – 1 byte
- Forwarded Message Code – 1 byte
- Fragment Control Byte – 1 byte
- Payload Length – 2 bytes
- Payload – variable length
- Error Detection Code – 1 byte

2.5.2 *Byte-Aligned Table*

Byte	Description
1	System Code, byte 1 – ASCII "M"
2	System Code, byte 2 – ASCII "C"
3	System Code, byte 3 – ASCII "G"

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>4</td><td>System Code, byte 4 – ASCII “P”</td></tr>
<tr><td>5</td><td>Message Type (8)</td></tr>
<tr><td>6</td><td rowspan="4">Unit ID</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td>Message Numerator (Anti-Tango™)</td></tr>
<tr><td>11</td><td rowspan="2">Spare</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td><td>Serial Port Source
<table>
<tr><td colspan="3">Source of Payload
0 – N/A
1 – N/A
2 – COM2 (BT)
3 – COM3
4 – COM4
5 – COM5
6 – CFE Micro
7 – N/A</td><td>CFE Connected
0 – Not connected
1 – Connected</td><td colspan="4">Static nibble containing value 0x07</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>14</td><td>Spare</td></tr>
<tr><td>15</td><td>Forwarded Message Code
Sequential 7 bits ID of the container + container indication bit (MSB)
Assigned for each container
<table>
<tr><td>0 – Simple payload
1 – Container</td><td colspan="7">In case of container: sequential 7 bits ID of the container In case of simple payload: sequential 7 bits ID of the forwarded packet</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 6</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>
</table>

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>16</td><td>Fragment Control Byte
<table>
<tr><td>First Fragment
0 – Not first
1 - First</td><td>Last Fragment
0 – Not last
1 - Last</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>17</td><td rowspan="2">Payload Length</td></tr>
<tr><td>18</td></tr>
<tr><td>…</td><td>Payload</td></tr>
<tr><td>…</td><td>Error Detection Code (8-bit additive checksum, excluding system code)</td></tr>
</table>

2.5.3 *Detailed Per-Field Specifications*

2.5.3.1 System Code

Refer to Section 2.2.3.1

2.5.3.2 Message Type

Logged Fragment of Forwarded Data from Serial Port to Wireless Channel messages contain a value of 8 (eight) in the message type field.

2.5.3.3 Unit ID

Refer to Section 2.2.3.3

2.5.3.4 Message Numerator (Anti-Tango™)

Refer to Section 2.2.3.5

2.5.3.5 Serial Port Source

This field provides information about the source of data connected to the unit serial port.

2.5.3.6 Forwarded Message Code

This field provides information about the container in the message.

If the unit is configured to work with container ("Forward Data as Container" parameter (address 285, bit 6) is enabled), the payload will be in a form of a container: forwarded payload from serial port is escorted by 48 bytes of FM (fleet management) data, and 2 bytes of total length of payload + FM data.

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If the unit is configured to work with simple payload ("Forward Data as Container" parameter (address 285, bit 6) is disabled), the payload will be in a form of a simple payload: forwarded payload from serial port only.

In addition, this byte includes a container/simple payload sequential ID.

2.5.3.7 Fragment Control Byte

This field provides information about the current payload fragment.

The current implementation of message type 8 allows to send the payload in a single message (i.e. without fragmentation). However, for backward compatibility reasons, there is an option to fragment the payload.

If the unit is configured to work with the extended implementation ("Backward compatible OTA msg type 8" parameter (address 1349, bit 2) = extended), the payload will be sent in single type 8 message (up to 512 bytes payload). In this case, the fragment control byte will be set to 0xC0.

If the unit is configured to work with the backward compatible implementation ("Backward compatible OTA msg type 8" parameter (address 1349, bit 2) = backward compatible), the payload will be sent in fragmented type 8 messages (up to 235 bytes payload, up to 82 bytes per fragment). In this case, the fragment control byte will be used normally.

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2.6 Modular Message (Message Type 9)

The modular data packet is designed to provide different data types in the same message.

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 – 1 byte
- Packet Control Field – 1 byte
- Message 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
- Nth Sub-Data Length – 1 byte
- Nth Sub-Data– variable length, depends on Data Type N
- Error Detection Code – 1 byte

2.6.2 *Byte-Aligned Table*

Byte	Description
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 ID
7	
8	

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9	
10	Communication Control field
11	
12	Message Numerator
13	Packet Control Field
14	Length (of the modules section - not including the checksum)
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
Last Byte	Error Detection Code (8-bit additive checksum, excluding system code)

2.6.3 *Detailed Per-Field Specifications*

2.6.3.1 System Code

Refer to Section 2.2.3.1

2.6.3.2 Message Type

Modular messages contain a value of 9 (nine) in the message type field.

2.6.3.3 Unit ID

Refer to Section 2.2.3.3

2.6.3.4 Communication Control Field

Refer to Section 2.2.3.4

2.6.3.5 Message Numerator (Anti-Tango™)

Refer to Section 2.2.3.5

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2.6.3.6 Packet Control Field

Direction	Out of space indication	Unused					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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

2.6.3.7 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.

2.6.4 *Outbound Sub-Data Types Table*

Code (Hex)	Function
0x01	Firmware Platform Manifest
0x04	Time and Location Stamp
0x06	PSP – UL messages from Alarm system
0x07	Usage Counter
0x08	Authentication Table Update
0x09	Neighbor List of the Serving GSM Cell
0x0A	Maintenance Server Platform Manifest
0x0B	Data Forwarded from the Keyboard
0x0C	3G Cell ID Data
0x0D	Compressed vector change report
0x12	Modular Platform Manifest
0x14	Pulse Counter Measurement
0x16	Fleet End of trip report
0x18	CFE Inputs Status Update
0x19	One-Wire Temperature Measurements

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Code (Hex)	Function
0x1A	Car Sharing 2 Reservation Entry Response
0x1C	CDMA Cell ID Data

2.6.5 *Firmware Platform Manifest*

This sub-data is generated as a reply to Firmware Platform Manifest Request (0x01).

Byte	Description
0	Sub-data type (0x01)
1	Length – 18
2	Processor family identifier 0x01 – PIC18Fx520/620/720 0x02 – PIC18Fx621/525 0x03 – PIC18Fx527/622/627/722 (x=6/8) 0x04 – ARM Cortex M3 F10x 0x05 – ARM Cortex M3 L15x 0x07 – STM32F101RDT6 0x08 – STM32F103RFT6 0x09 – STM32F429IGH6 0x0A – STM32F103VET7 0x0B – STM32L151VDT6
3	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 STM32F101RCT6 0x05 – 64 pin STM32F103RDT6 0x06 – 64 pin STM32L151RDT6 0x07 – 176 pin micro, peripherals as per family
4-5	Size of program memory (in 1024 bytes units) (LSB)
	Size of program memory (in 1024 bytes units) (MSB)

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Byte	Description
6-7	Size of volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (LSB)
	Size of volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (MSB)
8-9	Size of internal non-volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (LSB)
	Size of internal non-volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (MSB)
10-11	Size of external non-volatile memory (in 1024 bytes units) (LSB)
	Size of external non-volatile memory (in 1024 bytes units) (MSB)
12	External non-volatile memory type 0x01 – I2C generic NVM (most EEPROMs). 0x02 – SPI generic NVM. 0x03 – Adesto Rev. E 0x04 – SPI N25Q NVM 0x05 – SPI MX25L6433F
13	Hardware Version See Unit Hardware Version
14-15	Reprogramming facility identifier (LSB) Depends on HW/FW variant
	Reprogramming facility identifier (MSB) Depends on HW/FW variant
16-17	Script language version (LSB) (0x01)
	Script language version (MSB) (0x00)
18-19	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.

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Byte	Description
	Current Firmware ID (MSB) 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.

2.6.6 *Time and Location Stamp*

This sub-data is generated as a reply to Time and Location Stamp Request (0x04). It is also automatically added to the self-initiated messages generated by the unit.

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Sub-data type (0x04)</td></tr>
<tr><td>1</td><td>Length – 25</td></tr>
<tr><td>2</td><td>Location status (flags)
<table>
<tr><td>Time Accuracy

0 – Time is accurate
1 – Time is Inaccurate</td><td>GPS Connection

0 – Connected
1 – Not Connected</td><td colspan="6">Spare</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>3</td><td>Mode 1 (from GPS)</td></tr>
<tr><td>4</td><td>Mode 2 (from GPS)</td></tr>
<tr><td>5</td><td>Number of satellites used (from GPS)</td></tr>
<tr><td>6</td><td rowspan="4">Longitude</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td rowspan="4">Latitude</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
</table>

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14	Altitude
15	
16	
17	Ground speed
18	
19	Speed direction (true course)
20	
21	UTC time – seconds
22	UTC time – minutes
23	UTC time – hours
24	UTC date – day
25	UTC date – month
26	UTC date – year Current Year minus 2000 (e.g. value of 7 = year 2007)

2.6.6.1 MODE 1/2 from GPS

Refer to Section 2.2.3.21

2.6.6.2 Number of Satellites Used

Refer to Section 2.2.3.22

2.6.6.3 Longitude, Latitude

Refer to Section 2.2.3.23

2.6.6.4 Altitude

Refer to Section 2.2.3.24

2.6.6.5 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).

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.

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2.6.6.6 Heading/Speed Direction (True Course)

Refer to Section 2.2.3.26

2.6.6.7 UTC Time

Refer to Section 2.2.3.27

2.6.6.8 UTC Date

Refer to Section 2.2.3.28

2.6.7 *PSP – UL Messages from Alarm System*

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

Byte	Description
0	Sub-Data Type (0x06)
1	Length – Variable
…	Payload (data forwarded from car alarm system)

2.6.8 *Usage Counter*

This sub-data is generated as a reply to Usage Counter Request (0x07), or as a periodical update. In the latter case, it is sent with the Time and Location Stamp (sub-data 0x04).

Byte	Description
0	Sub-Data Type (0x07)
1	Length – 9
2	Spare
3	Counter 1 Input Number
4	Counter 1 Value (Minutes)
5	
6	
7	Counter 2 Input Number

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Byte	Description
8	Counter 2 Value (Minutes)
9	
10	

Input's Numbers Definition

2.6.9 *Authentication Table Update*

This sub-data is generated as a reply to Authentication Table Update Command (0x08).

Byte	Description	
0	Sub-Data Type (0x08)	
1	Length – 9	
2	Spare	
3	Authentication table Index 0	Authentication table Index 1
4	Authentication table Index 2	Authentication table Index 3
5	Authentication table Index 4	Authentication table Index 5
6	Authentication table Index 6	Authentication table Index 7
7	Authentication table Index 8	Authentication table Index 9
8	Authentication table Index 10	Authentication table Index 11
9	Authentication table Index 12	Authentication table Index 13
10	Authentication table Index 14	Authentication table Index 15

2.6.10 *Neighbor list of the Serving GSM Cell*

This sub-data is sent:

- Passively, as a reply to Cell ID Request (0x09).
- Actively, if enabled in unit's configuration, separately for home and roam GSM networks (addresses 201 and 203 respectively, bits 0, 1, 3 and 4).

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Byte	Description
0	Sub-Data Type (0x09)
1	Length – 53
2	Spare (0x00)
3	seconds (0-59)
4	minutes (0-59)
5	hours (0-23)
6	day (1-31)
7	month (1-12)
8	Year (Current Year minus 2000 (e.g. value of 7 = year 2007))
9	Serving Cell BSIC (Base Station Identification Code)
10	Serving Cell LAC (LSB) (Localization Area Code)
11	Serving Cell LAC (MSB) (Localization Area Code)
12	Serving Cell ID (LSB)
13	Serving Cell ID (MSB)
14	Serving Cell Power (Received signal strength in dBm (hex). The sign is not saved, this value is always representing a negative number)
15	Neighbor Cell 1 BSIC
16	Neighbor Cell 1 LAC (LSB)
17	Neighbor Cell 1 LAC (MSB)
18	Neighbor Cell 1 Cell ID (LSB)
19	Neighbor Cell 1 Cell ID (MSB)
20	Neighbor Cell 1 Power

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Byte	Description
…	…
45	Neighbor Cell 6 BSIC
46	Neighbor Cell 6 LAC (LSB)
47	Neighbor Cell 6 LAC (MSB)
48	Neighbor Cell 6 Cell ID (LSB)
49	Neighbor Cell 6 Cell ID (MSB)
50	Neighbor Cell 6 Power
	Zero Padding to complete the 55 bytes assigned for single event (if it's a logged event, i.e. sent actively)

2.6.11 *Maintenance Server Platform Manifest*

Periodically (or upon server command) 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 sub-data which is described below.

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 NVM Allocation (Anti-Flooding). 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	Description
0	Sub-data type (0x0A)
1	Length – 34
2	Processor family identifier 0x01 – PIC18Fx520/620/720 0x02 – PIC18Fx621/525 0x03 – PIC18Fx527/622/627/722 (x=6/8) 0x04 – ARM Cortex M3 F10x 0x05 – ARM Cortex M3 L15x 0x07 – STM32F101RDT6

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Byte	Description
	0x08 – STM32F103RFT6 0x09 – STM32F429IGH6 0xA – STM32F103VET7 0x0B – STM32L151VDT6
3	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 STM32F101RCT6 0x05 – 64 pin STM32F103RDT6 0x06 – 64 pin STM32L151RDT6 0x07 – 176 pin micro, peripherals as per family
4-5	Size of program memory (in 1024 bytes units) (LSB)
	Size of program memory (in 1024 bytes units) (MSB)
6-7	Size of volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (LSB)
	Size of volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (MSB)
8-9	Size of internal non-volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (LSB)
	Size of internal non-volatile memory (Divided by 128 bytes and rounded up/down to closest integer) (MSB)
10-11	Size of external non-volatile memory (in 1024 bytes units) (LSB)
	Size of external non-volatile memory (in 1024 bytes units) (MSB)
12	External non-volatile memory type 0x01 – I2C generic NVM (most EEPROMs). 0x02 – SPI generic NVM. 0x03 – Adesto Rev. E 0x04 – SPI N25Q NVM 0x05 – SPI MX25L6433F

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Byte	Description
13	Hardware Version See: Unit Hardware Version
14-15	Reprogramming facility identifier (LSB) Depends on HW/FW variant
	Reprogramming facility identifier (MSB) Depends on HW/FW variant
16-17	Script language version (LSB) (0x01)
	Script language version (MSB) (0x00)
18-19	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) 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.
20-21	Current PL ID (LSB) Infrastructure only, currently not supported
	Current PL ID (MSB) Infrastructure only, currently not supported
22-29	International mobile subscriber identity of the SIM (IMSI) Reference to GSM 07.07, 15 chars maximum
30-32	Modem's firmware revision From FW version 33x and later – 0x00 For FW versions older than 33x:

Byte	Description
30	Reserved (0)
31	Modem Revision ID, as presented in the table below
32	Modem Type Extension

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td></td><td>
<table>
<tr><td></td><td>(Extra byte, additional to the 3MSBits in the hardware byte of message type 0)</td></tr>
</table>
</td></tr>
<tr><td>33</td><td>Maintenance Configuration
<table>
<tr><td colspan="6">Spare</td><td>Firmware Upgrade Enabled

0 - Disabled
1 - Enabled</td><td>Programming Enabled

0 - Disabled
1 - Enabled</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>34
35</td><td>Release Candidate Revision ID
Little Endian 16 bit representing the Release Candidate SVN revision:
<table>
<tr><th>Value</th><th>Description</th></tr>
<tr><td>0</td><td>Formal Release</td></tr>
<tr><td>1-65535</td><td>The version is a Release Candidate. The 2 bytes represents the SVN revision number:
Example: If the hex file name is F000_...._RC540.hex the resulted
The binary value representing the decimal RC540 is 0x21C in little Endian.</td></tr>
</table>
</td></tr>
</table>

Modem Revision ID

ID (Dec)	Revision	Modem
0	Unknown	All (Used also in Nano from FW version 34d and on).
1	0.7.6	Enfora II
2	0.7.8	
3,4	reserved	
5	1.0.5	Enfora III

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ID (Dec)	Revision	Modem
6	6.1.1 (Beta)	
7	1.1.1PKG30	
8	1.1.1PKG41	
9	D3-1.1.2PKG47	
10	D4-1.1.2PKG47	
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	
30	10.00.033 (Obsolete)	Telit V2
31	10.00.036	
32	10.00.035 (Obsolete)	
33	10.00.016	
34-40	reserved	

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ID (Dec)	Revision	Modem
41	GLM-4-0610-000	Motorola 24L
42-50	Reserved for Motorola	
51	01.000	Cinterion BGS3
52	02.000	Nano: Cinterion BGS2-W.Rel2 (Used only up to FW version 34c).
53	03.001_arn00.000.14	Nano: Cinterion EHS5-E (Used only up to FW version 34c).
54	03.001_arn00.000.14	Nano: Cinterion EHS5-US (Used only up to FW version 34c).
55	03.001_arn00.000.14	Nano: Cinterion EHS6A (Used only up to FW version 34c).
56	03.001_arn01.000.08	Nano: Cinterion BGS2-W.Rel3 (Used only up to FW version 34c).
57-70	Reserved for Cinterion	
71	12.00.002	Telit HE910-G (Reserved)
72	12.00.323	Telit HE910-NAD
73	13.00.003	Telit GE910 QUAD (V2)
74	12.00.504	Telit UE910-NAR
75	12.00.404	Telit UE910-EUR
76	10.00.023	Telit GE864 QUAD-V2

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ID (Dec)	Revision	Modem
77	16.00.303	Telit GE910 QUAD-V3
78	10.00.027	Telit GE864 QUAD-V2
79	12.00.516	Telit UE910-NAD
80	12.00.416	Telit UE910-EUD
81	10.01.522	Telit GE864 QUAD-V2
82	12.00.506	Telit UE910-NAR (SSL)
83-255	Reserved	

2.6.12 *Message Forwarded from Keyboard*

This sub-data is forwarded from SPC Keyboard (refer to 1-Wire Interface Protocol). It is sent with sub-data 0x04 (Time and Location Stamp)

Byte	Description
0	Sub-Data Type (0x0B)
1	Length – 26
2	Length of actual data forwarded (Message code + Specific message code data)
3	Spare
4-27	Message code + Specific message code data + Zero padding (The data length is normally shorter than 24 bytes; the extra bytes are zero padded. In case of response to Keyboard ID request, bytes 4-9 contain the Keyboard ID, the rest is zero padding)

2.6.13 *3G Cell ID Data*[7]

This sub-data is sent:

- Passively, as a reply to Cell ID data request (0x09). In this case the sub-data will be sent using the same communication transport as the request.
- Actively, if enabled in unit configuration, separately for home and roam GSM networks, on address 201 and 203 respectively, bits 0, 1, 3 and 4.

[7] Supported for 3G variants only

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Byte	Description
0	Sub-Data Type (0x0C)
1	Length – 53
2	Spare
3	seconds (0-59)
4	minutes (0-59)
5	hours (0-23)
6	day (1-31)
7	month (1-12)
8	Year (Current Year minus 2000 (e.g. value of 7 = year 2007))
9	MCC (LSB) (Mobile Country Code, Decimal, 200-901)
10	MCC (MSB) (Mobile Country Code, Decimal, 200-901)
11	MNC (LSB) (Mobile Network Code, Decimal, 0-999)
12	MNC (MSB) (Mobile Network Code, Decimal, 0-999)
13	LAC (LSB) (Localization Area Code)
14	LAC (MSB) (Localization Area Code)
15	RSCP (Received Signal Code Power - Energy after processing with gain from coding, which is equivalent to RSSI [RSCP=RSSI+EC/No]; dBm units, (-120)≤RSCP≤(-25))
16	Cell ID (Expanded 3G Cell ID (RNC + Cell ID + possible sector))
17	
18	
19	

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Byte	Description
20	Power (Received signal strength (hex); the sign is not saved, this value is always representing a negative number; dBm units)
21	AcT (Access Technology) 0 – GSM 2 – UTRAN
22	PSC (LSB) (Primary Scrambling Code, Decimal, 0-65535)
23	PSC (MSB) (Primary Scrambling Code, Decimal, 0-65535)
…	Zero Padding to complete the 55 bytes assigned for single event (if it's a logged event, i.e. sent actively)

2.6.14 *Compressed Vector Change Report*

Note that this sub-data will NEVER be generated as real-time or distress events, only as a logged event.

If a corresponding functionality is enabled by configuration, the compressed vector change data is sent by the unit in the following cases:

- Upon detection of 6th vector change detection occurrence - in this case the system will generate a Message Type-9 containing all 6 vector change detection occurrences.
- 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 Message Type-9 containing all previous vector change detection occurrences.
- Upon Stop - Message Type-9 containing all previous vector change detection occurrences (if any) will be generated immediately upon stop report.
- Upon reset command - the Message Type-9 containing all previous vector change detection occurrences (if any) will be generated.

Byte	Description
0	Sub-Data Type (0x0D)
1	Length – 53

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<table>
<tr><td>2</td><td colspan="3">Number of included vector change detections<table><tr><td colspan="5">Spare</td><td colspan="3">Number of included vector change detections</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>3-6</td><td>Longitude</td><td rowspan="7">Vector Change Detection 1</td></tr>
<tr><td>7-10</td><td>Latitude</td></tr>
<tr><td>11-13</td><td>Odometer</td></tr>
<tr><td>14</td><td>Spare</td></tr>
<tr><td>15</td><td>Course</td></tr>
<tr><td>16</td><td>Speed (km/h)</td></tr>
<tr><td>17-19</td><td>Time</td></tr>
<tr><td>20-21</td><td>Delta Longitude (from last vector change)</td><td rowspan="4">Vector Change Detection 2</td></tr>
<tr><td>22-23</td><td>Delta Latitude (from last vector change)</td></tr>
<tr><td>24-25</td><td>Time from vector change (seconds)</td></tr>
<tr><td>26</td><td>Speed (km/h)</td></tr>
<tr><td>27-33</td><td colspan="2">Vector Change Detection 3</td></tr>
<tr><td>34-40</td><td colspan="2">Vector Change Detection 4</td></tr>
<tr><td>41-47</td><td colspan="2">Vector Change Detection 5</td></tr>
<tr><td>48-54</td><td colspan="2">Vector Change Detection 6</td></tr>
</table>

Each message will contain up to 6 vector change occurrences, while the first one is reported in its full format, and 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 7 bytes containing a data of location change from the last vector change (or from the start event), time from the last event and speed.

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 2π.

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 -Π to +Π for longitude, or −Π/2 to +Π/2 for latitude.

Time from last vector change is recorded in seconds.

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.

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

2.6.15 *Modular Platform Manifest*

This sub-data is generated as a reply to Modular Platform Manifest Request (0x12).

Byte	Description
0	Sub-Data Type (0x12)
1	Length – Variable
2	Field 1 – Identifier
3	Field 1 – Length of Payload

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Byte	Description
4	Field 1 – Payload
…	…
…	Field N – Identifier
…	Field N – Length of Payload
…	Field N – Payload

Fields Definition

Processor Family Identifier

Field ID – 0x0	0x00 – PIC18F6722 0x01 – STM32F101RCT6 0x02 – STM32F103RDT6 0x03 – STM32L151RDT6 0x04 – STM32F101RDT6 0x05 – STM32F103RFT6 0x06 – STM32F429IGH6 0x07 – STM32F103VET7 0x08 – STM32L151VDT6

Accelerometer Identifier

Field ID – 0x1	0x00 – MMA7260QT 0x01 – LIS331DL 0x02 – LIS331DLH (12 bit) 0x03 – LIS3DH (16 bit)

Size of Program Memory

Field ID – 0x2 (Kbytes)	Cello, CelloTrack-T: 256 (dec) Cello-IQ, Cello-CANiQ, CelloTrack Nano: 384 (dec)

Amount of Non-Volatile Memory Used by Application (e.g. configuration)

Field ID – 0x3 (Bytes)	Default 0 (N.A)

Size of Internal RAM

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Field ID – 0x4 (Kbytes)	Cello, CelloTrack-T: 32 (dec) Cello-IQ, Cello-CANiQ: 64 (dec) CelloTrack Nano: 48 (dec)

Size of External Non-Volatile Memory

Field ID – 0x5 (Kbytes)	Cello, CelloTrack-T: 512(dec) Cello-IQ, Cello-CANiQ: 8192(dec) CelloTrack Nano: 1024 (dec)

Amount of External Non-Volatile Memory Used by Application (e.g. configuration)

Field ID – 0x6 (Kbytes)	Cello, CelloTrack-T, CelloTrack Nano: 4 Cello-IQ, Cello-CANiQ: 8

Size of External RAM

Field ID – 0x7 (Bytes)	Default - 0 (N.A)

Current Firmware ID Number

Field ID – 0x8	Same as in Type-0 message

Current Hardware ID Number

Field ID – 0x9	Same as in Type-0 message. See new table here

Modem Type

Field ID – 0xA	Same as in Type-0 message. See new table here (only the 3 modem ID bits, for backwards compatibility)

Modem Firmware Version

Field ID – 0xB	Byte 2: Reserved (sent as zero) Byte 1: • 0, from FW version 33x and later • Per table below, for FW versions older than 33x Byte 0: Reserved (sent as zero)
	from FW version 33x and later: Modem firmware string returned from the Modem (Byte 1)
	…
	Modem firmware string returned from the Modem (Byte n)

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Bytes 45-47 of Maintenance Platform Manifest contain the value of modem 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: Refer to Modem Version ID

The new Modem firmware reporting mechanism is supported by the following products and FW versions:

- Cello-CAN(IQ) from FW version 33x and later
- CR300/B from FW version 43c and later
- CelloTrack Nano from FW 34d and later

GPS Type

Field ID – 0xC	00 – CEL3535 01 – CEL1500 02 – CEL1500L 03 – CEG-1000 (Internal) 04 – SIRF4 chip (internal) 05 – Glonass (internal) 06 – SIRF4 ROM – NMEA 07 – Telit JF2 (internal) 08 – Telit SE868-V2 (internal) 09 – Telit Modified JF2 (CelloTrack T) 10 – Telit SE868-V3 (internal) 16 – NMEA (CelloTrack T)

GPS Firmware

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

First Activation Date/Time

Field ID – 0xE

Byte	Description
0	Year
1	Month
2	Day
3	Second

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	4 Minute 5 Hour Note that byte 0 is transmitted first, then byte 1 etc. On the display it's shown as d/m/y h:m:s

FW Upgrade Date/Time

Field ID – 0xF	Byte 0 Year 1 Month 2 Day 3 Second 4 Minute 5 Hour Note that byte 0 is transmitted first, then byte 1 etc. On the display it's shown as d/m/y h:m:s

Last Configuration Change Date/Time

Field ID – 0x10	Byte 0 Year 1 Month 2 Day 3 Second 4 Minute 5 Hour Note that byte 0 is transmitted first, then byte 1 etc. On the display it's shown as d/m/y h:m:s

Firmware File Name

Field ID – 0x11 (up to 120 bytes)	Firmware file name string

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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

DFD/SD Card Version

Field ID – 0x14

Byte	Description
0	DFD Version Byte 0
1	DFD Version Byte 1
2	DFD Version Byte 2
3	DFD Version Byte 3
4	SD Card Version Byte 0
5	SD Card Version Byte 1
6	SD Card Version Byte 2
7	SD Card Version Byte 3

The SD card version is extracted from a file called ver.txt in the DFD's SD card root directory.

Cello-CANiQ VIN

Field ID – 0x15	VIN – Vehicle Identification Number Null terminated string, Up to 17 Bytes

IMSI/IMEI/MEID

Field ID – 0x16	IMSI – 8 Bytes, decimal IMEI – 8 Bytes, decimal MEID – 8 Bytes, decimal (for CDMA devices)

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Originating FW ID

Field ID – 0x17	This module holds the originating FW version or the last version the code tree was merged with. **Byte** / **Description** 0 – Originating Version ID 1 – Originating Sub Version ID The version of the trunk (Before Branching or after merging) Example: 33b 33 – Version ID b – Sub Version → subversion Letter – 'a' = 'b'-'a'=1

Version Information

Field ID – 0x19	**Byte** / **Description** 0 – Version Identification (Feature Package) 0 – Legacy/Old units only 1 – IQ30 2 – IQ40 3 – IQ50 4 – CAN-IQ30 5 – CAN-IQ40 6 – CAN-IQ50 1 – Spare 2 – Spare 3 – Spare 4 – Spare

Size of Internal Non-Volatile Memory

Field ID – 0x1A	Cello, CelloTrack-T, Cello-IQ, Cello-CANiQ: 0 (Dec)

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(Divided by 128 bytes and rounded up/down to closest integer)	CelloTrack Nano: 96 (Dec) = 12KB

BT Module/Extender Identification

Field ID – 0x1B

Byte	Description
0	Module ID 0 – CSR 1010
1	BLE stack version
2	CBLE application major version
3	CBLE application minor version
4-9	CBLE MAC address (MSB first)

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Byte	Description
0	Module ID 1 – BlueGiga BT121
1	HW Revision
2	
3	FW Version – Bootloader
4	
5	FW Version – Major
6	
7	FW Version – Minor
8	
9	FW Version – Patch
10	
11	FW Version – Build
12	
13	Spare

SIM ICCID

Field ID – 0x1C	ASCII String (Up to 20 Bytes)

PIN#8 HW Selected Function

Field ID – 0x1D	0 - K-line 1 - D8 DTCO 2 - Siren

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2.6.16 *Pulse Counter Measurement Response*

This sub-data is generated as a reply to Pulse Counter Measurement Request (sub-data 0x14). It is sent with sub-data 0x04 (Time and Location Stamp).

Byte	Description
0	Sub-Data Type (0x14)
1	Length – 26
2	Spare
3	Spare
4	Counter 1 (Liter) 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).
5	
6	
7	
8	Counter 2 (Liter) 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).
9	
10	
11	
12	Spare
13	Spare
14	Spare
15	Spare
16	Spare
17	Spare
18	Spare
19	Spare

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Byte	Description
20	Spare
21	Spare
22	Spare
23	Spare
24	Spare
25	Spare
26	Spare
27	Spare

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.

2.6.17 *Fleet End of Trip Report*

This sub-data is sent by the unit at end of trip. It is sent with sub-data 0x04 (Time and Location Stamp).

Byte	Description
0	Sub-Data Type (0x16)
1	Length – 26
2	Spare
3	Spare
4	Current Odometer Count (little Endian)
5	
6	
7	

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Byte	Description
8	Current Trip Fuel Consumption (little Endian) (100 ml resolution)
9	
10	
11	
12	Fuel Tank Level (100 ml resolution)
13	
14	Fuel Tank Level (%)
15	Delta engine hours in this trip (Minutes)
16	
17	Spare
18	Spare
19	Spare
20	Spare
21	Spare
22	Spare
23	Spare
24	Spare
25	Spare
26	Spare
27	Spare

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2.6.18 *CFE Inputs Status Update*

This sub-data holds the CFE inputs status and measurements. This message can be autonomously generated by the unit (With CFE) or as a reply to CFE Inputs Status Update Request (sub-data 0x18). It is sent with sub-data 0x04 (Time and Location Stamp).

Byte	Description
0	Sub-Data Type (0x18)
1	Length – 26
2	Spare
3	Spare
4	Door (Pin 14) Assigned function (same as in the configuration) Since Legacy Cello doesn't support 8/12 bit ADC resolution this message will always send 8 bit resolution
5	Door Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
6	Door Measurement (MSB)
7	Shock (Pin 15) Assigned function (same as in the configuration) Since Legacy Cello doesn't support 8/12 bit ADC resolution this message will always send 8 bit resolution
8	Shock Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
9	Shock Measurement (MSB)
10	Input 1 Assigned function (same as in the configuration)
11	Input 1 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
12	Input 1 Measurement (MSB)
13	Input 2 Assigned function (same as in the configuration)
14	Input 2 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)

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Byte	Description
15	Input 2 Measurement (MSB)
16	Input 3 Assigned function (same as in the configuration)
17	Input 3 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
18	Input 3 Measurement (MSB)
19	Input 4 Assigned function (same as in the configuration)
20	Input 4 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
21	Input 4 Measurement (MSB)
22	Input 5 Assigned function (same as in the configuration)
23	Input 5 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
24	Input 5 Measurement (MSB)
25	Input 6 Assigned function (same as in the configuration)
26	Input 6 Measurement (LSB) (In case of discrete: 0 for 0, 255 for 1)
27	Input 6 Measurement (MSB)

2.6.19 *One-Wire Temperature Sensor Measurement*

This sub-data holds the One-Wire temperature sensor measurements. This message is generated by the unit as a reply to One-Wire Temperature Sensor Measurement Request (sub-data 0x19). It is sent with sub-data 0x04 (Time and Location Stamp).

Byte	Description
0	Sub-Data Type (0x19)
1	Length – 26

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Byte	Description
2	First One-Wire ID (Byte 0)
3	First One-Wire ID (Byte 1)
4	First One-Wire ID (Byte 2)
5	First One-Wire ID (Byte 3)
6	First One-Wire measurement (LSB) (Coefficient 0.0625)
7	First One-Wire measurement (MSB) (Coefficient 0.0625)
8	Second One-Wire ID (Byte 0)
9	Second One-Wire ID (Byte 1)
10	Second One-Wire ID (Byte 2)
11	Second One-Wire ID (Byte 3)
12	Second One-Wire measurement (LSB) (Coefficient 0.0625)
13	Second One-Wire measurement (MSB) (Coefficient 0.0625)
14	Third One-Wire ID (Byte 0)
15	Third One-Wire ID (Byte 1)
16	Third One-Wire ID (Byte 2)
17	Third One-Wire ID (Byte 3)
18	Third One-Wire measurement (LSB) (Coefficient 0.0625)
19	Third One-Wire measurement (MSB) (Coefficient 0.0625)
20	Fourth One-Wire ID (Byte 0)
21	Fourth One-Wire ID (Byte 1)
22	Fourth One-Wire ID (Byte 2)
23	Fourth One-Wire ID (Byte 3)

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Byte	Description
24	Fourth One-Wire measurement (LSB) (Coefficient 0.0625)
25	Fourth One-Wire measurement (MSB) (Coefficient 0.0625)
26	Spare
27	Spare

2.6.20 *Car Sharing 2 Reservation Entry Response*

This sub-data is sent as a reply to Car Sharing 2 Reservation Command message (0x1A) with Read command from server.

Byte	Description
0	Sub-Data Type (0x1A)
1	Length – 53
2	Slot Number
3	Spare
4–9	Driver ID (SCN) Bytes 0-5 of reservation table entry
10-13	Reservation Start time/date Bytes 6-9 of reservation table entry (Number of Seconds from December 31, 1989, 12 am UTC.)
…	Zero Padding to complete the 55 bytes assigned for single event (if it's a logged event, i.e. sent actively)
7	
8	
9	
10	

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2.6.21 *CDMA Cell ID Data*[8]

This sub-data will be sent:

- Passively, as a response to Cell ID data request (0x09). 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 201 and 203 respectively, bits 3 and 4.

Byte	Description
0	Sub-Data Type (0x1C)
1	Length (0x35)
2	Spare
3	seconds (0-59)
4	minutes (0-59)
5	hours (0-23)
6	day (1-31)
7	month (1-12)
8	Year (Current Year minus 2000 (e.g. value of 7 = year 2007))
9	SID (LSB) (System ID, Decimal, 0-999)
10	SID (MSB) (System ID, Decimal, 0-999)
11	NID (LSB) (Network ID)
12	NID (MSB) (Network ID)
13	RSSI (Received Signal Strength Index [RSSI=Rx Power + EC/Io]; dBm units)
14	BSID (Base Station ID (Cell ID + possible sector))
15	
16	

[8] Supported for CDMA variants only

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Byte	Description
17	
…	Zero Padding to complete the 55 bytes assigned for single event (if it's a logged event, i.e. sent actively)

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2.7 Modular Message (Message Type 11)

Type 11 was introduced for supporting true modular protocol. The basic structure of the protocol is designed to carry records with predefined structure called modules. The protocol will be used as an extension for Cello fleet protocol. Type 11 supports theoretical message length of up to 65536 bytes, tough the actual rate will be constrained by the HW limitations. It contains the following data (listed in the actual transmitted order):

2.7.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Communication Control Field – 2 bytes
  - Message Numerator – 1 byte
- Packet Control Field – Legacy fleet field
- Message length – 2 bytes
- Spare – 4 bytes
- Payload Modules – User Configuration Depended
- Error Detection Code – 1 byte

2.7.2 *Byte-Aligned Table*

Byte	Description
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 (11)
6	Unit ID
7	
8	
9	
10	Communication Control Field
11	

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12	Message Numerator
13	Packet Control Field
14	Length (of the modules section - not including the checksum)
15	
16	= 0x0000
17	Symbolizes outbound message (while in inbound these 2 bytes are allocated to length which is ≠ 0)
18	Spare (sent as 0)
19	
20-28	Module Name 8 - FW_HW ID (Mandatory)
29-50	Module Name 6 - GPS Location Stamp (Mandatory)
51-60	Module Name 7 - Time stamp (Mandatory)
…	
	Other Modules
…	
…	
Last Byte	Error Detection Code (8-bit additive checksum, excluding system code)

2.7.3 *Detailed Per-Field Specifications*

2.7.3.1 System Code

Refer to Section 2.2.3.1

2.7.3.2 Message Type

Modular messages contain a value of 11 (eleven) in the message type field.

2.7.3.3 Unit ID

Refer to Section 2.2.3.3

2.7.3.4 Communication Control Field

Refer to Section 2.2.3.4

2.7.3.5 Command Numerator (Anti-Tango™)

Refer to Section 2.2.3.5

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2.7.3.6 Packet Control Field

Direction	Out of space indication	Unused					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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.

2.7.3.7 Length

That field includes the number of data bytes of the modules (with their codes and lengths). It is the number of bytes from byte 16 to the byte of the checksum, which is not included.

2.7.4 *Outbound Type 11 Module Structure*

The general structure of a type 11 module is as follows:

Byte	Description
0	Module Code
1	Length of module – Number of payload bytes
2	
3	Module Payload bytes
.	
.	
n	

2.7.5 *Outbound Type 11 Modules Table*

Code	Description
1	DTC Event
2	Variables Dump List (Programmable Message Structure)
3	OBDII MIL Status
4	Calibration Data Snap Shot

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Code	Description
6	GPS Location Stamp
7	GPS Time Stamp
8	FW ID
9	ACK/NACK
10	Configuration Memory Write Response
11	Configuration Memory Read Response
12	CAN-GPS Speed Calibration Status
13	Authenticated Features Query Response
17	CAN Supported Standard Parameters
18	K-Line Supported Standard Parameters
22	VIN Read Response
24	CAN Bus Status
25	Trigger Event ID
28	General Status Event
30	Reserved for PointerCept General Status Event
31	CAN Variables Status Dump
37	Current J1939 DTC Status
38	J1939 DTC Appeared/Disappeared
44	MultiSense Additional Information
45	Full System MultiSense Readings
50	DTCO Connect/Disconnect Event
51	DTCO Time
52	DTCO Driver Identification Numbers
53	DTCO Parameter Change Event
54	DTCO Periodic Event

2.7.6 *Overview of CelloTrack 4/Nano/Cello with BT Extender Messaging*

When CelloTrack Nano was developed, the goal was to support 3 different kinds of customers:

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- Legacy customers, who already have older CelloTrack devices and want the same functionality.
- New customers that want to build everything from scratch.
- Customers that want to combine the legacy devices with the new functionality, or who are in transition between the old and the new worlds.

To achieve this goal, the messages are divided into 2 types:

- Legacy functionality messages (as in the CelloTrack-T): These messages can be passed either by the legacy type-0 and/or "encapsulated type-0 over type-11" as explained below.
- New functionality messages: These can be passed **fully** and natively over the type-11 modular messages, and/or (if configured) over the legacy type-0 system but with only the possible data (sometimes thin or partial data).

All functionality of the events uses Type-0 legacy events and/or the advanced Type-11 messages, all according to the configuration bits per feature.

Each specialized feature has the following 4 bits of configuration:

Type-11		Type-0	
Logged	"Active log event"	Logged	Distress
Bit 3	Bit 2	Bit 1	Bit 0

Type-0 could also be "Active log event" or not, depending on the global (one per system) bit of "Enable Active Events" (in address 0000.0 of the PL).

This enables the user to select between the following options:

Type-11 options:

- 0= Disable
- 1= "Active Log Event"
- 2= Logged

Type-0 options:

- 0= Disable (the global "Active log event" bit will be ignored)
- 1= Distress (the global "Active log event" bit will be ignored)
- 2= Logged
- 3= Logged & Distress (not a recommended setting if the "Active log event" bit is set, as it will cause the sending of 2 messages per event).

The log memory supports both types simultaneously, as a continuous and united space.

After developing the BT extender for Cello units, which now can communicate with MultiSense devices, Cello units also use this messaging logics (Type 11 only) for some MultiSense events.

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NOTE: When "Active log event" is used, the unit turns on the GNSS and waits for a fix (up to 90 seconds). If a fix is achieved, both the GPS stamp and time stamps of the event are overridden.

2.7.7 *General Definitions and Data Structures in CelloTrack 4/Nano/Cello with BT Extender*

The CelloTrack 4/Nano and Cello with BT extender design is based on the following data structures:

Description	Source of measurement 0x00÷0x0F – MultiSense unit (according to place in the PL, whether occupied/enabled or not) 0xFB – BT Extender 0xFC – Guest MultiSense (not in the list) 0xFD – High accuracy or specialized sensors of the CelloTrack Nano 20 (for example: Accurate temperature sensor, pressure sensor, etc) 0xFE – MCU internal (temperature only) 0xFF – Reserved							
Bit	7	6	5	4	3	2	1	0

Description	Temperature measured [0..7]							
Units, valid range	0.1ºC in signed (in SINT16 format), -500÷1000 = -50÷100 ºC (The measurement is accurate in the -40÷80 ºC range)							
Bit	7	6	5	4	3	2	1	0

Description	Temperature measured [12]=sign bit only	Reserved			Temperature measured [8..11]			
Units, valid range					0.1ºC in signed (in SINT16 format)			
Bit	7	6	5	4	3	2	1	0

2.7.8 *DTC Event*

Byte	Description

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0	Module 1 - DTC Event
1	Length of module – Variable
2	
3	Number of DTCs received by Mode 3 If there are more DTCs than mentioned in this byte, they were received by mode 7
4	Spare
5	DTC Entry (2 Bytes)
6	
7	DTC Entry (2 Bytes)
8	
…	…

DTC Entry

Error Type		DTC Code													
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0

Error Type table

Code	Error Type
0	P – Power train
1	C - Chassis
2	B - Body
3	U – Network

2.7.9 *Variables Dump List*

This Message will be sent as part of the Cello-CANiQ Trigger event message. This is a mandatory module designed to identify the trigger Event ID and the Cello-CANiQ variables list attached to the event. The variable dump list is a programmable list of CAN variables selected when the user builds the CAN triggering. Please refer to "Cello-CANiQ Integration Manual" for more details.

Trigger Event module will be sent with the following modules to create trigger Event message:

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Type 11 Header	Module 8 (FW ID)	Module 6 (Location)	Module 7 (Time)	Module 25 (Trigger ID)	Module 2 (Event)

Byte	Description
0	Module 2 – Variable Dump List
1	Length of module – Variable
2	
3	Operator ID
4	
5	PL Signature
6	
7	
8	
9	Number Of Variables
10	Variable ID (2 Bytes)
11	
12	Variable Length = 0x04 (constant for all variables. In case of shorter variables, the data is in the LSB of the variable payload, and the rest of the payload is zero padded.)
	Variable payload (raw data, as received from the bus)
…	…
	Variable ID (2 Bytes)
	Variable Length
	Variable payload

2.7.10 *OBDII MIL Status*

This module will be generated upon change in OBDII MIL lamp status (unsolicited). This module will be followed by modules 6, 7, 8.

Byte	Description
0	Module 3 – OBDII MIL Status

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1	Length of module - 9
2	
3	Spare
4	Spare
5	OBDII MIL Status

Spare							OBDII MIL Status 0 – Off 1 – On
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

6	Spare
7	Spare
8	Spare
9	Spare
10	Spare
11	Spare

2.7.11 *Calibration Data Snap Shot*

Byte	Description
0	Module 4 - Calibration Data Snap Shot
1	Length of module - 6
2	
3	Spare
4	Spare
5-8	Current Odometer

2.7.12 *GPS Location Stamp*

Byte	Description

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0	Module 6 - GPS Location Stamp
1	Length of module - 19
2	
3	HDOP
4	Mode 1 (from GPS)
5	Mode 2 (from GPS)
6	Number of satellites used (from GPS)
7	Longitude
8	
9	
10	
11	Latitude
12	
13	
14	
15	Altitude
16	
17	
18	
19	Ground speed (km/h)
20	Speed direction (true course)
21	

2.7.13 *GPS Time Stamp*

Byte	Description
0	Module 7 – GPS Time Stamp
1	Length of module - 7
2	
3	Validity of time (valid - 1 /invalid - 0)

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4	System time – seconds
5	System time – minutes
6	System time – hours
7	System date – day
8	System date – month
9	System date – year (-2000)

2.7.14 *Firmware ID*

Byte	Description
0	Module 8 - FW ID
1	Length of module - 6
2	
3	Spare
4	Type 11 Protocol ID (=1)
5	FW Version ID (example: 33)
6	FW Sub-Version ID (example: 1 for a)
7	HW ID (example: 20)
8	Spare

2.7.15 *ACK/NACK*

Byte	Description
0	Module 9 – ACK/NACK
1	Length of module – 3
2	
3	0 - ACK 1 - NACK
4	NACK Code (decimal) 0 - General NACK 10 - Failed VIN Write Attempt

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	70 - Exceeded Number of Failed Feature Authentication Attempts (the unit will ignore Feature Authentication command for the next hour) 71 - Feature Authentication Code Discrepancy
5	Spare

2.7.16 *Configuration Memory Write Response*

Byte	Description
0	Module 10 – Configuration Memory Write Response
1	Length of module – Variable
2	
3	Numerator
4	
5	Number of instances ACK
6	Instance 1 action status 0 - OK 1 - Write Error
7	Instance 2 action status 0 - OK 1 - Write Error
	…

2.7.17 *Configuration Memory Read Response*

Byte	Description	
0	Module 11 – Configuration Memory Read Response	
1	Length of module – Variable	
2		
3	Numerator	
4		
5	Number of Instances	
6	Memory type – 0	
7	Memory entry unit type	Instance 1

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	0 – Bit 1 – Byte 2 – Word (16 bits) 3 – Double Word (32 bits) (Only Byte entry unit type is currently supported)	
8	Address in the configuration memory space	
9		
10		
11		
12	Number of Entries	
13		
…	Data Payload	
…	…	Instance 2
…	…	
…	…	

2.7.18 *CAN-GPS Speed Calibration Status*

Byte	Description
0	Module 12 – CAN-GPS Speed Calibration Status
1	Length of module – 39
2	
3	Spare
4	Spare
5	CAN-GPS Calibration Status 0 – CAN-GPS calibration started 1 – CAN-GPS calibration accomplished 2 – CAN-GPS calibration error 3 – CAN-GPS calibration status unknown
6-7	0-10km/h CAN-GPS Conversion (1/1000)
8-9	11-20 km/h CAN-GPS Conversion (1/1000)
10-11	21-30 km/h CAN-GPS Conversion (1/1000)

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12-13	31-40 km/h CAN-GPS Conversion (1/1000)
14-15	41-50 km/h CAN-GPS Conversion (1/1000)
16-17	51-60 km/h CAN-GPS Conversion (1/1000)
18-19	61-70 km/h CAN-GPS Conversion (1/1000)
20-21	71-80 km/h CAN-GPS Conversion (1/1000)
22-23	81-90 km/h CAN-GPS Conversion (1/1000)
24-25	91-100 km/h CAN-GPS Conversion (1/1000)
26-27	101-110 km/h CAN-GPS Conversion (1/1000)
28-29	111-120 km/h CAN-GPS Conversion (1/1000)
30-31	121-130 km/h CAN-GPS Conversion (1/1000)
32-33	131-140 km/h CAN-GPS Conversion (1/1000)
34-35	141-150 km/h CAN-GPS Conversion (1/1000)
36-37	151-160 km/h CAN-GPS Conversion (1/1000)
38-39	161-170 km/h CAN-GPS Conversion (1/1000)
40-41	171-180 km/h CAN-GPS Conversion (1/1000)

2.7.19 *Authenticated Features Query Response*

This module enables sending features bitmaps upon receiving Authenticated Features Query Command (module 13).

This module shall be sent with mandatory module 8 (FW ID).

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Module 13 – Authenticated Features Query Response</td></tr>
<tr><td>1</td><td rowspan="2">Length of module – 21</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td>Spare</td></tr>
<tr><td>4</td><td>Spare</td></tr>
<tr><td>5</td><td>Authenticated Features Matrix Byte 0
<table>
<tr><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</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>
</table>

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<table>
<tr><td>6</td><td>Authenticated Features Matrix Byte 1
<table>
<tr><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>Obs.</td><td>PointerCept
0 - Inactive
1 - Active</td><td>Obs.</td><td>Obs.</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>7</td><td>Authenticated Features Matrix Byte 2
<table>
<tr><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Basic Driver Behavior
0 - Inactive
1 - Active</td><td>TDLT
0 - Inactive
1 - Active</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>8</td><td>Authenticated Features Matrix Byte 3</td></tr>
<tr><td>9</td><td>Authenticated Features Matrix Byte 4</td></tr>
<tr><td>10</td><td>Authenticated Features Matrix Byte 5</td></tr>
<tr><td>11</td><td>Authenticated Features Matrix Byte 6</td></tr>
<tr><td>12</td><td>Authenticated Features Matrix Byte 7</td></tr>
<tr><td>13</td><td>Authenticated Features Matrix Byte 8</td></tr>
<tr><td>14</td><td>Authenticated Features Matrix Byte 9</td></tr>
<tr><td>15</td><td>Authenticated Features Matrix Byte 10</td></tr>
<tr><td>16</td><td>Authenticated Features Matrix Byte 11</td></tr>
<tr><td>17</td><td>Authenticated Features Matrix Byte 12</td></tr>
<tr><td>18</td><td>Authenticated Features Matrix Byte 13</td></tr>
<tr><td>19</td><td>Authenticated Features Matrix Byte 14</td></tr>
<tr><td>20</td><td>Spare</td></tr>
<tr><td>21</td><td>Spare</td></tr>
<tr><td>22</td><td>Spare</td></tr>
<tr><td>23</td><td>Spare</td></tr>
</table>

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2.7.20 *CAN Supported Standard Parameters*

This module enables to send a list of CAN standard parameters, supported for each ECU in the current vehicle. The unit queries the CAN bus for supported standard parameters after every Ignition On, and the results are kept in the unit memory. After receiving a General Module Query (Type 11, Module 29, Inbound), the unit will reply with this module. If there are no valid results in the unit memory upon receiving the General Module Query, the unit will reply with this module, with ECU Amount (Byte 5) = 0.

Byte	Description
0	Module 17 – CAN Supported Standard Parameters
1	Length of module – 141
2	
3	Spare
4	CAN Bus Baud Rate 0 - Not Detected 1 - 125 Kbps 2 - 250 Kpbs 3 - 500 Kbps
5	ECU Amount (0 if there were no valid results received from the bus)
6	ECU 1 Arbitration ID lower 8 bits (CAN)
7	ECU 2 Arbitration ID lower 8 bits (CAN)
8	ECU 3 Arbitration ID lower 8 bits (CAN)
9	ECU 4 Arbitration ID lower 8 bits (CAN)
10	Spare
11	Vehicle Protocol 0 - Not detected 1 - CAN 11bit 2 - CAN 29bit
12	Spare
13	Spare
14	Spare
15	Spare

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<table>
<tr><td>16</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>17</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>18</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>19</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>20</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x21-0x28 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x28</td><td>PID 0x27</td><td>PID 0x26</td><td>PID 0x25</td><td>PID 0x24</td><td>PID 0x23</td><td>PID 0x22</td><td>PID 0x21</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>
</table>

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21	ECU 1, SID 0x01 Supported Standard Parameters 0x29-0x30 (0 - Not Supported, 1 - Supported)

PID 0x30	PID 0x2F	PID 0x2E	PID 0x2D	PID 0x2C	PID 0x2B	PID 0x2A	PID 0x29
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

22	ECU 1, SID 0x01 Supported Standard Parameters 0x31-0x38 (0 - Not Supported, 1 - Supported)

PID 0x38	PID 0x37	PID 0x36	PID 0x35	PID 0x34	PID 0x33	PID 0x32	PID 0x31
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

23	ECU 1, SID 0x01 Supported Standard Parameters 0x39-0x40 (0 - Not Supported, 1 - Supported)

PID 0x40	PID 0x3F	PID 0x3E	PID 0x3D	PID 0x3C	PID 0x3B	PID 0x3A	PID 0x39
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

24	ECU 1, SID 0x01 Supported Standard Parameters 0x41-0x48 (0 - Not Supported, 1 - Supported)

PID 0x48	PID 0x47	PID 0x46	PID 0x45	PID 0x44	PID 0x43	PID 0x42	PID 0x41
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

25	ECU 1, SID 0x01 Supported Standard Parameters 0x49-0x50 (0 - Not Supported, 1 - Supported)

PID 0x50	PID 0x4F	PID 0x4E	PID 0x4D	PID 0x4C	PID 0x4B	PID 0x4A	PID 0x49
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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<table>
<tr><td>26</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x51-0x58 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x58</td><td>PID 0x57</td><td>PID 0x56</td><td>PID 0x55</td><td>PID 0x54</td><td>PID 0x53</td><td>PID 0x52</td><td>PID 0x51</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>27</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x59-0x60 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x60</td><td>PID 0x5F</td><td>PID 0x5E</td><td>PID 0x5D</td><td>PID 0x5C</td><td>PID 0x5B</td><td>PID 0x5A</td><td>PID 0x59</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>28</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x61-0x68 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x68</td><td>PID 0x67</td><td>PID 0x66</td><td>PID 0x65</td><td>PID 0x64</td><td>PID 0x63</td><td>PID 0x62</td><td>PID 0x61</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>29</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x69-0x70 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x70</td><td>PID 0x6F</td><td>PID 0x6E</td><td>PID 0x6D</td><td>PID 0x6C</td><td>PID 0x6B</td><td>PID 0x6A</td><td>PID 0x69</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>30</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x71-0x78 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x78</td><td>PID 0x77</td><td>PID 0x76</td><td>PID 0x75</td><td>PID 0x74</td><td>PID 0x73</td><td>PID 0x72</td><td>PID 0x71</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>
</table>

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<table>
<tr><td>31</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x79-0x80 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x80</td><td>PID 0x7F</td><td>PID 0x7E</td><td>PID 0x7D</td><td>PID 0x7C</td><td>PID 0x7B</td><td>PID 0x7A</td><td>PID 0x79</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>32</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x81-0x88 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x88</td><td>PID 0x87</td><td>PID 0x86</td><td>PID 0x85</td><td>PID 0x84</td><td>PID 0x83</td><td>PID 0x82</td><td>PID 0x81</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>33</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x89-0x90 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x90</td><td>PID 0x8F</td><td>PID 0x8E</td><td>PID 0x8D</td><td>PID 0x8C</td><td>PID 0x8B</td><td>PID 0x8A</td><td>PID 0x89</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>34</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x91-0x98 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x98</td><td>PID 0x97</td><td>PID 0x96</td><td>PID 0x95</td><td>PID 0x94</td><td>PID 0x93</td><td>PID 0x92</td><td>PID 0x91</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>35</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x99-0xA0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA0</td><td>PID 0x9F</td><td>PID 0x9E</td><td>PID 0x9D</td><td>PID 0x9C</td><td>PID 0x9B</td><td>PID 0x9A</td><td>PID 0x99</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>
</table>

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<table>
<tr><td>36</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xA1-0xA8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA8</td><td>PID 0xA7</td><td>PID 0xA6</td><td>PID 0xA5</td><td>PID 0xA4</td><td>PID 0xA3</td><td>PID 0xA2</td><td>PID 0xA1</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>37</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xA9-0xB0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB0</td><td>PID 0xAF</td><td>PID 0xAE</td><td>PID 0xAD</td><td>PID 0xAC</td><td>PID 0xAB</td><td>PID 0xAA</td><td>PID 0xA9</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>38</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xB1-0xB8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB8</td><td>PID 0xB7</td><td>PID 0xB6</td><td>PID 0xB5</td><td>PID 0xB4</td><td>PID 0xB3</td><td>PID 0xB2</td><td>PID 0xB1</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>39</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xB9-0xC0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xC0</td><td>PID 0xBF</td><td>PID 0xBE</td><td>PID 0xBD</td><td>PID 0xBC</td><td>PID 0xBB</td><td>PID 0xBA</td><td>PID 0xB9</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>40</td><td>Spare</td></tr>
<tr><td>41</td><td>Spare</td></tr>
<tr><td>42</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>
</table>

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<table>
<tr><td>43</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>44</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>45</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>46</td><td>Spare</td></tr>
<tr><td>47</td><td>Spare</td></tr>
<tr><td>48</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>
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<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>
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	PID 0x40	PID 0x3F	PID 0x3E	PID 0x3D	PID 0x3C	PID 0x3B	PID 0x3A	PID 0x39
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
56	ECU 2, SID 0x01 Supported Standard Parameters 0x41-0x48 (0 - Not Supported, 1 - Supported)							
	PID 0x48	PID 0x47	PID 0x46	PID 0x45	PID 0x44	PID 0x43	PID 0x42	PID 0x41
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
57	ECU 2, SID 0x01 Supported Standard Parameters 0x49-0x50 (0 - Not Supported, 1 - Supported)							
	PID 0x50	PID 0x4F	PID 0x4E	PID 0x4D	PID 0x4C	PID 0x4B	PID 0x4A	PID 0x49
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
58	ECU 2, SID 0x01 Supported Standard Parameters 0x51-0x58 (0 - Not Supported, 1 - Supported)							
	PID 0x58	PID 0x57	PID 0x56	PID 0x55	PID 0x54	PID 0x53	PID 0x52	PID 0x51
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
59	ECU 2, SID 0x01 Supported Standard Parameters 0x59-0x60 (0 - Not Supported, 1 - Supported)							
	PID 0x60	PID 0x5F	PID 0x5E	PID 0x5D	PID 0x5C	PID 0x5B	PID 0x5A	PID 0x59
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
60	ECU 2, SID 0x01 Supported Standard Parameters 0x61-0x68 (0 - Not Supported, 1 - Supported)							
	PID 0x68	PID 0x67	PID 0x66	PID 0x65	PID 0x64	PID 0x63	PID 0x62	PID 0x61
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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<tr><td>62</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x71-0x78 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x78</td><td>PID 0x77</td><td>PID 0x76</td><td>PID 0x75</td><td>PID 0x74</td><td>PID 0x73</td><td>PID 0x72</td><td>PID 0x71</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>63</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x79-0x80 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x80</td><td>PID 0x7F</td><td>PID 0x7E</td><td>PID 0x7D</td><td>PID 0x7C</td><td>PID 0x7B</td><td>PID 0x7A</td><td>PID 0x79</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>
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66	ECU 2, SID 0x01 Supported Standard Parameters 0x91-0x98 (0 - Not Supported, 1 - Supported) PID 0x98 | PID 0x97 | PID 0x96 | PID 0x95 | PID 0x94 | PID 0x93 | PID 0x92 | PID 0x91 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0
67	ECU 2, SID 0x01 Supported Standard Parameters 0x99-0xA0 (0 - Not Supported, 1 - Supported) PID 0xA0 | PID 0x9F | PID 0x9E | PID 0x9D | PID 0x9C | PID 0x9B | PID 0x9A | PID 0x99 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0
68	ECU 2, SID 0x01 Supported Standard Parameters 0xA1-0xA8 (0 - Not Supported, 1 - Supported) PID 0xA8 | PID 0xA7 | PID 0xA6 | PID 0xA5 | PID 0xA4 | PID 0xA3 | PID 0xA2 | PID 0xA1 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0
69	ECU 2, SID 0x01 Supported Standard Parameters 0xA9-0xB0 (0 - Not Supported, 1 - Supported) PID 0xB0 | PID 0xAF | PID 0xAE | PID 0xAD | PID 0xAC | PID 0xAB | PID 0xAA | PID 0xA9 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0

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<tr><td>122</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x51-0x58 (0 - Not Supported, 1 - Supported)
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140	ECU 4, SID 0x09 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported) PID 0x18 | PID 0x17 | PID 0x16 | PID 0x15 | PID 0x14 | PID 0x13 | PID 0x12 | PID 0x11 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0
141	ECU 4, SID 0x09 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported) PID 0x20 | PID 0x1F | PID 0x1E | PID 0x1D | PID 0x1C | PID 0x1B | PID 0x1A | PID 0x19 bit 7 | bit 6 | bit 5 | bit 4 | bit 3 | bit 2 | bit 1 | bit 0
142	Spare
143	Spare

2.7.21 *K-Line Supported Standard Parameters*

This module enables to send a list of K-Line standard parameters, supported for each ECU in the current vehicle. The unit queries the K-Line bus for supported standard parameters after every Ignition On, and the results are kept in the unit memory. After receiving a General Module Query (Type 11, Module 29, Inbound), the unit will reply with this module. If there are no valid results in the unit memory upon receiving the General Module Query, the unit will reply with this module, with ECU Amount (Byte 5) = 0.

Byte	Description
0	Module 18 – K-Line Supported Standard Parameters
1	Length of module – 141
2	
3	Spare
4	CAN Bus Baud Rate 0 - Not Detected 1 - 125 Kbps 2 - 250 Kpbs 3 - 500 Kbps
5	ECU Amount (0 if there were no valid results received from the bus)
6	ECU 1 Arbitration ID lower 8 bits (CAN)

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<table>
<tr><td>7</td><td>ECU 2 Arbitration ID lower 8 bits (CAN)</td></tr>
<tr><td>8</td><td>ECU 3 Arbitration ID lower 8 bits (CAN)</td></tr>
<tr><td>9</td><td>ECU 4 Arbitration ID lower 8 bits (CAN)</td></tr>
<tr><td>10</td><td>Spare</td></tr>
<tr><td>11</td><td>Vehicle Protocol

0 - Not detected
1 - CAN 11bit
2 - CAN 29bit</td></tr>
<tr><td>12</td><td>Spare</td></tr>
<tr><td>13</td><td>Spare</td></tr>
<tr><td>14</td><td>Spare</td></tr>
<tr><td>15</td><td>Spare</td></tr>
<tr><td>16</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>17</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>18</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)

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</table>

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<table>
<tr><td>19</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>20</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x21-0x28 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x28</td><td>PID 0x27</td><td>PID 0x26</td><td>PID 0x25</td><td>PID 0x24</td><td>PID 0x23</td><td>PID 0x22</td><td>PID 0x21</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>21</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x29-0x30 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x30</td><td>PID 0x2F</td><td>PID 0x2E</td><td>PID 0x2D</td><td>PID 0x2C</td><td>PID 0x2B</td><td>PID 0x2A</td><td>PID 0x29</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>22</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x31-0x38 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x38</td><td>PID 0x37</td><td>PID 0x36</td><td>PID 0x35</td><td>PID 0x34</td><td>PID 0x33</td><td>PID 0x32</td><td>PID 0x31</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>
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<table><tr><td>PID 0x40</td><td>PID 0x3F</td><td>PID 0x3E</td><td>PID 0x3D</td><td>PID 0x3C</td><td>PID 0x3B</td><td>PID 0x3A</td><td>PID 0x39</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>
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<table><tr><td>PID 0x48</td><td>PID 0x47</td><td>PID 0x46</td><td>PID 0x45</td><td>PID 0x44</td><td>PID 0x43</td><td>PID 0x42</td><td>PID 0x41</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>
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<table><tr><td>PID 0x58</td><td>PID 0x57</td><td>PID 0x56</td><td>PID 0x55</td><td>PID 0x54</td><td>PID 0x53</td><td>PID 0x52</td><td>PID 0x51</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>
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</table>

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<table>
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<tr><td>32</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x81-0x88 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x88</td><td>PID 0x87</td><td>PID 0x86</td><td>PID 0x85</td><td>PID 0x84</td><td>PID 0x83</td><td>PID 0x82</td><td>PID 0x81</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>33</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x89-0x90 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x90</td><td>PID 0x8F</td><td>PID 0x8E</td><td>PID 0x8D</td><td>PID 0x8C</td><td>PID 0x8B</td><td>PID 0x8A</td><td>PID 0x89</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>
</table>

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<table>
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<table><tr><td>PID 0x98</td><td>PID 0x97</td><td>PID 0x96</td><td>PID 0x95</td><td>PID 0x94</td><td>PID 0x93</td><td>PID 0x92</td><td>PID 0x91</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>35</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0x99-0xA0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA0</td><td>PID 0x9F</td><td>PID 0x9E</td><td>PID 0x9D</td><td>PID 0x9C</td><td>PID 0x9B</td><td>PID 0x9A</td><td>PID 0x99</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>36</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xA1-0xA8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA8</td><td>PID 0xA7</td><td>PID 0xA6</td><td>PID 0xA5</td><td>PID 0xA4</td><td>PID 0xA3</td><td>PID 0xA2</td><td>PID 0xA1</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>37</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xA9-0xB0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB0</td><td>PID 0xAF</td><td>PID 0xAE</td><td>PID 0xAD</td><td>PID 0xAC</td><td>PID 0xAB</td><td>PID 0xAA</td><td>PID 0xA9</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>38</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xB1-0xB8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB8</td><td>PID 0xB7</td><td>PID 0xB6</td><td>PID 0xB5</td><td>PID 0xB4</td><td>PID 0xB3</td><td>PID 0xB2</td><td>PID 0xB1</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>
</table>

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<table>
<tr><td>39</td><td>ECU 1, SID 0x01 Supported Standard Parameters 0xB9-0xC0 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0xC0</td><td>PID 0xBF</td><td>PID 0xBE</td><td>PID 0xBD</td><td>PID 0xBC</td><td>PID 0xBB</td><td>PID 0xBA</td><td>PID 0xB9</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>40</td><td>Spare</td></tr>
<tr><td>41</td><td>Spare</td></tr>
<tr><td>42</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>43</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>44</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>45</td><td>ECU 1, SID 0x09 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>
</table>

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<tr><td>48</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

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</table>

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</table>

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<tr><td>60</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x61-0x68 (0 - Not Supported, 1 - Supported)
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<tr><td>61</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x69-0x70 (0 - Not Supported, 1 - Supported)
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<tr><td>62</td><td>ECU 2, SID 0x01 Supported Standard Parameters 0x71-0x78 (0 - Not Supported, 1 - Supported)
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<tr><td>86</td><td>ECU 3, SID 0x01 Supported Standard Parameters 0x31-0x38 (0 - Not Supported, 1 - Supported)

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92	ECU 3, SID 0x01 Supported Standard Parameters 0x61-0x68 (0 - Not Supported, 1 - Supported)

PID 0x68	PID 0x67	PID 0x66	PID 0x65	PID 0x64	PID 0x63	PID 0x62	PID 0x61
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

93	ECU 3, SID 0x01 Supported Standard Parameters 0x69-0x70 (0 - Not Supported, 1 - Supported)

PID 0x70	PID 0x6F	PID 0x6E	PID 0x6D	PID 0x6C	PID 0x6B	PID 0x6A	PID 0x69
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

94	ECU 3, SID 0x01 Supported Standard Parameters 0x71-0x78 (0 - Not Supported, 1 - Supported)

PID 0x78	PID 0x77	PID 0x76	PID 0x75	PID 0x74	PID 0x73	PID 0x72	PID 0x71
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

95	ECU 3, SID 0x01 Supported Standard Parameters 0x79-0x80 (0 - Not Supported, 1 - Supported)

PID 0x80	PID 0x7F	PID 0x7E	PID 0x7D	PID 0x7C	PID 0x7B	PID 0x7A	PID 0x79
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

96	ECU 3, SID 0x01 Supported Standard Parameters 0x81-0x88 (0 - Not Supported, 1 - Supported)

PID 0x88	PID 0x87	PID 0x86	PID 0x85	PID 0x84	PID 0x83	PID 0x82	PID 0x81
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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<tr><td>97</td><td>ECU 3, SID 0x01 Supported Standard Parameters 0x89-0x90 (0 - Not Supported, 1 - Supported)

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<tr><td>105</td><td>Spare</td></tr>
<tr><td>106</td><td>ECU 3, SID 0x09 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>107</td><td>ECU 3, SID 0x09 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>108</td><td>ECU 3, SID 0x09 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>
</table>

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<table>
<tr><td></td><td></td></tr>
<tr><td>109</td><td>ECU 3, SID 0x09 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>110</td><td>Spare</td></tr>
<tr><td>111</td><td>Spare</td></tr>
<tr><td>112</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>113</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>114</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported)
<table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>
</table>

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<table>
<tr><td>115</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>116</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x21-0x28 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x28</td><td>PID 0x27</td><td>PID 0x26</td><td>PID 0x25</td><td>PID 0x24</td><td>PID 0x23</td><td>PID 0x22</td><td>PID 0x21</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>117</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x29-0x30 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x30</td><td>PID 0x2F</td><td>PID 0x2E</td><td>PID 0x2D</td><td>PID 0x2C</td><td>PID 0x2B</td><td>PID 0x2A</td><td>PID 0x29</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>118</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x31-0x38 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x38</td><td>PID 0x37</td><td>PID 0x36</td><td>PID 0x35</td><td>PID 0x34</td><td>PID 0x33</td><td>PID 0x32</td><td>PID 0x31</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>119</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x39-0x40 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x40</td><td>PID 0x3F</td><td>PID 0x3E</td><td>PID 0x3D</td><td>PID 0x3C</td><td>PID 0x3B</td><td>PID 0x3A</td><td>PID 0x39</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>120</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x41-0x48 (0 - Not Supported, 1 - Supported)</td></tr>
</table>

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	PID 0x48	PID 0x47	PID 0x46	PID 0x45	PID 0x44	PID 0x43	PID 0x42	PID 0x41
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
121	ECU 4, SID 0x01 Supported Standard Parameters 0x49-0x50 (0 - Not Supported, 1 - Supported)							
	PID 0x50	PID 0x4F	PID 0x4E	PID 0x4D	PID 0x4C	PID 0x4B	PID 0x4A	PID 0x49
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
122	ECU 4, SID 0x01 Supported Standard Parameters 0x51-0x58 (0 - Not Supported, 1 - Supported)							
	PID 0x58	PID 0x57	PID 0x56	PID 0x55	PID 0x54	PID 0x53	PID 0x52	PID 0x51
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
123	ECU 4, SID 0x01 Supported Standard Parameters 0x59-0x60 (0 - Not Supported, 1 - Supported)							
	PID 0x60	PID 0x5F	PID 0x5E	PID 0x5D	PID 0x5C	PID 0x5B	PID 0x5A	PID 0x59
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
124	ECU 4, SID 0x01 Supported Standard Parameters 0x61-0x68 (0 - Not Supported, 1 - Supported)							
	PID 0x68	PID 0x67	PID 0x66	PID 0x65	PID 0x64	PID 0x63	PID 0x62	PID 0x61
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
125	ECU 4, SID 0x01 Supported Standard Parameters 0x69-0x70 (0 - Not Supported, 1 - Supported)							
	PID 0x70	PID 0x6F	PID 0x6E	PID 0x6D	PID 0x6C	PID 0x6B	PID 0x6A	PID 0x69
	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0

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<table>
<tr><td></td><td></td></tr>
<tr><td>126</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x71-0x78 (0 - Not Supported, 1 - Supported)
<table>
<tr><td>PID 0x78</td><td>PID 0x77</td><td>PID 0x76</td><td>PID 0x75</td><td>PID 0x74</td><td>PID 0x73</td><td>PID 0x72</td><td>PID 0x71</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>127</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x79-0x80 (0 - Not Supported, 1 - Supported)
<table>
<tr><td>PID 0x80</td><td>PID 0x7F</td><td>PID 0x7E</td><td>PID 0x7D</td><td>PID 0x7C</td><td>PID 0x7B</td><td>PID 0x7A</td><td>PID 0x79</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>128</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x81-0x88 (0 - Not Supported, 1 - Supported)
<table>
<tr><td>PID 0x88</td><td>PID 0x87</td><td>PID 0x86</td><td>PID 0x85</td><td>PID 0x84</td><td>PID 0x83</td><td>PID 0x82</td><td>PID 0x81</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>129</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x89-0x90 (0 - Not Supported, 1 - Supported)
<table>
<tr><td>PID 0x90</td><td>PID 0x8F</td><td>PID 0x8E</td><td>PID 0x8D</td><td>PID 0x8C</td><td>PID 0x8B</td><td>PID 0x8A</td><td>PID 0x89</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>
</table>

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<table>
<tr><td>130</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x91-0x98 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0x98</td><td>PID 0x97</td><td>PID 0x96</td><td>PID 0x95</td><td>PID 0x94</td><td>PID 0x93</td><td>PID 0x92</td><td>PID 0x91</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>131</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0x99-0xA0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA0</td><td>PID 0x9F</td><td>PID 0x9E</td><td>PID 0x9D</td><td>PID 0x9C</td><td>PID 0x9B</td><td>PID 0x9A</td><td>PID 0x99</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>132</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0xA1-0xA8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xA8</td><td>PID 0xA7</td><td>PID 0xA6</td><td>PID 0xA5</td><td>PID 0xA4</td><td>PID 0xA3</td><td>PID 0xA2</td><td>PID 0xA1</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>133</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0xA9-0xB0 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB0</td><td>PID 0xAF</td><td>PID 0xAE</td><td>PID 0xAD</td><td>PID 0xAC</td><td>PID 0xAB</td><td>PID 0xAA</td><td>PID 0xA9</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>134</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0xB1-0xB8 (0 - Not Supported, 1 - Supported)

<table><tr><td>PID 0xB8</td><td>PID 0xB7</td><td>PID 0xB6</td><td>PID 0xB5</td><td>PID 0xB4</td><td>PID 0xB3</td><td>PID 0xB2</td><td>PID 0xB1</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>135</td><td>ECU 4, SID 0x01 Supported Standard Parameters 0xB9-0xC0 (0 - Not Supported, 1 - Supported)</td></tr>
</table>

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	<table><tr><td>PID 0xC0</td><td>PID 0xBF</td><td>PID 0xBE</td><td>PID 0xBD</td><td>PID 0xBC</td><td>PID 0xBB</td><td>PID 0xBA</td><td>PID 0xB9</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>
136	Spare
137	Spare
138	ECU 4, SID 0x09 Supported Standard Parameters 0x01-0x08 (0 - Not Supported, 1 - Supported) <table><tr><td>PID 0x08</td><td>PID 0x07</td><td>PID 0x06</td><td>PID 0x05</td><td>PID 0x04</td><td>PID 0x03</td><td>PID 0x02</td><td>PID 0x01</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>
139	ECU 4, SID 0x09 Supported Standard Parameters 0x09-0x10 (0 - Not Supported, 1 - Supported) <table><tr><td>PID 0x10</td><td>PID 0x0F</td><td>PID 0x0E</td><td>PID 0x0D</td><td>PID 0x0C</td><td>PID 0x0B</td><td>PID 0x0A</td><td>PID 0x09</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>
140	ECU 4, SID 0x09 Supported Standard Parameters 0x11-0x18 (0 - Not Supported, 1 - Supported) <table><tr><td>PID 0x18</td><td>PID 0x17</td><td>PID 0x16</td><td>PID 0x15</td><td>PID 0x14</td><td>PID 0x13</td><td>PID 0x12</td><td>PID 0x11</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>
141	ECU 4, SID 0x09 Supported Standard Parameters 0x19-0x20 (0 - Not Supported, 1 - Supported) <table><tr><td>PID 0x20</td><td>PID 0x1F</td><td>PID 0x1E</td><td>PID 0x1D</td><td>PID 0x1C</td><td>PID 0x1B</td><td>PID 0x1A</td><td>PID 0x19</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>
142	Spare
143	Spare

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2.7.22 *VIN Read Response*

Byte	Description
0	Module 22 – VIN Read Response
1	Length of module – 17
2	
3	VIN – Byte 0
…	…
19	VIN – Byte 16

2.7.23 *CAN Bus Status*

Byte	Description
0	Module 24 – CAN Bus Status
1	Length of module – 6
2	
3	OBDII CAN Bus State 0 – Unknown 1 – Disconnected 2 – Connected
4	CAN Bus Rate 0 – 125 Kbps 1 – 250 Kbps 2 – 500 Kbps 3 – 1 Mbps
5	CAN Bus Format 0 – 11 bits 1 – 29 bits
6	Spare
7	Spare
8	Spare

2.7.24 *Trigger Event ID*

The module is sent upon event triggering, and describes the operator which triggered an event.

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Byte	Description
0	Module 25 - Trigger Event ID
1	Length of module – 5
2	
3	Operator Type 0 – Logical Filter Dual Threshold 1 – Logical Filter Single Threshold 2 – Spare 3 – Is In Set 4 – Is Not In Set 5 – Logical Delta 6 – Logical Delta Since Last Violation 7 – Timer 8 – Spare 9 – Compare 2 Operands 10 – Separator 11 – Spare 12 – Logical 13 – Compare Operands with Constant 30 – Generate Event
4	Operator ID
5	Spare
6	Spare
7	Spare

2.7.25 *General Status Event*

This module includes system events and notifications. The Module structure has dedicated event fields which will identify the event type and the attached information fields. The module can support multiple concatenated events structures.

General Event module is sent with HW ID, GPS time and location modules (modules 8, 6 and 7). The message is built as follows:

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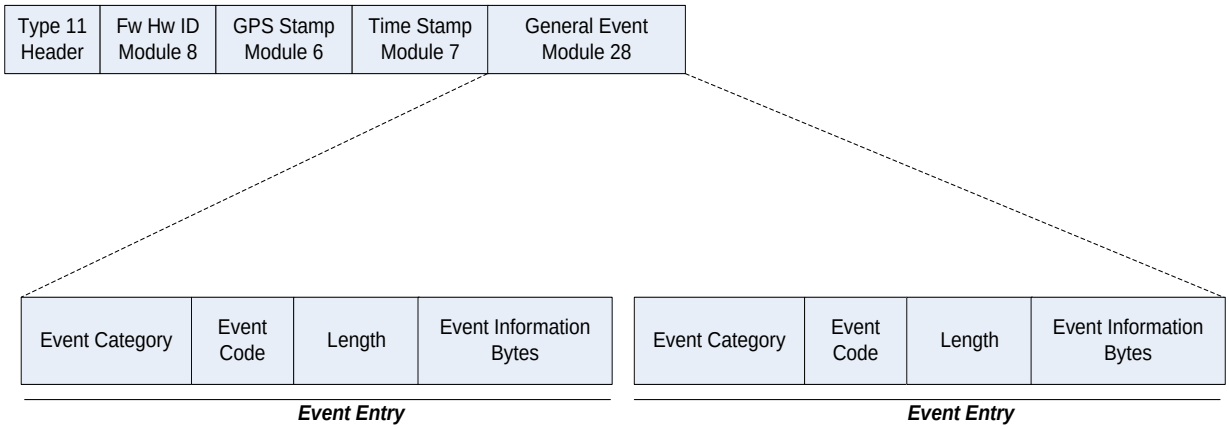

Module 28 below describes the general format of a "General Event". The module can carry multiple entries of "General Event structures". Each "General Event Entry" includes Event Category, Event code, Event data length in bytes and event related data bytes.

Byte	Description
0	Module 28 - General Status Event
1	Length of module – Variable
2	
3	Number of entries
4-5	1st Event Category
6-7	1st Event Code
8	1st Event related data length (bytes)
9	1st Event Related info bytes …
…	2nd Event Category
…	…

Event codes table

Event Category	Event Code	Description
0	2	CAN BUS Event
0	30	K-Line BUS Event
1,2,3	4	Package Open/Close

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Event Category	Event Code	Description
1,2,3	7	MultiSense Provisioning
1,2,3	15	MultiSense Door/Window Open/Close
2	24	BT classic connected/disconnected
2	25	BT Extender Provisioning

CAN Bus Event

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 8
2	
3	Number of entries
4	Event Category – 0 (Cello-CANiQ)
5	
6	Event Code – 2 (CAN BUS Event)
7	
8	Length – 2
9	Event Sub Code 0 - Response Received for Standard Parameters Query 1 - No Response for Standard Parameters Query
10	Spare

K-Line Bus Event

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 8
2	
3	Number of entries
4	Event Category – 0 (Cello-CANiQ)
5	

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6	Event Code – 30 (K-Line Bus Event)
7	
8	Length – 2
9	<table><tr><th>BUS State Event code</th><th>Description</th></tr><tr><td>0</td><td>Connected</td></tr><tr><td>1</td><td>Disconnected</td></tr></table>
10	Spare

Impact and Free-fall Recognition

Type-0 and/or this Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 12
2	
3	Number of entries
4	Event Category – 1 (Nano) / 2 (BT Extender)
5	
6	Event Code 1 – Impact 16 – Free-fall
7	
8	Length – 6
9	Source of measurement According to this definition
10	Spare
11	Impact/ Free-fall acceleration RMS value 32-bit value of $(X^2+Y^2+Z^2)$, where each of the axis is in 250µg units. (Example: X=2g=8000, Y=3g=12000, Z=8g=32000 → RMS=$8000^2+12000^2+32000^2$ = 1232000000=0x496ED400)
12	
13	
14	

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Package Open/Close

Type-0 and/or this Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 10
2	
3	Number of entries
4	Event Category – 1 (Nano) / 2 (BT Extender) / 3 (CelloTrack 4)
5	
6	Event Code – 4 (Package Open/Close)
7	
8	Length – 4
9	Source of measurement According to this definition
10	Open/Close 0 – Close 1 – Open
11	Filtered current light value (lux units, 0.25 lux resolution)
12	

MultiSense Package Open/Close

Type-0 and/or a type-11 event (Event Code – 4 (Package Open/Close), identical to Package Open/Close event) is used.

MultiSense Provisioning

Type-0 and/or this Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 33
2	
3	Number of entries

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4	Event Category – 1 (Nano) / 2 (BT Extender) / 3 (CelloTrack 4)	
5		
6	Event Code – 7 (MultiSense Provisioning)	
7		
8	Length – 27	
9	Source of measurement According to this definition	
10	Problem code 0 – All OK 1 – Lost communication 2 – Communication restored 3 – Low bat 4 – Low bat restored 5 – Dead bat 6 – Dead bat restored 7 – MultiSense Power-up 8 – MultiSense Power-down by button	
11	Battery level (%)	
12	Last RSSI value (SR-RF) (Signed, dBm units)	
13	System time – seconds	Time of last communication from the specific MultiSense
14	System time – minutes	
15	System time – hours	
16	System date – day	
17	System date – month	
18	System date – year (-2000)	
19	MultiSense FW version – Minor Version	
20	MultiSense FW version – Major Version	

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<table>
<tr><td>21</td><td>BOM mask (indicate which fields below are relevant)
<table>
<tr><td>Spare</td><td>Temp. sensor enable</td><td>Humidity sensor enable</td><td>Magnetic sensor enable</td><td>Light sensor enable</td><td>Accel. sensor enable</td><td colspan="2">Spare</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>22</td><td>Enabled sensors mask (indicate which fields below are relevant)
<table>
<tr><td>Spare</td><td>Temp. sensor enable</td><td>Humidity sensor enable</td><td>Magnetic sensor enable</td><td>Light sensor enable</td><td>Accel. sensor enable</td><td>TX On Violation only</td><td>Spare</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>23
24</td><td>Last measured temperature
(Signed, 0.1°C resolution)</td></tr>
<tr><td>25
26</td><td>Last measured humidity
(0.1% resolution)</td></tr>
<tr><td>27
28</td><td>Last measured light level
(0.5 lux resolution)</td></tr>
<tr><td>29
30</td><td>Last measured X acceleration
(Signed, 250µg resolution)</td></tr>
<tr><td>31
32</td><td>Last measured Y acceleration
(Signed, 250µg resolution)</td></tr>
<tr><td>33
34</td><td>Last measured Z acceleration
(Signed, 250µg resolution)</td></tr>
<tr><td>35</td><td>
<table>
<tr><td>Accelerometer Self-Test Result

0 – Fail
1 – Pass</td><td colspan="6">Spare</td><td>Magnetic Sensor State

0 – Magnet Not Present
1 – Magnet Present</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>
</table>

MultiSense Door/Window Open/Close

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Type-0 and/or this Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 10
2	
3	Number of entries
4	Event Category – 1 (Nano) / 2 (BT Extender) / 3 (CelloTrack 4)
5	
6	Event Code – 15 (Door/Window Open/Close)
7	
8	Length – 4
9	Source of measurement According to this definition
10	Open/Close 0 – Close 1 – Open
11	Spare
12	Spare

To request the status of a certain MultiSense (or Nano/BT Extender), the following Type 11 command should be used:

Byte	Description
0	Module 32 - General Command
1	Length of module – 6
2	
3	Number of Command entries sent by this module – 1
4	Command ID – 259 (Nano/Cello with BT Extender: send status of the designated source)
5	
6	Length of entry data – 2
7	Source of measurement According to this definition

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8	Spare

If the source is one of the MultiSense units, the answer to this command is the "MultiSense provisioning message" as shown above.

If the source is BT extender (0xFB), the answer to this command is the "BT Extender provisioning message" as shown above.

If the source is Nano (0xFD), the answer will be a type-11 message with module name 42 as payload, as described here.

BT Classic Channel (of BT Extender) Connection/Disconnection

After recognition of BT Classic (of BT extender) channel connection/disconnection, this event is created.

This Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – Variable
2	
3	Number of entries
4	Event Category – 2 (BT Extender)
5	
6	Event Code – 24 (BT classic connected/disconnected)
7	
8	Length – Variable
9	Source of measurement Always 0xFB, according to this definition
10	Problem Code 0 – Reserved 1 – Connected 2 – Disconnected
11	BT master (host) MAC address
12	
13	
14	

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15	
16	
…	BT classic master friendly name ASCII String (Maximum 40 bytes, UTF-8 encoding)
…	Spare (1 byte)

BT Extender Provisioning

This Type-11 module is used:

Byte	Description
0	Module 28 - General Status Event
1	Length of module – 22
2	
3	Number of entries
4	Event Category – 2 (BT Extender)
5	
6	Event Code – 25 (BT Extender Provisioning)
7	
8	Length – 16
9	Source of measurement Always 0xFB, according to this definition
10	Problem code 0 – Reserved 1 – Lost communication 2 – Communication restored
11	Module ID 0 – Reserved 1 – BlueGiga BT121
12	HW Revision
13	
14	FW Version – Bootloader
15	

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16	FW Version – Major
17	
18	FW Version – Minor
19	
20	FW Version – Patch
21	
22	FW Version – Build
23	
24	Spare

2.7.26 *CAN Variables Status Dump*

This module will be sent by the unit towards the server upon receiving "General Module Query" (Inbound Type 11, module 29) with requested module ID set to 31. The module will include the content of all the defined CAN variables. Each variable is represented by a "Variable Dump Entry" structure. The variable IDs are allocated by the programmer tool during the CAN variables definition and allocation.

Byte	Description
0	Module 31 – CAN Variables Status Dump
1	Length of module – Variable
2	
3	Number of variable entry sent by this module
4	
	Variable dump Entry 1
	Variable dump Entry 2
	…

Variable Dump Entry

	Variable ID

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	Variable parsing format 0 – Unknown 1 – Bool 2 – UINT 8 3 – SINT 8 4 – UINT 16 5 – SINT 16 6 – UINT 32 7 – SINT 32 8 – Float 9 – String
	Number of data bytes
	Variable data bytes …

2.7.27 *Current J1939 DTC Status*

This module will be sent by the unit towards the server upon receiving "General Module Query" (Inbound Type 11, module 29) with requested module ID set to 37. The module will include the statuses of all current J1939 DTC and indication lamps.

Byte	Description
0	Module 37 – Current J1939 DTC Status
1	Length of module – Variable
2	
3	Spare
4	First Source Number (DTC may be reported by few ECU sources on bus; the unit supports reports from 4 different ECUs)
5	Spare
6	Physical Indication Lamp Status (same as appears in PGN 0x00FECA, bytes 1-2)
7	
8	Amount of active DTCs in the message
9	DTC #1
10	
11	
12	

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13	DTC #2
14	
15	
16	
…	…
…	Second Source Number (DTC may be reported by few ECU sources on bus; the unit supports reports from 4 different ECUs)
…	…

2.7.28 *J1939 DTC Appeared/Disappeared*

This module will be generated upon change in J1939 DTC\Indication lamp status (unsolicited).

J1939 DTC Appeared message will be generated if:

- New DTC is continuously active for 15 seconds
- MIL/RSL lamp is continuously active for 2 seconds
- AWL/PL lamp is continuously active for 30 seconds
- A Flash lamp is continuously active for 30 seconds

J1939 DTC Disappeared message will be generated if:

- New DTC is continuously not active for 3 minutes
- MIL/RSL/AWL/PL lamp is continuously not active for 30 seconds
- A Flash lamp is continuously not active for 30 seconds

This module will be followed by modules 6, 7, 8.

Byte	Description
0	Module 38 – J1939 DTC Appeared/Disappeared
1	Length of module – Variable
2	
3	Spare
4	Transmission Reasons Bitmask

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<table>
<tr><td>5</td><td>
<table>
<tr><td>Flash MIL

0 – Not Active
1 – Active</td><td>Flash RSL

0 – Not Active
1 – Active</td><td>Flash AWL

0 – Not Active
1 – Active</td><td>Flash PL

0 – Not Active
1 – Active</td><td>Malfunction Indicator Lamp (MIL) Status change

0 – No Change
1 – Change</td><td>Red Stop Lamp (RSL) Status change

0 – No Change
1 – Change</td><td>Amber Warning Lamp (AWL) Status change

0 – No Change
1 – Change</td><td>Protect Lamp (PL) Status change

0 – No Change
1 – Change</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>
<table>
<tr><td colspan="7">Spare</td><td>DTC Added or Removed

0 – Not Added/Removed
1 – Added/Removed</td></tr>
<tr><td>Bit 15</td><td>Bit 14</td><td>Bit 13</td><td>Bit 12</td><td>Bit 11</td><td>Bit 10</td><td>Bit 9</td><td>Bit 8</td></tr>
</table>
</td></tr>
<tr><td>6</td><td>Source Number (DTC may be reported by few ECU sources on bus; the unit supports reports from 4 different ECUs)</td></tr>
<tr><td>7</td><td>Spare</td></tr>
<tr><td>8</td><td rowspan="2">Physical Indication Lamp Status (same as appears in PGN 0x00FECA, bytes 1-2)</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td><td>Amount of active DTCs in the message</td></tr>
<tr><td>11</td><td rowspan="4">DTC #1</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td><td rowspan="4">DTC #2</td></tr>
<tr><td>16</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td></tr>
<tr><td>…</td><td>…</td></tr>
</table>

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2.7.29 *Full System MultiSense Readings*

Supported from Cello FW version 35g and later (supporting BT extender)

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Module 45 – Full System MultiSense Readings</td></tr>
<tr><td>1</td><td rowspan="2">Length of module – 35</td></tr>
<tr><td>2</td></tr>
<tr><td>3</td><td>Number of Entries</td></tr>
<tr><td>4</td><td>TX Reason
0 – Retransmission (not a changing point between relaxed and violating timer)
1 – Not retransmission (changing point between relaxed and violating timer)
2 – A violating area, with violation sampling rate</td></tr>
<tr><td>5</td><td>MultiSense index in the system (0-15)</td></tr>
<tr><td>6</td><td rowspan="6">MultiSense MAC address
(Full 6 bytes address)</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td><td>Last MultiSense TX reason (as reported by MultiSense)</td></tr>
<tr><td>13</td><td>TH Status
<table>
<tr><td>Spare</td><td>Humi. Alert
0 – No Alert
1 – Alert</td><td>Humi. Violation
0 – Not violating
1 – Violating</td><td>Humi. TH
0 – Lower
1 – Upper</td><td>Spare</td><td>Temp. Alert
0 – No Alert
1 – Alert</td><td>Temp. Violation
0 – Not violating
1 – Violating</td><td>Temp. TH
0 – Lower
1 – Upper</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>14</td><td>Battery level (%)</td></tr>
<tr><td>15</td><td>Last RSSI (BLE)
(Signed, dBm)</td></tr>
<tr><td>16</td><td>OTA protocol version</td></tr>
</table>

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<table>
<tr><td>17</td><td>MultiSense Minor FW Version</td></tr>
<tr><td>18</td><td>MultiSense Major FW Version</td></tr>
<tr><td>19</td><td>BOM mask (indicate which fields below are relevant)
<table>
<tr><td>Spare</td><td>Temp. sensor enable</td><td>Humidity sensor enable</td><td>Magnetic sensor enable</td><td>Light sensor enable</td><td>Accel. sensor enable</td><td colspan="2">Spare</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>20</td><td>Enabled sensors mask (indicate which fields below are relevant)
<table>
<tr><td>Spare</td><td>Temp. sensor enable</td><td>Humidity sensor enable</td><td>Magnetic sensor enable</td><td>Light sensor enable</td><td>Accel. sensor enable</td><td>TX On Violation only</td><td>Spare</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>21
22</td><td>Last measured temperature
(Signed, 0.1°C resolution)</td></tr>
<tr><td>23
24</td><td>Last measured humidity
(0.1% resolution)</td></tr>
<tr><td>25
26</td><td>Last measured light level
(0.5 lux resolution)</td></tr>
<tr><td>27
28</td><td>Last measured X acceleration
(Signed, 250µg resolution)</td></tr>
<tr><td>29
30</td><td>Last measured Y acceleration
(Signed, 250µg resolution)</td></tr>
<tr><td>31
32</td><td>Last measured Z acceleration
(Signed, 250µg resolution)</td></tr>
</table>

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33	<table><tr><td>Accelerometer Self-Test Result 0 – Fail 1 – Pass</td><td colspan="5">Spare</td><td>Package State 0 – Close 1 - Open</td><td>Magnetic Sensor State 0 – Magnet Not Present 1 – Magnet Present</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>
34	Spare
35	Spare
36	Spare
37	Spare

2.7.30 *DTCO Connect/Disconnect Event*

This message will be sent upon recognition of DTCO device connection/disconnection to/from D8 port.

Except of the new module defined below, the message will include modules 6, 7, 8, 51, 52, 53.

Byte	Description
0	Module 50 – DTCO Connect/Disconnect Event
1	Length of module – 19
2	
3	Source of System Parameters 1 <table><tr><td colspan="6">Spare</td><td colspan="2">Odometer Source 0 - Estimated by GPS 1 - CAN 2 - Frequency Counter 3 - DTCO 4-7 - Spare</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>

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<table>
<tr><td>4</td><td>Source of System Parameters 2
<table>
<tr><td colspan="2">D8 DTCO Connection Status
0 - Disconnected
1 - Connected</td><td colspan="3">Speed source
0 - GPS
1 - Freq. Counter
2 - CAN
3 - DTCO
4-7 - Spare</td><td colspan="2">RPM source
0 - Freq. Count
1 - CAN
2 - DTCO
3 - Spare</td><td colspan="2">Driver ID source
0 - 1-Wire bus
1 - COM port
2 - DTCO
3 - Spare</td></tr>
<tr><td colspan="2">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>5</td><td>Spare</td></tr>
<tr><td>6</td><td>DTCO SW Number</td></tr>
<tr><td>7</td><td>Code Page (D8: Code Page)</td></tr>
<tr><td>8-20</td><td>VRN – Vehicle Registration Number (D8: Vehicle Registration Number; zero padded)</td></tr>
</table>

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<table>
<tr><td>21</td><td>Work States (D8: TCO1/DB1)
<table>
<tr><td colspan="8">Bit</td><td rowspan="2">Definition</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></tr>
<tr><td colspan="9">Driver 1 Working State</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>0</td><td>0</td><td>Break/Rest</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>0</td><td>1</td><td>Availability</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>0</td><td>Work</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>1</td><td>Drive</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>0</td><td>0</td><td>Reserved</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>0</td><td>1</td><td>Reserved</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>0</td><td>Error</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>1</td><td>Not Available</td></tr>
<tr><td colspan="9">Driver 2 Working State</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>0</td><td>0</td><td>X</td><td>X</td><td>X</td><td>Break/Rest</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>0</td><td>1</td><td>X</td><td>X</td><td>X</td><td>Availability</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>1</td><td>0</td><td>X</td><td>X</td><td>X</td><td>Work</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>1</td><td>1</td><td>X</td><td>X</td><td>X</td><td>Reserved</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>0</td><td>0</td><td>X</td><td>X</td><td>X</td><td>Reserved</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>0</td><td>1</td><td>X</td><td>X</td><td>X</td><td>Reserved</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>1</td><td>0</td><td>X</td><td>X</td><td>X</td><td>Error</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>1</td><td>1</td><td>X</td><td>X</td><td>X</td><td>Not Available</td></tr>
<tr><td colspan="9">Driver Recognize</td></tr>
<tr><td>0</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Vehicle Motion Not Detected</td></tr>
<tr><td>0</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Vehicle Motion Detected</td></tr>
<tr><td>1</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Error</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Not Available</td></tr>
</table></td></tr>
</table>

2.7.31 *DTCO Time*

Byte	Description

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0	Module 51 – DTCO Time
1	Length of module – 7
2	
3	Spare
4	DTCO time – seconds (D8: Time Date/DB1)
5	DTCO time – minutes (D8: Time Date/DB2)
6	DTCO time – hours (D8: Time Date/DB3)
7	DTCO date – day (D8: Time Date/DB5)
8	DTCO date – month (D8: Time Date/DB4)
9	DTCO date – year (-2000) (D8: Time Date/DB6)

2.7.32 *DTCO Driver Identification Numbers*

Byte	Description
0	Module 52 – DTCO Driver Identification Numbers
1	Length of module – 36
2	
3-20	DIN 1 - Driver 1 Identification Number (D8: Driver 1 Identification Number; zero padded)
21-38	DIN 2 - Driver 2 Identification Number (D8: Driver 2 Identification Number; zero padded)

2.7.33 *DTCO Parameters Change Event*

This message will be sent upon recognition of change of one of the parameters reported by DTCO through D8 or FMS.

If "DTCO Source Selection" parameter (address 240, bits 0-2) is set to 1 (D8 VDO), then except of the new module defined below, the message will include modules 6, 7, 8, 51, 52 (only if DIN 1/2 changed), 22 (only if VIN changed).

Byte	Description
0	Module 53 – DTCO Parameters Change Event
1	Length of module – 14
2	

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<table>
<tr><td>3</td><td>Source of System Parameters 1
<table>
<tr><td colspan="6">Spare</td><td colspan="2">Odometer Source
0 - Estimated by GPS
1 - CAN
2 - Frequency Counter
3 - DTCO
4-7 - Spare</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>4</td><td>Source of System Parameters 2
<table>
<tr><td>D8 DTCO Connection Status
0 - Disconnected
1 - Connected</td><td colspan="3">Speed source
0 - GPS
1 - Freq. Counter
2 - CAN
3 - DTCO
4-7 - Spare</td><td colspan="2">RPM source
0 - Freq. Count
1 - CAN
2 - DTCO
3 - Spare</td><td colspan="2">Driver ID source
0 - 1-Wire bus
1 - COM port
2 - DTCO
3 - Spare</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>5</td><td>DTCO Source
<table>
<tr><td colspan="4">Spare</td><td>FMS</td><td>D8 Stoneridge (Infrastructure)</td><td>D8 VDO</td><td>Spare</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>
</table>

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6	Generation Reason 1						
	DIN1 (Relevant only for D8, not FMS)	VIN (Relevant only for D8, not FMS)	Additional Information (Ignition) (Relevant only for D8, not FMS)	Speed Authorized (Relevant for Stoneridge only, not FMS)	Tachograph Status	Work States	Driver 2 states	Driver 1 states
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
7	Generation Reason 2							
	Spare							DIN2 (Relevant only for D8, not FMS)
	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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8	Generation Reason 3

By Request	DTCO Disconnected	DTCO Connected	Spare				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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9

Work States (D8: TCO1/DB1)

Bit								Definition
7	6	5	4	3	2	1	0	
Driver 1 Working State								
X	X	X	X	X	0	0	0	Break/Rest
X	X	X	X	X	0	0	1	Availability
X	X	X	X	X	0	1	0	Work
X	X	X	X	X	0	1	1	Drive
X	X	X	X	X	1	0	0	Reserved
X	X	X	X	X	1	0	1	Reserved
X	X	X	X	X	1	1	0	Error
X	X	X	X	X	1	1	1	Not Available
Driver 2 Working State								
X	X	0	0	0	X	X	X	Break/Rest
X	X	0	0	1	X	X	X	Availability
X	X	0	1	0	X	X	X	Work
X	X	0	1	1	X	X	X	Reserved
X	X	1	0	0	X	X	X	Reserved
X	X	1	0	1	X	X	X	Reserved
X	X	1	1	0	X	X	X	Error
X	X	1	1	1	X	X	X	Not Available
Driver Recognize								
0	0	X	X	X	X	X	X	Vehicle Motion Not Detected
0	1	X	X	X	X	X	X	Vehicle Motion Detected
1	0	X	X	X	X	X	X	Error
1	1	X	X	X	X	X	X	Not Available

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10 Driver 1 States (D8: TCO1/DB2; FMS: TCO1/DB2)

Bit								Definition
7	6	5	4	3	2	1	0	
Driver 1 States								
X	X	X	X	0	0	0	0	No Time Related Warning Detected
X	X	X	X	0	0	0	1	Limit #1: 15 Minutes Before 4.5 Hours
X	X	X	X	0	0	1	0	Limit #2: 4.5 Hours Reached
X	X	X	X	0	0	1	1	Limit #3: 15 Minutes Before Optional Warning 1
X	X	X	X	0	1	0	0	Limit #4: Optional Warning 1 Reached
X	X	X	X	0	1	0	1	Limit #5: 15 Minutes Before Optional Warning 2
X	X	X	X	0	1	1	0	Limit #6: Optional Warning 2 Reached
X	X	X	X	0	1	1	1	Reserved
X	X	X	X	1	0	0	0	Reserved
X	X	X	X	1	0	0	1	Reserved
X	X	X	X	1	0	1	0	Reserved
X	X	X	X	1	0	1	1	Reserved
X	X	X	X	1	1	0	0	Reserved
X	X	X	X	1	1	0	1	Other
X	X	X	X	1	1	1	0	Error
X	X	X	X	1	1	1	1	Not Available
Driver Card, Driver 1								
X	X	0	0	X	X	X	X	Driver Card Not Present
X	X	0	1	X	X	X	X	Driver Card Present
X	X	1	0	X	X	X	X	Error
X	X	1	1	X	X	X	X	Not Available
Overspeed								
0	0	X	X	X	X	X	X	No Overspeed
0	1	X	X	X	X	X	X	Overspeed
1	0	X	X	X	X	X	X	Error
1	1	X	X	X	X	X	X	Not Available

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11 Driver 2 States (D8: TCO1/DB3; FMS: TCO1/DB3)

Bit								Definition
7	6	5	4	3	2	1	0	
Driver 2 States								
X	X	X	X	0	0	0	0	No Time Related Warning Detected
X	X	X	X	0	0	0	1	Limit #1: 15 Minutes Before 4.5 Hours
X	X	X	X	0	0	1	0	Limit #2: 4.5 Hours Reached
X	X	X	X	0	0	1	1	Limit #3: 15 Minutes Before Optional Warning 1
X	X	X	X	0	1	0	0	Limit #4: Optional Warning 1 Reached
X	X	X	X	0	1	0	1	Limit #5: 15 Minutes Before Optional Warning 2
X	X	X	X	0	1	1	0	Limit #6: Optional Warning 2 Reached
X	X	X	X	0	1	1	1	Reserved
X	X	X	X	1	0	0	0	Reserved
X	X	X	X	1	0	0	1	Reserved
X	X	X	X	1	0	1	0	Reserved
X	X	X	X	1	0	1	1	Reserved
X	X	X	X	1	1	0	0	Reserved
X	X	X	X	1	1	0	1	Other
X	X	X	X	1	1	1	0	Error
X	X	X	X	1	1	1	1	Not Available
Driver Card, Driver 2								
X	X	0	0	X	X	X	X	Driver Card Not Present
X	X	0	1	X	X	X	X	Driver Card Present
X	X	1	0	X	X	X	X	Error
X	X	1	1	X	X	X	X	Not Available
Not Defined								
0	0	X	X	X	X	X	X	Not Defined
0	1	X	X	X	X	X	X	Not Defined
1	0	X	X	X	X	X	X	Not Defined
1	1	X	X	X	X	X	X	Not Defined

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<table>
<tr><td>12</td><td>Tachograph Status (D8: TCO1/DB4; FMS: TCO1/DB4)
<table>
<tr><td colspan="8">Bit</td><td rowspan="2">Definition</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></tr>
<tr><td colspan="9">System Event</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>0</td><td>No Tachograph Event</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>Tachograph Event</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>0</td><td>Error</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>Not Available</td></tr>
<tr><td colspan="9">Handling Information</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>X</td><td>X</td><td>No Handling Information</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>0</td><td>1</td><td>X</td><td>X</td><td>Handling Information</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>X</td><td>X</td><td>Error</td></tr>
<tr><td>X</td><td>X</td><td>X</td><td>X</td><td>1</td><td>1</td><td>X</td><td>X</td><td>Not Available</td></tr>
<tr><td colspan="9">Tachograph Performance</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Normal Performance</td></tr>
<tr><td>X</td><td>X</td><td>0</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Performance Analysis</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Error</td></tr>
<tr><td>X</td><td>X</td><td>1</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Not Available</td></tr>
<tr><td colspan="9">Direction Indicator (Option)</td></tr>
<tr><td>0</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Forward</td></tr>
<tr><td>0</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Reverse</td></tr>
<tr><td>1</td><td>0</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Error</td></tr>
<tr><td>1</td><td>1</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>X</td><td>Not Available (MTCO 1234)</td></tr>
</table></td></tr>
<tr><td>13
14</td><td>Speed Authorized - infrastructure for Stoneridge only (otherwise sent as zero)</td></tr>
</table>

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15 Additional Information – High Byte (D8: Additional Information/High Byte)

Bit								Definition
7	6	5	4	3	2	1	0	
Mode of Operation								
X	X	X	X	X	0	0	0	Not Activated
X	X	X	X	X	0	0	1	Operational
X	X	X	X	X	0	1	0	Control
X	X	X	X	X	0	1	1	Calibration
X	X	X	X	X	1	0	0	Company
X	X	X	X	X	1	0	1	Error
X	X	X	X	X	1	1	0	Error
X	X	X	X	X	1	1	1	Not Available
All Other								
X	X	X	X	X	X	X	X	Not Defined

16 Additional Information – Low Byte (D8: Additional Information/Low Byte)

Bit								Definition
7	6	5	4	3	2	1	0	
D1								
X	X	X	X	X	X	0	0	D1 Input Logic 0
X	X	X	X	X	X	0	1	D1 Input Logic 1
X	X	X	X	X	X	1	0	Error
X	X	X	X	X	X	1	1	Not Available
D2								
X	X	X	X	0	1	X	X	D2 Input Logic 0
X	X	X	X	0	1	X	X	D2 Input Logic 1
X	X	X	X	1	1	X	X	Error
X	X	X	X	1	1	X	X	Not Available
Ignition								

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	X	X	0	0	X	X	X	X	Off
	X	X	0	1	X	X	X	X	On
	X	X	1	0	X	X	X	X	Error
	X	X	1	1	X	X	X	X	Not Available
	Drawer								
	0	0	X	X	X	X	X	X	Open
	0	1	X	X	X	X	X	X	Closed
	1	0	X	X	X	X	X	X	Error
	1	1	X	X	X	X	X	X	Not Available

2.7.34 *DTCO Periodic Event*

This message will be sent periodically, during Ignition On mode only, according to "Period of DTCO Update" parameter (address 245-246).

Except of the new module defined below, the message will include modules 6, 7, 8, 51.

Byte	Description
0	Module 54 – DTCO Periodic Event
1	Length of module – 17
2	
3	Spare
4	Source of System Parameters 1

Spare					Odometer Source 0 - Estimated by GPS 1 - CAN 2 - Frequency Counter 3 - DTCO 4-7 - Spare		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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<table>
<tr><td>5</td><td>Source of System Parameters 2
<table>
<tr><td colspan="2">D8 DTCO Connection Status
0 - Disconnected
1 - Connected</td><td colspan="3">Speed source
0 - GPS
1 - Freq. Counter
2 - CAN
3 - DTCO
4-7 - Spare</td><td colspan="2">RPM source
0 - Freq. Count
1 - CAN
2 - DTCO
3 - Spare</td><td colspan="2">Driver ID source
0 - 1-Wire bus
1 - COM port
2 - DTCO
3 - Spare</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>6</td><td rowspan="2">Tachograph Vehicle speed (D8: TCO1/DB5-DB6; FMS: TCO1/DB7-DB8; 0-250.996 km/h, 1/256 km/h/bit)</td></tr>
<tr><td>7</td></tr>
<tr><td>8</td><td rowspan="4">Vehicle Distance (Odometer) (D8: Vehicle Distance/DB1-DB4; 5m/bit)</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td><td rowspan="4">Trip Distance (D8: Vehicle Distance/DB5-DB8; 5m/bit)</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td><td rowspan="2">K-Factor (D8: K-Factor; 0.001 Pulse/m/bit)</td></tr>
<tr><td>17</td></tr>
<tr><td>18</td><td rowspan="2">Engine speed (D8: Engine Speed; 0.125 RPM/bit)</td></tr>
<tr><td>19</td></tr>
</table>

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3 Command Channel (Inbound Messages)

3.1 Overview

The command channel comprises seven types of messages, as described in the following:

- **Generic Command (Message Type 0)** – some commands are sent using this legacy message. This message is always replied with a legacy status/location message from the target unit (if the command is received successfully).
- **Programming Command (Message Type 1)** – this message provides OTA programming capabilities, and is always replied to with a programming data message from the target unit, when received correctly.
- **Generic Acknowledge Message (Message Type 4)** – this message is sent by the server to verify reception of outbound status/location, telemetry or transparent data messages.
- **Forward Data Command (Message Type 5)** – this message allows the sending of data to the terminal attached to the unit.
- **Modular Message Request (Message Type 9)** – this legacy modular 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, etc.
- **Self Re-flash Chunks (Message Type 10)** – this message 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.
- **Modular Message Request (Message Type 11)** – this modular message type implements an extended modular protocol, intended to replace older message types (0, 1, and 9). It is used to request the unit to send many types of data in a modular message packet, like CAN bus applications, CelloTrack Nano, etc.

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3.2 Generic Command (Message Type 0)

The generic command message is the main command interface to the unit.

3.2.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Command Numerator – 1 byte
  - Authentication Code – 4 bytes
- Command Code – 1 byte (repeated twice)
- 1st Command Data Field – 1 byte (repeated twice)
- 2nd Command Data Field – 1 byte (repeated twice)
- Command Specific Data Field – 4 bytes
- Error Detection Code – 1 byte

3.2.2 *Byte-Aligned Table*

Byte	Description
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 (0)
6	Unit ID
7	
8	
9	
10	Command Numerator
11	Authentication Code
12	
13	
14	

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15	Command Code
16	Command Code (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)

3.2.3 *Detailed Per-Field Specifications*

3.2.3.1 System Code

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

3.2.3.2 Message Type

Message type identifies the kind of the message. It allows the receiver to differentiate between different messages types, according to the value sent in this field.

Generic command messages contain a value of 0 (zero) in the message type field.

3.2.3.3 Unit ID

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

3.2.3.4 Command Numerator Field

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

3.2.3.5 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 FW 27p and up). For example: an attempt to change the traffic destination IP by unauthorized personnel.

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

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

The following are default values of the Authentication 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

3.2.3.6 Command Code

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

3.2.3.7 Command Data Fields (1st and 2nd)

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

3.2.3.8 Command Specific Data Field

The command specific data field contains additional information, which is needed by some of the commands.

The available commands and corresponding data fields are detailed below:

Command Code (Hex)	Description
0x00	Immediate status request
0x02	Unit state change Data field value: 0x00: Go to Standby 0x01: Go to Emergency mode

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Command Code (Hex)	Description
	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 NVM. 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 transmissions = 2 Time between distress transmissions 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. 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

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Command Code (Hex)	Description
	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 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.

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Command Code (Hex)	Description
	Command Specific Data field: don't care
0x06	Alarm Cadence Control command (supported only by Cello AR 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
0x0D	Erase tracking Log from NVM memory Data field: don't care
0x0E	Reset GPS receiver Data field: Zero for standard reset (by On/Off pin) 1st = 0x5A 2nd =0xA5 For Factory GPS reset command. Note, that the unit can (configurable) perform GPS reset automatically in the following cases: • Standard reset (by On/Off pin) on ignition off. • If the GPS is communicating, but not navigating and MODE1=0, MODE2=16 for 10 minutes the unit performs a factory GPS reset. • 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. • If same condition as in item 3 remains true for the next 15 minutes the unit performs a factory GPS reset.
0x0F	Lock /Unlock sequence detection learn (for Security units 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
0x10	Force GPS energizing (Not supported by Cello family) The command allows maintaining GPS activated, regardless of hibernation logic.

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<table>
<tr><th>Command Code (Hex)</th><th>Description</th></tr>
<tr><td></td><td>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 and up)
0 – Main server
1 – Secondary server (provisioning)
2 – Maintenance Server</td></tr>
<tr><td>0x14</td><td>Calibrate frequency counters
Data field 1 contains description of the calibration type:
<table>
<tr><td colspan="6">Reserved</td><td>Source type
0 – GP Freq. (RPM)
1 – Speed</td><td>Calibrated input
0 – pin 14
1 – pin 15</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>
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: don't care</td></tr>
<tr><td>0x15</td><td>Control of transparent mode over COM (independent from control by Door input (pin 14)).
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>
<tr><td>0x1B</td><td>PointerCept Control Command (Infrastructure)</td></tr>
</table>

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<table>
<tr><th>Command Code (Hex)</th><th>Description</th></tr>
<tr><td></td><td>Data field 1 contains action code: 0 - deactivate, 1- activate
Data field 2 contains activation time (in 10 minutes units): 1 to 255 minutes, 0 – illegal value</td></tr>
<tr><td>0x1C</td><td>Car Sharing 2: Call Central Control Command
This command will include index of the preprogrammed phone number, which will be used upon dial up.
1 - Will cause the unit to dial to number programmed in addresses 273
2 - Will cause the unit to dial to number programmed in addresses 167
<table><tr><td>17</td><td>Data Field 1 – Call Center Phone number index (1 or 2)</td></tr><tr><td>18</td><td>Data Field 1 (repetition) – Call Center Phone number index (1 or 2)</td></tr></table></td></tr>
<tr><td>0x1F</td><td>CAN-GPS Speed Calibration Command</td></tr>
<tr><td>0x2E</td><td>Car Sharing 2: Lock/Unlock Command
This command will include command code for vehicle door Lock/Unlock.
1 – Lock
2 – Unlock
<table><tr><td>17</td><td>Data Field 1: Command Code (1 – Lock, 2 – Unlock)</td></tr><tr><td>18</td><td>Data Field 1 (repetition): Command Code (1 – Lock, 2 – Unlock)</td></tr></table></td></tr>
</table>

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3.3 Programming Command (Message Type 1)

The programming command message allows to configure the unit.

NOTE: For configuration spaces larger than 4K (Typically in Cello-IQ and Cello-CANiQ units) it is mandatory to use Type 11 programming command (modules 10, 11).

3.3.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Command Numerator – 1 byte
  - Authentication Code – 4 bytes
- Block Code – 1 byte
- Programming Masking Bitmap – 2 bytes
- Block Data – 16 bytes
- Error Detection Code – 1 byte

3.3.2 *Byte-Aligned Table*

Byte	Description
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 (1)
6	Unit ID
7	
8	
9	
10	Command Numerator
11	Authentication Code
12	

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13	
14	
15	Block Code
16	Programming Masking Bitmap
17	<table><tr><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>7</td><td>6</td><td>5</td><td>4</td><td>3</td><td>2</td><td>1</td><td>0</td></tr><tr><td colspan="8">Byte 17</td><td colspan="8">Byte 16</td></tr></table>
18-33	Block Data
34	Error Detection Code (8-bit additive checksum, excluding system code)

3.3.3 *Detailed Per-Field Specifications*

3.3.3.1 System Code

Refer to Section 3.2.3.1

3.3.3.2 Message Type

Programming Command messages contain a value of 1 (one) in the message type field.

3.3.3.3 Unit ID

Refer to section 3.3.3.33.2.3.3

3.3.3.4 Command Numerator Field

Refer to section 3.2.3.4

3.3.3.5 Authentication Code

Refer to section 3.2.3.5

3.3.3.6 Block Code

OTA (over the air) parameter programming is done in blocks. The entire NVM 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).

3.3.3.7 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 value represents a byte in the parameters memory block. A value of "1" in a certain bit enables programming to the corresponding byte in the parameters memory, where a value of "0" prohibits programming of that byte.

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3.3.3.8 Block Data

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

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3.4 Generic Acknowledge Message (Message Type 4)

The generic acknowledge message is an inbound message sent by server to verify reception of outbound Status/Location (Type 0), Data Forwarding (Type 7, 8) and Modular (Type 9) messages.

3.4.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Command Numerator – 1 byte
  - Authentication Code – 4 bytes
- Action Code – 1 byte
- Main Acknowledge Number – 2 bytes (1 reserved)
- Secondary Acknowledge Number – 2 bytes (reserved)
- Compressed Date – 2 bytes
- Compressed Time – 2 bytes
- Spare – 2 bytes
- Error Detection Code – 1 byte

3.4.2 *Byte-Aligned Table*

Byte	Description
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 (4)
6	Unit ID
7	
8	
9	
10	Command Numerator
11	Authentication Code

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12	
13	
14	
15	Action Code (sent as zero)
16	Main Acknowledge Number – LSB
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	Compressed Date
22	
23	Compressed Time
24	
25	
26	Spare
27	
28	Error Detection Code (8-bit additive checksum, excluding system code)

Compressed Date

Day					Month				Year (-2000)						
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Byte 22								Byte 21							

Compressed Time

Spare (sent as 128)							Seconds						Minutes						Hours				
23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Byte 25							Byte 24						Byte 23										

3.4.3 *Detailed Per-Field Specifications*

3.4.3.1 System Code

Refer to Section 3.2.3.1

3.4.3.2 Message Type

Generic Acknowledge messages contain a value of 4 (four) in the message type field.

3.4.3.3 Unit ID

Refer to section 3.2.3.3

3.4.3.4 Command Numerator Field

Refer to section 3.2.3.4

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3.4.3.5 Authentication Code

Refer to section 3.2.3.5

3.4.3.6 Action Code

Sent as zero.

3.4.3.7 Main Acknowledge Number

This field contains the Message Numerator filed of the acknowledged outbound message.

3.4.3.8 Secondary Acknowledge Number

Currently not used and sent as zero.

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3.5 Forward Data Command (Message Type 5)

The unit can forward data from the OTA channel to its serial port.

3.5.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Command Numerator – 1 byte
  - Authentication Code – 4 bytes
- Settings Byte – 1 byte
- Data length – 1 byte + 2 bits of Settings Byte (the 2 bits extension is applicable only for transparent mode)
- Data to Forward – variable length (up to 255 bytes (in regular forwarding mode) or up to 518 bytes (in transparent mode))
- Error Detection Code – 1 byte

3.5.2 *Byte-Aligned Table*

Byte	Description
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 (5)
6	Unit ID
7	
8	
9	
10	Command Numerator
11	Authentication Code
12	
13	
14	

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<table>
<tr><td>15</td><td>Settings Byte
<table>
<tr><td colspan="3">Destination of Payload
0 – N/A
1 – N/A
2 – COM2 (BT)
3 – COM3
4 – COM4
5 – COM5
6 – CFE Micro
7 – N/A</td><td colspan="2">Reserved</td><td>Data Length Bit 9 (MSB)</td><td>Data Length (Bit 8)</td><td>Packet to Garmin (Garmin serial protocol)
0 – Not to Garmin
1 – To Garmin</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>Data Length</td></tr>
<tr><td>17</td><td>Data to Forward</td></tr>
</table>

3.5.3 *Detailed Per-Field Specifications*

3.5.3.1 System Code

Refer to Section 3.2.3.1

3.5.3.2 Message Type

Forward Data Command messages contain a value of 5 (five) in the message type field.

3.5.3.3 Unit ID

Refer to section 3.3.3.33.2.3.3

3.5.3.4 Command Numerator Field

Refer to section 3.2.3.4

3.5.3.5 Authentication Code

Refer to section 3.2.3.5

3.5.3.6 Settings Byte

This byte is used for different system indications.

Data Length Bits 8 and 9 extension will be used for transparent mode only.

In case CFE configuration is used, Destination of Payload will define the target CFE serial port.

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3.5.3.7 Data Length

This field should contain a number of bytes to forward: up to 255 bytes in regular forwarding mode, or 511 bytes in transparent mode.

3.5.3.8 Data to Forward

This is the data that is forwarded to the serial port. This field must be an exact number of bytes long, as specified in the Data Length field.

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3.6 Modular Message Request (Message Type 9)

The modular data packet request is designed to provide different data types in the same packet.

3.6.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Unit ID – 4 bytes
  - Command Numerator – 1 byte
- Authentication Code – 4 bytes
- Packet Control Field – 1 byte
- Message 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
- Nth Sub-Data Length – 1 byte
- Nth Sub-Data– variable length, depends on Data Type N
- Error Detection Code – 1 byte

3.6.2 *Byte-Aligned Table*

Byte	Description
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 ID (total 32 bits)
7	
8	

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9	
10	Command Numerator
11	Authentication Code
12	
13	
14	
15	Packet Control Field
16	Length (of the modules section - not including the checksum)
17	First Sub-data Type
18	First Sub-data Length
19	First Sub-data Data
…	…
	Nth Sub-data Type
	Nth Sub-data Length
	Nth Sub-data Data
Last Byte	Error Detection Code (8-bit additive checksum, excluding system code)

3.6.3 *Detailed Per-Field Specifications*

3.6.3.1 System Code

Refer to Section 3.2.3.1

3.6.3.2 Message Type

Modular message requests contain a value of 9 (nine) in the message type field.

3.6.3.3 Unit ID

Refer to Section 3.2.3.3

3.6.3.4 Command Numerator (Anti-Tango™)

Refer to Section 3.2.3.4

3.6.3.5 Authentication Code

Refer to Section 3.2.3.5

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3.6.3.6 Packet Control Field

Direction	Out of space indication	Unused					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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.

3.6.3.7 Length

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

3.6.4 *Inbound Sub-Data Types Table*

Code (Hex)	Function
0x01	Firmware Platform Manifest Request
0x04	Time and Location Stamp Request
0x06	PSP – DL messages to Alarm System
0x07	Usage Counter Request
0x08	Authentication Table Update Command
0x09	Cell ID Request
0x0B	Forward Data To Keyboard
0x12	Modular Platform Manifest Request
0x14	Pulse Counter Measurement Request
0x18	CFE Inputs Status Update Request
0x19	One-Wire Temperature Sensors Measurement Request
0x1A	Car Sharing 2 Reservation Command

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3.6.5 *Firmware Platform Manifest Request*

This sub-data serves as a Firmware Manifest Request. The unit responds to this sub-data with Firmware Platform Manifest sub-data (0x01).

Byte	Description
0	Sub-Data Type (0x01)
1	Length – 0

3.6.6 *Time and Location Stamp Request*

This sub-data serves as a Time and Location Stamp Request. The unit responds to this sub-data with Time and Location Stamp sub-data (0x04).

Byte	Description
0	Sub-Data Type (0x04)
1	Length – 0

3.6.7 *PSP – DL Messages 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 unit acknowledges, by a regular status message (Outbound message type 0 with bit 0 = '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.

Byte	Description
0	Sub-Data Type (0x06)
1	Length – Variable
…	Payload (data forwarded to car alarm system)

3.6.8 *Usage Counter Request*

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.

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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 are automatically updated on each RS232 and OTA "Counter's Set" command.

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Sub-Data Type (0x07)</td></tr>
<tr><td>1</td><td>Length – 9</td></tr>
<tr><td>2</td><td>Control Byte
<table>
<tr><td colspan="5">Spare</td><td>Enable Periodical Update
0 – Disable
1 – Enable</td><td colspan="2">Action Bits
0 – Read counters data
1 – Write counter 1
2 – Write counter 2
3 – Write counters 1 and 2</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>3</td><td>Update Period (Minutes, 0 – cancels periodic reports)</td></tr>
<tr><td>4</td><td>Spare</td></tr>
<tr><td>5</td><td rowspan="3">Counter 1 Value (Minutes)</td></tr>
<tr><td>6</td></tr>
<tr><td>7</td></tr>
</table>

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Byte	Description
8	Counter 2 Value (Minutes)
9	
10	

NOTE: If both Action bits are zero (request command) the Counter 1/2 Value fields are sent as zeros.

3.6.9 *Authentication Table Update Command*

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 NVM 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.

The default values of the Authentication Table (8 bytes, 16 nibbles) are as follows:

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

Note: The values in the authentication table must be different.

This sub-data is sent to the unit in order to access an Authentication Table values OTA (read, write or modify).

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Sub-Data Type (0x08)</td></tr>
<tr><td>1</td><td>Length – 10</td></tr>
<tr><td>2</td><td>Action Byte
<table>
<tr><td colspan="6">Spare</td><td colspan="2">Read/Write
0 - Read Authentication table from NVM
1 – Write Authentication table to NVM</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>3</td><td>Spare</td></tr>
<tr><td>4</td><td>Authentication table Index 0</td><td>Authentication table Index 1</td></tr>
<tr><td>5</td><td>Authentication table Index 2</td><td>Authentication table Index 3</td></tr>
<tr><td>6</td><td>Authentication table Index 4</td><td>Authentication table Index 5</td></tr>
<tr><td>7</td><td>Authentication table Index 6</td><td>Authentication table Index 7</td></tr>
<tr><td>8</td><td>Authentication table Index 8</td><td>Authentication table Index 9</td></tr>
<tr><td>9</td><td>Authentication table Index 10</td><td>Authentication table Index 11</td></tr>
<tr><td>10</td><td>Authentication table Index 12</td><td>Authentication table Index 13</td></tr>
<tr><td>11</td><td>Authentication table Index 14</td><td>Authentication table Index 15</td></tr>
</table>

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

3.6.10 *Cell ID Request*

This sub-data causes the unit to generate a Type-9 outbound message, containing the last known Cell ID related information (updated every 60 seconds). The generated message will vary according to unit Modem: 2G – sub-data 0x09, 3G – 0x0C, CDMA – 0x1C, 4G – 0x1D.

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Byte	Description
0	Sub-Data Type (0x09)
1	Length – 2
2	Cell ID Request (0x09)
3	Spare

3.6.11 *Forward Data to Keyboard*

This sub-data is forwarded to SPC Keyboard (refer to 1-Wire Interface Protocol).

Byte	Description
0	Sub-Data Type (0x0B)
1	Length – Variable (If this field is 0, the unit will respond by Keyboard ID)
2	Length of data to be forwarded
3	Length of expected reply from the Keyboard to be forwarded back
4	Command Type 0x80 – Reset Keyboard (1 data byte) 0x33 – Keyboard ID Request (no data bytes) 0x81 – Feedback to Driver (3 data bytes) 0x82 – Set Operational State (2 data bytes) 0x83 – Time Update (4 data bytes) 0x85 – Access Code Programming (3 data bytes) 0x87 – System Code (Multicode) Programming (3 data bytes) 0x89 – Status Request (1 data byte) 0x8A – Code Request (2 data bytes) 0x8C – Driver Code Control Command (4 data bytes)
…	Command Data (variable length)

3.6.12 *Modular Platform Manifest Request*

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 the 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
0	Sub-Data Type (0x12)
1	Length – 6
2	Bit Map 0

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

3	Bit Map 1

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

4	Bit Map 2

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Originating FW ID	IMSI/IMEI/MEID	Cello-CANiQ VIN (Vehicle ID)	DFD/SD card version	Boot loader ID	System ID (STM ID in case of STM controller)	Firmware name (string)	Last Configuration Change Date/Time

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Byte	Description
5	Bit Map 3 Maintenance Configuration | Modem Firmware Sub Version | PIN#8 HW Selected Function | SIM ICCID | BT Extender Identification | Size of internal non-volatile memory request | Version Information | Nano sensors Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0
6	Bit Map 4 Reserved | Reserved | Reserved | Reserved | Reserved | Battery Fuel Gauge Identification | Silicon Labs 4632 receiver version | BT version number Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0
7	Bit Map 5 Reserved | Reserved | Reserved | Reserved | Reserved | Reserved | Reserved | Reserved Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0

Note: Reserved bits will be sent as 0.

3.6.13 *Pulse Counter Measurement Request*

Pulse counter measurement request is mainly used for fuel consumption measurement. The measurement is taken from the last time the counter was reset.

Byte	Description
0	Sub-Data Type (0x14)
1	Length – 2
2	Spare

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Byte	Description
3	Spare

3.6.14 *CFE Inputs Status Update Request*

This message is sent by the server towards the unit for requesting CFE analog inputs measurements results.

Byte	Description
0	Sub-Data Type (0x18)
1	Length – 2
2	Spare
3	Spare

3.6.15 *One-Wire Temperature Sensor Measurement Request*

This message is sent by the server towards the unit for requesting One-Wire temperature sensor measurement results.

Byte	Description
0	Sub-Data Type (0x19)
1	Length – 2
2	Spare
3	Spare

3.6.16 *Car Sharing 2 Reservation Command*

This message will be sent by the server towards the unit for updating selected entry in the unit reservation table. The Reservation Command can write or read one entry in the unit reservation table. The action byte (Byte 19) selects the command code and the unit reservation entry slot.

Byte	Description
0	Sub-Data Type (0x1A)

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>1</td><td>Length – 18</td></tr>
<tr><td>2</td><td>Action Byte
<table>
<tr><td>Slot Number bit 6</td><td>Read/Write
0 – read
1 – write</td><td colspan="6">Slot Number bits 0-5</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>3</td><td>Spare</td></tr>
<tr><td>4–9</td><td>Driver ID (SCN)
Bytes 0-5 of reservation table entry</td></tr>
<tr><td>10-13</td><td>Reservation Start time/date
Bytes 6-9 of reservation table entry
(Number of Seconds from December 31, 1989, 12 am UTC.)</td></tr>
<tr><td>14-19</td><td>Spare (sent as 0)
Bytes 10-15 of reservation table entry</td></tr>
</table>

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3.7 Modular Message Request (Message Type 11)

Type 11 was introduced for supporting true modular protocol. The basic structure of the protocol is designed to carry records with predefined structure called modules. The protocol will be used as an extension for Cello fleet protocol. Type 11 supports theoretical message length of up to 65536 bytes, tough the actual rate will be constrained by the HW limitations.

3.7.1 *Message Ingredients*

- Message header
  - System Code – 4 bytes
  - Message Type – 1 byte
  - Destination Unit ID – 4 bytes
  - Command Numerator – 1 byte
- Authentication Code – 4 bytes
- Packet Control Field – Legacy fleet field
- Message length – 2 bytes
- spare – 4 bytes
- Payload Modules – User Configuration Depended
- Error Detection Code – 1 byte

3.7.2 *Byte-Aligned Table*

Byte	Description
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 (11)
6	Unit ID
7	
8	
9	
10	Command Numerator (When transmitting ACK/NACK packet, it carries the numerator of the original message)

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11	Authentication Code
12	
13	
14	
15	Packet Control Field
16	Length (of the modules section - not including the checksum). Must be ≠ 0 (to symbolize inbound message), meaning that there should not be a message without any modules.
17	
18	Spare (sent as 0)
19	
20	
21	
22	Modules
…	…
…	…
Last Byte	Error Detection Code (8-bit additive checksum, excluding system code)

3.7.3 *Detailed Per-Field Specifications*

3.7.3.1 System Code

Refer to Section 3.2.3.1

3.7.3.2 Message Type

Modular message requests contain a value of 11 (eleven) in the message type field.

3.7.3.3 Unit ID

Refer to Section 3.2.3.3

3.7.3.4 Command Numerator (Anti-Tango™)

Refer to Section 3.2.3.4

3.7.3.5 Authentication Code

Refer to Section 3.2.3.5

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3.7.3.6 Packet Control Field

Direction	Out of space indication	Unused					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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.

3.7.3.7 Length

That field includes the number of data bytes of the modules (with their codes and lengths). It is the number of bytes from byte 18 to the byte of the checksum, which is not included.

3.7.4 *Inbound Type 11 Module Structure*

The general structure of a type 11 module is as follows:

Byte	Description
0	Module Code
1	Length of module (16 bits) – Number of payload bytes
2	
3	Module Payload bytes
.	
.	
n	

3.7.5 *Inbound Type 11 Modules Table*

Code	Description
9	ACK (from server)
10	Configuration Memory Write
11	Configuration Memory Block Request
13	Authenticated Features Command

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Code	Description
21	VIN String Write
22	VIN String Read Request
29	General Module Query
32	General Command
35	Forwarded CAN Query

3.7.6 *ACK/NACK*

Byte	Description
0	Module 9 – ACK/NACK
1	Length of module – 3
2	
3	0 - ACK
4	Spare
5	Spare

3.7.7 *Configuration Memory Write*

Byte	Description	
0	Module 10 - Configuration Memory Write	
1	Length of module – Variable	
2		
3	Numerator	
4		
5	Number of instances	
6	Memory type – 0	
7	Memory entry unit type 0 – Bit 1 – Byte 2 – Word (16 bits) 3 – Double Word (32 bits)	Instance 1

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	(Only Byte entry unit type is currently supported)	
8	Address in the configuration memory space	
9		
10		
11		
12	Number of Entries	
13		
…	Data payload (according to the entry size and the number of entries defined above)	
…	…	Instance 2
…	…	
…	…	

3.7.8 *Configuration Memory Read Request*

Byte	Description	
0	Module 11 - Configuration Memory Read Request	
1	Length of module – Variable	
2		
3	Numerator	
4		
5	Number of instances	
6	Memory type – 0	
7	Memory entry unit type 0 – Bit 1 – Byte 2 – Word (16 bits) 3 – Double Word (32 bits) (Only Byte entry unit type is currently supported)	Instance 1
8	Address in the configuration memory space	
9		

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10		
11		
12	Number of Entries	
13		
…	…	Instance 2
…	…	
…	…	

3.7.9 *Authenticated Features Command*

This module enables query/activation/de-activation of features in the unit. It contains the desired features codes.

On query command, there will be no feature codes.

On activation/de-activation command the unit will reply with ACK/NACK (module 9), while on query command the unit will reply with Authenticated Features Query Response (module 13).

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Module 13 – Authenticated Features Command</td></tr>
<tr><td>1</td><td>Length of module – Variable</td></tr>
<tr><td>2</td><td></td></tr>
<tr><td>3</td><td>Control Byte
<table>
<tr><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td>Spare</td><td colspan="2">Command Code
0 - Query
1 - Activation
2 - De-Activation</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>4</td><td>Spare</td></tr>
<tr><td>5</td><td>Number of Feature Codes
(0 for query command, 1-8 for activation/de-activation)</td></tr>
<tr><td>6</td><td>C[0]</td><td rowspan="3">Feature Code 1</td></tr>
<tr><td>7</td><td>C[1]</td></tr>
<tr><td>8</td><td>C[2]</td></tr>
</table>

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9	C[3]	
10	Spare	
11	Spare	
12	Spare	
13	Spare	
14	Spare	
15	Spare	
16	C[0]	Feature Code 2
17	C[1]	
18	C[2]	
19	C[3]	
20	Spare	
21	Spare	
22	Spare	
23	Spare	
24	Spare	
25	Spare	
…	…	
…	C[0]	Feature Code n
	C[1]	
	C[2]	
	C[3]	
	Spare	
	Spare	
	Spare	
	Spare	
	Spare	
	Spare	

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3.7.10 *VIN String Write*

Byte	Description
0	Module 21 – VIN String Write
1	Length of module – 17
2	
3	VIN – Byte 0
4	VIN – Byte 1
…	…
…	…
19	VIN – Byte 16

3.7.11 *VIN String Read Request*

Byte	Description
0	Module 22 – VIN String Read Request
1	Length of module – 4
2	
3	Spare
4	Spare
5	Spare
6	Spare

3.7.12 *General Module Query*

This command will be sent by the server to request a set of outbound modules to be returned to the server. The module describes a list of module IDs. The addressed unit will respond with a type 11 message carrying the requested modules content arranged in the same order of the request.

Byte	Description
0	Module 29 – General Module Query
1	Length of module – Variable
2	

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3	Number of requested Modules
4	First requested module ID
5	Second requested module ID
…	…

3.7.13 *General Command*

This module enables the server to command the unit to perform multiple actions while specifying the action code and optional data bytes attached to the command. The general format of the module is shown below. The unit will send Acknowledge (outbound type 11 module 9) upon receiving this module.

Byte	Description	
0	Module 32 – General Command	
1	Length of module – Variable	
2		
3	Number of Command entries	
4	Command ID	Command Entry 1
5		
…	Command data bytes	
…	Command ID	Command Entry 2
…		
…	Command data bytes	
…	…	

Commands Types Description:

Command ID	Description	Number of Attached data bytes	Expected unit response
0	Reset CAN OTA events Queue pointers	0	One ACK for all the command request
1	Reset Unit	0	One ACK for all the command request
259	Nano/Cello with BT Extender: send status	1	Status of the designated source

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	of the designated source		

3.7.14 *Forwarded CAN Query*

This module enables the server to command the unit to forward CAN query to CAN bus (in both J1939 and OBD II modes). The unit will send Acknowledge upon receiving the module.

Byte	Description
0	Module 35 – Forwarded CAN Query
1	Length of module – 15
2	
3	Spare
4	Number of repetitions 0 – means that the query will only be forwarded once 1 – means it will be repeated after 100ms 2 – means it will be repeated 2 times with 100ms between each repetition and so on)
5	Control Byte (LSB - Header Format) 0 – Automatic 1 – 11bit 2 – 29 bit
6	Arbitration ID
7	Arbitration ID
8	Arbitration ID
9	Arbitration ID
10	Number of additional data bytes
11	Mode (SID)
12	PID Byte 1
13	PID Byte 2
14	User defined
15	User defined
16	User defined

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17	User defined

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4 CSA OTA Protocol

4.1 Overview

CSA (Cellocator Safety Application) is a dedicated FW application (running independently of the legacy fleet application), intended to identify driver maneuvers, and to analyze, score, and report the driver behavior.

4.1.1 *CSA (IQ) Features Set*

The CSA application (also commercially referred as "IQ") has some features set. The full CSA features set is called IQ50, while the reduced features set is called IQ40. The following table describes the differences between IQ40 and IQ50:

Feature	Sub-Feature	Features Set	
		IQ40 (Reduced)	IQ50 (Full)
Simple Maneuvers	Speeding	√ (no raw data)	√
	Harsh Acceleration	√ (no raw data)	√
	Harsh Braking	√ (no raw data)	√
	Harsh Turn	√ (no raw data)	√
Complex Maneuvers	Turn & Acceleration	–	√
	Turn & Brake	–	√
	Off Road	–	√
	Excessive RPM	–	√
	Slalom	–	√
	Crash	√ (GPS profile only)	√
E-Call		√	√
EDR		–	√

4.1.2 *CSA Message Types*

The CSA is communicating with a dedicated safety server. As such, this application implements a dedicated CSA protocol. The protocol defines some interactions. Each interaction is a process, containing at least two messages (the message itself and its ACK).

Any active CSA message to the server (generated by the unit logic and not as a response to a request or command) requires an ACK.

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Any command or request sent from the server to CSA will be replied by a message containing a different set of modules, depending on the command. Such a CSA response does not require an ACK from the server.

The CSA protocol comprises five types of messages (and FTP/TFTP files), as described in the following:

- **CSA Event (Outbound, Message Type 0)**

  This message is sent by CSA to notify the safety server about certain events such as speeding, idling, dangerous maneuvers or accident buffer overflow.

  CSA Event requires CSA ACK (Type 1) from the server in order to be deleted from the buffer. If the ACK is not received, the event is resent after the configured timeout (30 seconds by default).

  Self-initiated CSA event contains at least CSA Full Event (module 30), but other modules (such as PLMN) may also be auto-attached to it according to configuration.

  CSA Event generated as a reply to a command contains at least Event ID (module 0), but can contain as many modules as requested in a command. Obviously in such case no ACK is required.

- **CSA ACK (Inbound, Message Type 1)**

  This message is sent by the safety server to verify reception of CSA Event (Type 0) with any event reason except 14 (reply to command). This message contains only module 9 (ACK/NACK).

  The numerator of this message contains the repetition of the numerator from the CSA Event (Type 0) message.

- **CSA Programming Command (Inbound, Message Type 2)**

  This message provides OTA programming capabilities, and is always replied with a CSA Programming Data message (Type 3) from the target unit, when received correctly. It is not accessible through the plain programming API.

  The CSA programming parameters memory is part of a Cello unit programming parameters memory and practically hosted on certain addresses assigned for CSA. The CSA manages an address conversion (offset) and the server treats the first address of the CSA programming parameters memory as zero.

  Normally this command will contain single Programming Command (module 10).

- **CSA Programming Data (Outbound, Message Type 3)**

  This message is sent as a reply to CSA Programming command (Type 2), or by request. It contains the new contents of the programmed block, which allows verification of the programming. It is not accessible through the plain programming API. Normally it will contain only Programming Response (module 11). In case of Programming Command (module 10) in a request was accompanied by Status Request (module 12), this reply will also contain modules requested in Status Request module.

- **CSA Command (Inbound, Message Type 4)**

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This interaction is initiated by the safety server when immediate action is required (interaction with LED monitor, raw upload initiation, eco and score request, etc.). It will contain the module of one command. In most cases only one command can be sent in a single message, although there are a few exceptions allowing requesting few modules in a single reply.

CSA Command will always cause the CSA to reply by CSA Event (Type 0). This reply will contain at least Full CSA Event (Module 30), but can also be accompanied by other modules, e.g. if Status Request (Module 12) is attached to the command.

The unit can provide 2 levels of reply to the command (as per configuration):

- Upon reception, before performance: The unit will deliver Event ID (module 0), containing zero in the CSA event numerator field and repeating 16 bits message numerator of the command in the corresponding message field (bytes 6-7).
- Upon execution: The unit will deliver Event ID (module 0), repeating the command numerator in the CSA event numerator field and repeating 16 bits message numerator of the command in the corresponding message field (bytes 6-7).

- **FTP/TFTP Files**

  The unit can also generate safety related data files that are sent via FTP/TFTP to the safety server. The safety information includes trip and maneuver raw data and statistics, and EDR crash files. Raw data files are compressed for cost effective transmission and server side storage optimizations.

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4.2 General CSA Message Structure

The CSA protocol implements modular message, containing at least one module out of a predefined list of modules, encapsulated into a generic protocol frame.

4.2.1 *Message Ingredients*

- Message header
  - System Code – 3 bytes
  - Message Length – 2 bytes
  - Message Numerator – 2 bytes
  - Packet Control Field – 1 byte
  - Unit ID – 4 bytes
- Payload Modules
- Error Detection Code – 1 byte

4.2.2 *Byte-Aligned Table*

Byte	Description
1	System Code, byte 1 – ASCII "C"
2	System Code, byte 2 – ASCII "S"
3	System Code, byte 3 – ASCII "A"
4	Message Length
5	
6	Message Numerator
7	
8	Packet Control Field
9	Unit ID
10	
11	
12	
13-…	First Module
…	Other Modules (Optional)
Last Byte	Error Detection Code (8-bit additive checksum, excluding system code)

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4.2.3 *Detailed Per-Field Specifications*

4.2.3.1 System Code

System code is a 3-byte value, which identifies the Cellocator system. The field is sent as the ASCII values of the letters "C", "S", "A", in that order.

4.2.3.2 Message Length

The length of the message (in bytes), not including System Code, Message Length, and Error Detection Code.

4.2.3.3 Message Numerator

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

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.

4.2.3.4 Packet Control Field

Initiator	Direction	CSA Protocol Version (1)			Message Type		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Message Type

Indicates the message type (0-4)

CSA Protocol Version

Indicates the CSA protocol version ID. Always set to 1.

Direction

0 – Inbound

1 – Outbound

Initiator

0 – Reply or ACK

1 – Unit initiated

4.2.3.5 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 unit contain the same value in the Unit ID field.

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4.2.4 *CSA Modules Table*

Code	Description	Inbound	Outbound	Appears in message types	Support of concatenation in reply
0	Event ID		√	0	
1	Driver ID		√	0	√
2	Trip ID		√	0	√
3	Maneuver ID		√	0	√
4	PLMN		√	0, 3	√
5	Memory Usage Status		√	0	√
6	GPS Stamp		√	0	√
7	Time Stamp		√	0, 3	√
8	CSA FW ID		√	0	√
9	ACK	√		1	
10	Programming Command	√		2	
11	Programming Response		√	3	
12	Status Request	√		4	
13	Driver Feedback Device Control	√		4	
15	Request Maneuver/Trip Statistics	√		4	
16	Request Maneuver Raw + Statistics	√		4	
17	Request Accident Raw	√		4	
18	Erase Unsent CSA Events	√		4	
19	Erase Accident Data	√		4	

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Code	Description	Inbound	Outbound	Appears in message types	Support of concatenation in reply
20	Calibration/Off Road Ready Mode Command	√		4	
21	Raw logger Mode Command	√		4	
22	Response to Raw Data Control Command		√	0	
30	CSA Full Event		√	0	
31	ABC Maneuver Statistics		√	0	
32	Trip Statistics		√	0	
33	RPM		√	0	√
35	EDR Crash Attributes		√	0	
36	VIN		√	0	
37	Calibration/Off Road Status		√	0	
42	Calibration Matrix Set/Read Command	√		2	
43	Calibration Matrix Response		√	3	
48	Reserved for Manufacturer Use		√	0	
52	Off Road Setup Data Set/Read Command	√		2	
53	Off Road Setup Data Response		√	3	
54	Real Time Raw Accelerometer Data Control Command	√		4	

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Code	Description	Inbound	Outbound	Appears in message types	Support of concatenation in reply
55	Real Time Raw Accelerometer Data		√	0	
56	Restore Default Vehicle Preset	√	√	2, 3	
57	Vehicle Preset Configuration Command	√	√	2, 3	
58	Over Speed Maneuver Statistics		√	0	
59	RPM Continuous Maneuver Statistics		√	0	
60	Idling Continuous Maneuver Statistics		√	0	
61	Off Road Continuous Maneuver Statistics		√	0	
62	General CSA Control Command	√		4	
63	Crash Maneuver Statistics		√	0	

4.2.5 *Event ID*

Byte	Description
0	Module 0 – Event ID
1	Length of module – 6
2	CSA Event Reason (see detailed table below)
3	CSA Event Sub Reason (see detailed table below)
4	CSA Event Numerator (0 in case of reply)

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5	
6	Operational Mode
7	Spare

CSA Event Reason/Sub Reason table:

CSA Event Reason	CSA Event Sub Reason and Description	
0 Reserved		
1 IP Up		
2 Crash (CSA event with this reason will be accompanied by module 35 (Crash attributes) and module 36 (VIN) Or, in case of crash maneuver support, module 63 (Crash maneuver) and module 36 (VIN)	0	EDR Light
	1	EDR Heavy
	2	Maneuver Light
	3	Maneuver Heavy
	128	EDR Light While parking
	129	EDR Heavy While parking
3 Crash Data Ready to Upload		
4 Maneuver Memory Overflow		

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<table>
<tr><th>CSA Event Reason</th><th colspan="2">CSA Event Sub Reason and Description</th></tr>
<tr><td>5
Calibration</td><td colspan="2">
<table>
<tr><td>Phase Number
0 – Phase 1
1 – Phase 2</td><td colspan="5">Step Number (1-10)</td><td>Calibration Status
0 – Calibration Started
1 – Calibration OK (will be escorted by module 43 (Calibration Matrix Response))
2 – Bad Installation
3 – Calibration in Progress
4 – Calibration Error</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 rowspan="4">6
Harsh Acceleration
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Green severity</td></tr>
<tr><td>2</td><td>Yellow severity</td></tr>
<tr><td>3</td><td>Red severity</td></tr>
<tr><td rowspan="4">7
Harsh Braking
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Green severity</td></tr>
<tr><td>2</td><td>Yellow severity</td></tr>
<tr><td>3</td><td>Red severity</td></tr>
<tr><td rowspan="4">8
Harsh Turn
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Green severity</td></tr>
<tr><td>2</td><td>Yellow severity</td></tr>
<tr><td>3</td><td>Red severity</td></tr>
<tr><td>9</td><td colspan="2"></td></tr>
</table>

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<table>
<tr><th>CSA Event Reason</th><th colspan="3">CSA Event Sub Reason and Description</th></tr>
<tr><td>Speeding
(Speeding maneuvers are sent when certain thresholds are crossed. On every speeding the Green is sent upon speeding detection (when getting inside speeding maneuver), then maybe yellow and red (one for each, at most). At the end of the maneuver the "speeding end" event is sent. Note the events are sent without any statistics.)</td><td colspan="3">
<table>
<tr><td>Maneuver Status
0 – During Maneuver
1 – End of Maneuver</td><td colspan="5">Spare</td><td colspan="2">Event Type
0 –Speeding End
1 – Speeding Green (Normal)
2 – Speeding Yellow (Moderate)
3 – Speeding Red (Dangerous)</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 rowspan="4">10
Lane Crossing
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td colspan="2">Reserved</td></tr>
<tr><td>1</td><td colspan="2">Green severity</td></tr>
<tr><td>2</td><td colspan="2">Yellow severity</td></tr>
<tr><td>3</td><td colspan="2">Red severity</td></tr>
<tr><td rowspan="4">11
Off Road
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td colspan="2">Off Road Start</td></tr>
<tr><td>1</td><td colspan="2">Reserved</td></tr>
<tr><td>2</td><td colspan="2">Reserved</td></tr>
<tr><td>3</td><td colspan="2">Off Road Start</td></tr>
<tr><td rowspan="4">12
Excessive RPM</td><td>0</td><td colspan="2">Low RPM</td></tr>
<tr><td>1</td><td colspan="2">High RPM</td></tr>
<tr><td>2</td><td colspan="2">Excessive RPM</td></tr>
<tr><td>3</td><td colspan="2">Back to Normal</td></tr>
</table>

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<table>
<tr><th>CSA Event Reason</th><th colspan="2">CSA Event Sub Reason and Description</th></tr>
<tr><td rowspan="3">13
Idling</td><td>0</td><td>Short Idling start</td></tr>
<tr><td>1</td><td>Long Idling start</td></tr>
<tr><td>2</td><td>Idling End</td></tr>
<tr><td>14
Reply to Command</td><td></td><td></td></tr>
<tr><td rowspan="4">15
Turn & Brake
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Green severity</td></tr>
<tr><td>2</td><td>Yellow severity</td></tr>
<tr><td>3</td><td>Red severity</td></tr>
<tr><td rowspan="4">16
Turn & Accelerate
(Requires Calibration, will not be generated prior to accomplishment of calibration procedure)</td><td>0</td><td>Reserved</td></tr>
<tr><td>1</td><td>Green severity</td></tr>
<tr><td>2</td><td>Yellow severity</td></tr>
<tr><td>3</td><td>Red severity</td></tr>
<tr><td>17
File Upload</td><td colspan="2">
<table>
<tr><td colspan="4">Uploaded File Type
0 – Reserved
1 – Maneuver File
2 – Trip File
3 – Crash File
4 – Recorder File (Infrastructure)</td><td colspan="4">Upload Status
0 – Successfully Uploaded & Erased
1 – Successfully Uploaded & Kept in Memory
2 – Failure – No File to Upload</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>
</table>

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<table>
<tr><th>CSA Event Reason</th><th>CSA Event Sub Reason and Description</th></tr>
<tr><td>18
Ignition status</td><td>
<table>
<tr><td colspan="4">Ignition On/Off
0 – Ignition Off
1 – Ignition On</td><td colspan="4">Ignition Detection Source
0 – Physical Ignition Input
1 – Accelerometer (Ignition)
2 – Accelerometer (Movement)
3 – Accelerometer + Voltage</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>19
Go/Halt Event</td><td>
<table>
<tr><td colspan="4">Halt/Go
0 – Halt
1 – Go</td><td colspan="4">Event Detection Source
0 – GPS
1 – Speed from Vss
2 – Accelerometer (Movement)
3 – Speed from CAN</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>20
Driver ID Update</td><td></td></tr>
</table>

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<table>
<tr><th>CSA Event Reason</th><th>CSA Event Sub Reason and Description</th></tr>
<tr><td>24
Trip Start/Stop</td><td>
<table>
<tr><td colspan="2">Spare</td><td colspan="5">Event Detection Source
0 – Ignition
1 – Accelerometer
2 – Accelerometer Movement
3 – Accelerometer Movement + Voltage
4 – Dallas
5 – GPIO (Door)
6 – GPIO (Ignition)
7 – GPIO (Distress)
8 – GPIO (Line A)
9 – GPIO (Line B)
10 – GPIO (Line C)
11 – Reset
12 – Re-flashing</td><td>Trip Start/Stop
0 – Stop
1 – Start</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>25
Speeding – GPS Recording
(This maneuver type will never be transmitted as a CSA event; It's used as a Maneuver Type in raw GPS record only if corresponding bit in the PL is enabled)</td><td></td></tr>
</table>

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<table>
<tr><th>CSA Event Reason</th><th>CSA Event Sub Reason and Description</th></tr>
<tr><td>26
Off Road Setup Process</td><td>
<table>
<tr><td>Off Road Setup Process Level
0 – 100 GPS Samples
1 – 1000 GPS Samples</td><td colspan="5">Off Road Setup Process Speed Range (Infrastructure – sent as 0)</td><td colspan="2">Off Road Setup Process Status
0 – Off Road Setup Process Started
1 – Off Road Setup Process OK
2 – Off Road Setup Process Failed
3 – Off Road Setup in Process</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>27
DFD Communication Status Change</td><td>0 – DFD Communication Lost
1 – DFD Communication Established</td></tr>
</table>

4.2.6 *Driver ID*

Byte	Description
0	Module 1 – Driver ID
1	Length of module – 6
2	Driver ID
3	
4	
5	
6	
7	

4.2.7 *Trip ID*

Byte	Description

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0	Module 2 – Trip ID
1	Length of module – 3
2	Trip ID (This field will be set to 0 on "Ignition On" and "IP Up" events)
3	
4	

4.2.8 *Maneuver ID*

Byte	Description
0	Module 3 – Maneuver ID
1	Length of module – 3
2	Maneuver ID (This field will be set to 0 on "Ignition On" and "IP Up" events)
3	
4	

4.2.9 *PLMN*

Byte	Description
0	Module 4 – PLMN
1	Length of module – 3
2	Operational PLMN (upon delivery)
3	
4	

4.2.10 *Memory Usage Status*

Byte	Description
0	Module 5 – Memory Usage Status
1	Length of module – 3
2	Maneuvers Data Usage [%]

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<table>
<tr><td>3</td><td>Accident Buffer Status Bitmask
<table>
<tr><td colspan="4">2nd Crash</td><td colspan="4">1st Crash</td></tr>
<tr><td colspan="3">Spare</td><td>0 – Empty
1 – Occupied</td><td colspan="3">Spare</td><td>0 – Empty
1 – Occupied</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>4</td><td>Spare</td></tr>
</table>

4.2.11 *GPS Stamp*

Byte	Description
0	Module 6 – GPS Stamp
1	Length of module – 19
2	HDOP
3	Mode 1 (from GPS)
4	Mode 2 (from GPS)
5	Number of Satellites Used (from GPS)
6	Longitude
7	
8	
9	
10	Latitude
11	
12	
13	
14	Altitude
15	
16	
17	
18	Ground Speed [km/h]
19	Speed Direction [degrees]

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20	

4.2.12 *Time Stamp*

Byte	Description
0	Module 7 – Time Stamp
1	Length of module – 7
2	Validity of Time (0 – Invalid, 1 – Valid)
3	System Time – Seconds
4	System Time – Minutes
5	System Time – Hours
6	System Date – Day
7	System Date – Month
8	System Date – Year (-2000)

4.2.13 *CSA FW ID*

Byte	Description
0	Module 8 – CSA FW ID
1	Length of module – 11
2	Features Set (0 – IQ50, 1 – IQ40)
3	CSA Protocol ID
4	Production ID (LSB)
5	Production ID (MSB)
6	FW Version ID (example: 33)
7	FW Sub-Version ID (example: 1 for a)
8	Spare
9	Spare
10	Spare
11	Spare
12	Spare

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4.2.14 *ACK*

Byte	Description
0	Module 9 – ACK
1	Length of module – 3
2	ACK to Message Type (currently only 0)
3	Spare
4	Spare

4.2.15 *Programming Command*

Byte	Description
0	Module 10 – Programming Command
1	Length of module – Variable
2	Programming Command Numerator
3	
4	Action Byte 0 – Read Command 1 – Write Command 2 – Lock Command (currently not in use) 3 – Unlock Command (currently not in use)
5	First Address
6	
7	
8	Data Length
…	Data (in case of Read command – single byte of 0)

4.2.16 *Programming Response*

Byte	Description
0	Module 11 – Programming Response
1	Length of module – Variable
2	Reply to Programming Command Numerator

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3	
4	Status Byte Status: 0 – Success, 1 – Failure | Failure ID Bit 7 | Bit 6 | Bit 5 | Bit 4 | Bit 3 | Bit 2 | Bit 1 | Bit 0
5	Spare
6	First Address
7	
8	
9	Data Length (only in case of reply to Read command)
…	Data (only in case of reply to Read command)

4.2.17 *Status Request*

A command with this module will cause the unit to generate a message containing the modules requested in the module.

Byte	Description
0	Module 12 – Status Request
1	Length of module – Variable
2	Number of Requested Modules (up to 10)
3	1st Requested Module
4	2nd Requested Module
…	…

4.2.18 *Driver Feedback Device Control*

This command enables the sending of signaling to the driver from Central control (Infrastructure only, currently not supported).

Byte	Description
0	Module 13 – Driver Feedback Device Control
1	Length of module – 4

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2	LED Activation Strength (1-6, 0 – Deactivate)
3	LED Activation Pattern (0-255)
4	Buzzer Activation Pattern (0-255)
5	Option Byte 0 – Automatic Management 1 – Manual Management

4.2.19 *Request Maneuver/Trip Statistics*

Byte	Description	
0	Module 15 – Request Maneuver/Trip Statistics	
1	Length of module – 7	
2	Spare	
3	Trip ID (LSB)	If this field contains a non-existing Trip ID, the unit will send NACK (TR 17, STR 3)
4	Trip ID	
5	Trip ID (MSB)	
6	Maneuver ID (LSB)	If this number contains 0xFFFFFF, the unit will generate statistic of the entire trip
7	Maneuver ID	
8	Maneuver ID (MSB)	

4.2.20 *Request Maneuver Raw + Statistics*

Byte	Description	
0	Module 16 – Request Maneuver Raw + Statistics	
1	Length of module – 7	
2	Spare	
3	Trip ID (LSB)	If this field contains a non-existing Trip ID, the unit will send NACK (TR 17, STR 3)
4	Trip ID	
5	Trip ID (MSB)	
6	Maneuver ID (LSB)	If this number contains 0xFFFFFF, the unit will initiate full raw upload of the entire trip
7	Maneuver ID	
8	Maneuver ID (MSB)	

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4.2.21 *Request Accident Raw Upload*

This command initiates accident(s) raw data upload.

Byte	Description
0	Module 17 – Request Accident Raw
1	Length of module – 1
2	Spare

4.2.22 *Erase Unsent CSA Events*

Upon reception of this command the unit will send Full Event (module 30) with TR reply to command.

Byte	Description
0	Module 18 – Erase Unsent CSA Events
1	Length of module – 1
2	Action Byte 0 – Delete Unsent CSA Events 1 – Delete All Files (other than EDR files)

4.2.23 *Erase Accident Data*

Upon reception of this command the unit will send Full Event (module 30) with TR reply to command.

Byte	Description
0	Module 19 – Erase Accident Data
1	Length of module – 1
2	Spare

4.2.24 *Calibration/Off Road Ready Mode Command*

This command initiates and finishes accelerometer calibrating mode, as well as requesting the calibration status. The reply to this command mandatorily includes Module 37 (Calibration Status).

Byte	Description
0	Module 20 – Calibration/Off Road Ready Mode Command
1	Length of module – 2

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2	Action Byte 0 – Request Calibration Status 1 – Leave Calibrated Mode (forget calibration and Off Road setup) 2 – Enter Calibration Mode (use existing calibration matrix) 3 – Enter Off Road Ready mode (use existing Off Road setup data)
3	Spare

4.2.25 *Raw Logger Mode Command*

This command initiates Raw Logger Mode, optionally for a limited time. The unit in Raw Logger Mode is continually logging acceleration/GPS data, packing it into files of 100kB size and uploading them to a server through an FTP/TFTP connection, as per CSA configuration (including compression settings). During Raw Logger Mode the CSA keeps working as usual, serial and OTA communication with CSA remaining available.

While in Raw Logger Mode, one minute after Ignition Off the unit pauses the log. It restarts the log upon switching to Ignition On.

After pausing the log, the unit also pauses the timer of raw mode duration and restarts it after switching to Ignition On.

Byte	Description
0	Module 21 – Raw Logger Mode Command
1	Length of module – 5
2	Control Byte 0 – Start 1 – Stop
3	Raw Logger Mode Duration (2 seconds/bit resolution, Max value of 36 hours, 0 – Unlimited)
4	
5	GPS Recording Resolution [Seconds] (should be sent as 1)
6	Accelerometer Recording Resolution (10 msec/bit resolution, should be sent as 5)

4.2.26 *Response to Raw Data Control Command*

Byte	Description
0	Module 22 – Response to Raw Data Control Command
1	Length of module – 5

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<table>
<tr><td>2</td><td>Operational Mode

<table>
<tr><td>Engine Status
0 – Off
1 – On</td><td>Raw logging
0 – Off
1 – On</td><td>Calibration Status
0 – Ready
1 – Calibrating</td><td>Driving Status
0 – Idling
1 – Driving</td><td colspan="2">Spare</td><td>DFD Comm. Status
0 – Connected
1 – Disc.</td><td>STBY Engine On/Off
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></td></tr>
<tr><td>3</td><td rowspan="2">Raw Logger Mode Duration (2 seconds/bit resolution, Max value of 36 hours, 0 – Unlimited)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>GPS Recording Resolution [Seconds] (should be sent as 1)</td></tr>
<tr><td>6</td><td>Accelerometer Recording Resolution (10 msec/bit resolution, should be sent as 5)</td></tr>
</table>

4.2.27 *CSA Full Event*

<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Module 30 – CSA Full Event</td></tr>
<tr><td>1</td><td>Length of module – 46</td></tr>
<tr><td>2</td><td>CSA Event Reason (see detailed table in module 0)</td></tr>
<tr><td>3</td><td>CSA Event Sub Reason (see detailed table in module 0)</td></tr>
<tr><td>4</td><td rowspan="2">CSA Event Numerator (0 in case of reply)</td></tr>
<tr><td>5</td></tr>
<tr><td>6</td><td>Operational Mode

<table>
<tr><td>Engine Status
0 – Off
1 – On</td><td>Raw logging
0 – Off
1 – On</td><td>Calibration Status
0 – Ready
1 – Calibrating</td><td>Driving Status
0 – Idling
1 – Driving</td><td colspan="2">Spare</td><td>DFD Comm. Status
0 – Connected
1 – Disc.</td><td>STBY Engine On/Off
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></td></tr>
</table>

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<table>
<tr><td>7</td><td>Spare</td></tr>
<tr><td>8</td><td rowspan="6">Driver ID</td></tr>
<tr><td>9</td></tr>
<tr><td>10</td></tr>
<tr><td>11</td></tr>
<tr><td>12</td></tr>
<tr><td>13</td></tr>
<tr><td>14</td><td rowspan="3">Trip ID</td></tr>
<tr><td>15</td></tr>
<tr><td>16</td></tr>
<tr><td>17</td><td rowspan="3">Maneuver ID</td></tr>
<tr><td>18</td></tr>
<tr><td>19</td></tr>
<tr><td>20</td><td>Maneuvers Data Usage [%]</td></tr>
<tr><td>21</td><td>Accident Buffer Status Bitmask
<table>
<tr><th colspan="4">2nd Crash</th><th colspan="4">1st Crash</th></tr>
<tr><td colspan="3">Spare</td><td>0 – Empty
1 – Occupied</td><td colspan="3">Spare</td><td>0 – Empty
1 – Occupied</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>22</td><td>Spare</td></tr>
<tr><td>23</td><td>HDOP</td></tr>
<tr><td>24</td><td>Mode 1 (from GPS)</td></tr>
<tr><td>25</td><td>Mode 2 (from GPS)</td></tr>
<tr><td>26</td><td>Number of Satellites Used (from GPS)</td></tr>
<tr><td>27</td><td rowspan="4">Longitude</td></tr>
<tr><td>28</td></tr>
<tr><td>29</td></tr>
<tr><td>30</td></tr>
</table>

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31	Latitude
32	
33	
34	
35	Altitude
36	
37	
38	
39	Ground Speed [km/h]
40	Speed Direction [degrees]
41	
42	System Time – Seconds
43	System Time – Minutes
44	System Time – Hours
45	System Date – Day
46	System Date – Month
47	System Date – Year (-2000)

4.2.28 *ABC Maneuver Statistics*

Byte	Description
0	Module 31 – ABC Maneuver Statistics
1	Length of module – 54
2-4	Trip ID
5-7	Maneuver ID
8	Maneuver Type 6 – Harsh Acceleration 7 – Harsh Brake 8 – Harsh Turn 10 – Sharp Lane Crossing 15 – Turn & Brake

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	16 – Turn & Accel	
9-16	Start Location (longitude and latitude of maneuver start)	
17-24	End Location (longitude and latitude of maneuver end)	
25-31	Start Time and Date (of maneuver start)	
32-33	Maneuver Duration (0.2 seconds/bit resolution)	
34-35	X Acceleration Average	Accelerations are sent on 16 bits, while only the 12 LSBits should be considered (the upper nibble is used for sign only). A 16g/4096 (=0.00390625) coefficient should be applied to convert to decimal.
36-37	Y Acceleration Average	
38-39	X Acceleration Max	
40-41	Y Acceleration Max	
42-43	Z Acceleration Max	
44	Speed Average [km/h]	
45	Speed Max [km/h]	
46	Speed Delta [km/h]	
47-48	RPM Max (Infrastructure – sent as 0)	
49-50	Fuel Flow Max (Infrastructure – sent as 0)	
51-52	Fuel Consumed (Infrastructure – sent as 0)	
53	ABS State (Infrastructure – sent as 0)	
54	Risk Score (0-100)	
55	Number of Init Frames (Indicates the number of accelerometer records before 1st GPS record, relevant for raw data files only)	

4.2.29 *Trip Statistics*

Byte	Description
0	Module 32 – Trip Statistics
1	Length of module – 73
2-4	Trip ID
5-10	Driver ID
11-17	Start Time and Date (of trip start)
18-20	Trip Duration [Seconds]

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21-24	Distance Traveled (in CSA base units)	
25-28	Movement Time [Seconds] (between Ignition On and Ignition Off, or until driver was replaced)	
29-32	Idle Time – Short [Seconds] (based on GPS + accelerometer information, according to 1st level threshold)	
33-36	Idle Time – Long [Seconds] (based on GPS + accelerometer information, according to 2nd level threshold)	
37-38	X Acceleration Max	Accelerations are sent on 16 bits, while only the 12 LSBits should be considered (the upper nibble is used for sign only). A 16g/4096 (=0.00390625) coefficient should be applied to convert to decimal.
39-40	Y Acceleration Max	
41-42	Z Acceleration Max	
43-46	"RMS" Acceleration Max ($X^2+Y^2+Z^2$) is calculated for each frame and the trip Max is sent; Server side completes to $\frac{1}{\sqrt{3}} * \sqrt{X^2 + Y^2 + Z^2}$)	
47	Speed Max	
48	Speed Average	
49	Trip Start Fuel Level [%]	
50	Trip End Fuel Level [%]	
51	Weighted Safety Score (0-100)	
52	Weighted Eco Score (0-100)	
53	Eco Scoring – Idle Score	
54	Eco Scoring – Urban Driving Score	
55	Eco Scoring – Highway Driving Score	
56-58	Eco Scoring – Idle Score Time [Seconds]	
59-61	Eco Scoring – Urban Score Time [Seconds]	
62-64	Eco Scoring – Highway Score Time [Seconds]	
65-68	Trip End Odometer	
69-70	Trip Delta Engine Time [Minutes]	
71-72	Trip Movement Fuel Consumption [100ml/bit resolution]	
73-74	Trip Idle Fuel Consumption [100ml/bit resolution]	

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4.2.30 *RPM*

Byte	Description
0	Module 33 – RPM
1	Length of module – 2
2	RPM
3	

4.2.31 *EDR Crash Attributes*

This module will be unconditionally attached to any CSA Event with Reason 2 (Crash Occurred). These modules will only be sent if the EDR is enabled. If the EDR is disabled and the user requires only crash maneuvers, the unit will send module 63.

Byte	Description
0	Module 35 – EDR Crash Attributes
1	Length of module – 14
2	Crash ID
3	Spare
4	Spare
5	Vehicle Type (as configured in PL) 0 – Private 1 – Large Van 2 – Light Truck/bus 3 – Heavy Truck
6	Crash Type 1 – Light Crash 2 – Heavy Crash
7-8	Acceleration Max (X or Y) during Crash

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<table>
<tr><td>9</td><td>Crash Information
<table>
<tr><td colspan="2">Spare</td><td>Parking Indication
0 – Crash while Driving
1 – Crash while Parking</td><td>Roll Indication
0 – Roll Event
1 – No Roll Event</td><td colspan="4">Crash Orientation
0 – Info Init
1 – Front
2 – Front Left
3 – Front Right
4 – Side Left
5 – Side Right
6 – Rear
7 – Rear Left
8 – Rear Right
9 – Down
10 – Up</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>10-11</td><td>Crash Duration [Seconds]</td></tr>
<tr><td>12</td><td>Number of Acceleration Samples Between Last GPS Before Crash and Crash</td></tr>
<tr><td>13</td><td>Number of Acceleration Samples Between Crash and Next GPS</td></tr>
<tr><td>14</td><td>Number of Complete GPS Seconds Before Crash</td></tr>
<tr><td>15</td><td>Number of Complete GPS Seconds After Crash</td></tr>
</table>

4.2.32 *VIN*

This module will be attached to a CSA Event with Reason 1 (Crash Occurred) if enabled in the configuration and supported by the unit (CAN version only).

Byte	Description
0	Module 36 – VIN
1	Length of module – 17
2-18	VIN (17 ASCII characters)

4.2.33 *Calibration/Off Road Status*

This module will be sent as a response to corresponding OTA command (module 20).

Byte	Description
0	Module 37 – Calibration/Off Road Status

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1	Length of module – 3
2	Calibration Status 0 – Not Calibrated 1 – Calibrated 2 – Bad Installation
3	Calibration Phase/Step

Phase Number (0-1)				Step Number (0-9)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

4	Off Road Status 0 – Not Calibrated 1 – Calibrated (100 samples Done) 2 – Calibrated (1000 samples Done)

4.2.34 *Calibration Matrix Set/Read Command*

This module is sent in Programming command in order to read or change the Calibration Matrix. The calibration data consists of 30 signed 2 bytes parameters.

For example:

9:9:(-250)		
16384:0:0	0:16372:592	0:(-592):16372
16372:0:592	**16384:0:0**	(-592):0:16372
16165:2671:0	(-2671):16165:0	**16384:0:0**

Note that the diagonal of the matrix is always the same (16384:0:0, 0:16384:0, 0:0:16384), so we to keep only 21 parameters as shown in the following matrix:

Index	1	2	3						
Data	9	9	-250						
Index				4	5	6	7	8	9
Data	16384	0	0	0	16372	592	0	-592	16372
Index	10	11	12				13	14	15
Data	16372	0	592	0	16384	0	-592	0	16372

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Index	16	17	18	19	20	21			
Data	16165	2671	0	-2671	16165	0	0	0	16384

Byte	Description
0	Module 42 – Calibration Matrix Set/Read Command
1	Length of module – 2 (for read command), 44 (for write command)
2	Action Byte 0 – Read 1 – Write
3	Spare
4-5	Index 1
…	
44-45	Index 21

4.2.35 *Calibration Matrix Response*

This module is sent in Programming reply as a response to Calibration Matrix Set Command, or as an escorting module to Calibration OK report.

Byte	Description
0	Module 43 – Calibration Matrix Response
1	Length of module – 43
2	Spare
3-4	Index 1
…	
43-44	Index 21

4.2.36 *Reserved for Manufacturer Use*

For debug versions only, this module is sent every hour (hardcoded) and includes memory usage details.

Byte	Description
0	Module 48 – Reserved for Manufacturer Use

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1	Length of module – Variable
…	Data (for Manufacturer Use Only)

4.2.37 *Off Road Setup Data Set/Read Command*

This module is sent in Programming command in order to read or change the Off Road Setup data. The Off Road setup data consists of 21 4 bytes parameters.

Byte	Description
0	Module 52 – Off Road Setup Data Set/Read Command
1	Length of module – 1 (for read command), 91 (for write command)
2	Action Byte 0 – Read 1 – Write
3-6	Index 1
…	
83-86	Index 21
87-92	Spare

4.2.38 *Off Road Setup Data Response*

This module is sent in Programming reply as a response to Off Road Setup Data Set Command.

Byte	Description
0	Module 53 – Off Road Setup Data Response
1	Length of module – 90
2-5	Index 1
…	
82-85	Index 21
86-91	Spare

4.2.39 *Real Time Raw Accelerometer Data Control Command*

This module is sent in message type 4 in order to initiate (or finish) the real time accelerometer data streaming mode. During this mode the unit delivers raw accelerometer data (8/10/12 bits to axis) to the CSA socket in real time.

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<table>
<tr><th>Byte</th><th>Description</th></tr>
<tr><td>0</td><td>Module 54 – Real Time Raw Accelerometer Data Control Command</td></tr>
<tr><td>1</td><td>Length of module – 5</td></tr>
<tr><td>2</td><td>Control Byte
<table>
<tr><td colspan="2">Accelerometer Resolution
0 – 8 bits
1 – 10 bits
2 – 12 bits</td><td colspan="3">Required Sampling Frequency[9]
0 – 100Hz
1 – 50Hz
2 – 25Hz
3 – 20Hz
4 – 10Hz
5 – 5Hz</td><td colspan="3">Update rate [seconds]
(0 to exit RT Accelerometer Data streaming mode).
Every update message will contain module 55 (or a few modules 55 if there are many frames or seconds reported per update) and GPS Stamp (module 6) aligned with the latest System Time in the message.
GPS module will always be attached as last module of the message.</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>3</td><td rowspan="2">Real Time Data Streaming Mode Duration [Seconds] (0 for infinity)</td></tr>
<tr><td>4</td></tr>
<tr><td>5</td><td>Spare</td></tr>
<tr><td>6</td><td>Spare</td></tr>
</table>

4.2.40 *Real Time Raw Accelerometer Data*

This module is sent in message type 0 during RT Accelerometer Data streaming mode, which is initiated by a command containing module 54.

The module contains accelerations recorded during the 1 second BEFORE the system time appears in the System Time of the module.

This message is not logged and does not require ACK from the server side.

Byte	Description
0	Module 55 – Real Time Raw Accelerometer Data

[9] Sampling rate in this command is independent, but can't be higher than the sampling frequency programmed on address 50 of CSA configuration. If it is higher, the value is saturated to the programmed sampling frequency.

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<table>
<tr><td>1</td><td>Length of module – Variable</td></tr>
<tr><td>2</td><td>Control Byte 1
<table>
<tr><td colspan="7">Number of Included Samples (each sample is 3/6 bytes, for 3 axis)</td><td>Sample Size
0 – 1 byte/axis
1 – 2 bytes/axis</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>3</td><td>Control Byte 2
<table>
<tr><td>Last Frame of the Second
0 – Not Last Frame
1 – Last Frame</td><td colspan="5">Frame number (in case of a high sampling rate all the samples of a single second cannot be compressed into a single module and split into a few frames)</td><td colspan="2">Sampling Frequency
0 – 100Hz
1 – 50Hz
2 – 25Hz
3 – 20Hz
4 – 10Hz
5 – 5Hz</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>4</td><td>Control Byte 3
<table>
<tr><td colspan="4">Spare</td><td colspan="2">Accelerometer Resolution
0 – 8 bits
1 – 10 bits
2 – 12 bits</td><td>Calibration Status
0 – Not Calibrated
1 - Calibrated</td><td>Time Accuracy
0 – Estimated
1 – Accurate</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>5</td><td>System Time – Seconds</td></tr>
<tr><td>6</td><td>System Time – Minutes</td></tr>
<tr><td>7</td><td>System Time – Hours</td></tr>
<tr><td>8</td><td>System Date – Day</td></tr>
<tr><td>9</td><td>System Date – Month</td></tr>
<tr><td>10</td><td>System Date – Year (-2000)</td></tr>
<tr><td>…</td><td>Sample 1 – X Acceleration</td></tr>
<tr><td>…</td><td>Sample 1 – Y Acceleration</td></tr>
</table>

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…	Sample 1 – Z Acceleration
…	…
…	Last Sample (up to 82) – X Acceleration
…	Last Sample (up to 82) – Y Acceleration
…	Last Sample (up to 82) – Z Acceleration

4.2.41 *Restore Default Vehicle Preset*

This module is sent in messages of type 2 whenever a preset restore to defaults for a certain vehicle type is required. The unit responds after the restore is completed with a message type 3 containing the same module.

Byte	Description
0	Module 56 – Restore Default Vehicle Preset
1	Length of module – 2
2	Vehicle Type 0 – Private 1 – Large Van 2 – Light Truck/Bus 3 – Heavy Truck
3	Spare

4.2.42 *Vehicle Preset Configuration Command*

This module is sent in messages of type 2 whenever a change in the preset for a certain vehicle type is required. The unit responds with a message type 3 containing the same module.

The numerical values specified in the message are the default values for all 4 vehicle presets from left to right: Private, Large Van, Light Truck/Bus, and Heavy Truck.

Unless specified else:

- All acceleration fields have 0-1g range and 0.04g resolution
- All speed fields have 0-255km/h range and 1km/h resolution
- All time fields have 0-2.55sec range and 0.01sec resolution

Byte	Description
0	Module 57 – Vehicle Preset Configuration Command
1	Length of module – 2 (for read command), 238 (for write command)

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2	Control Byte 0 – Read Command (sent inbound in message type 2) 1 – Write Command (sent inbound in message type 2) 2 – Response (sent outbound in message type 3)				
3	Preset Number 0 – Private 1 – Large Van 2 – Light Truck/Bus 3 – Heavy Truck				
4-13	Reserved for system configuration data (0)				
14	Frame Time	20	20	20	20
15	Xmax – Absolute maximum of acceleration on X Axis	102	92	76	65
16	Spare	9	9	9	9
17	Filter (IIR) Coefficient	5	5	5	5
18	Amount of violating samples to consider crash	3	3	3	3
19	Acceleration on X axis to consider maneuver start	51	51	44	34
20	Acceleration on Y axis to consider maneuver start	51	51	44	37
21	Acceleration on X axis (second threshold) to consider combo maneuver start	25	25	25	25
22	Acceleration on Y axis (second threshold) to consider combo maneuver start	25	25	25	25
23	Time threshold for considering lane crossing	30	40	50	70
24	Time threshold for considering maneuver	60	60	60	60
25	Break X Threshold	51	51	44	37
26	Brake Second X Threshold	25	25	25	25
27	Maximum maneuver length [seconds]	30	30	30	30

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28-32	Spare	10, 90, 140, 5, 15	10, 90, 140, 5, 15	10, 90, 140, 5, 15	10, 90, 140, 5, 15
33	Acceleration: Xavg	76	70	60	48
34	Acceleration: Xmax	102	92	76	60
35	Acceleration: Delta Speed	50	45	38	25
36-38	Acceleration: spare	Zeros	Zeros	Zeros	Zeros
39	ACCEL2TURN: Accel - Xavg	76	70	60	48
40	ACCEL2TURN: Accel - Xmax	102	92	76	60
41	ACCEL2TURN: Accel - Delta Speed	50	45	38	25
42	ACCEL2TURN: Turn - Yavg	115	102	88	60
43	ACCEL2TURN: Turn - Ymax	153	138	115	95
44	ACCEL2TURN: Turn - Avg Speed	100	90	75	50
45	TURN_AFTER_ACCEL: Accel - Xavg	76	70	60	48
46	TURN_AFTER_ACCEL: Accel - Xmax	102	92	76	60
47	TURN_AFTER_ACCEL: Accel - Delta Speed	50	45	38	25
48	TURN_AFTER_ACCEL: Turn - Yavg	115	102	88	60
49	TURN_AFTER_ACCEL: Turn - Ymax	153	138	115	95
50	TURN_AFTER_ACCEL: Turn - Avg Speed	100	90	75	50
51	SLALOM_AFTER_ACCEL: Accel - Xavg	76	70	60	48
52	SLALOM_AFTER_ACCEL: Accel - Xmax	102	92	76	60
53	SLALOM_AFTER_ACCEL: Accel - Delta Speed	50	45	38	25
54	SLALOM_AFTER_ACCEL: SLALOM - Yavg	140	125	105	90
55	SLALOM_AFTER_ACCEL: SLALOM - Ymax	0	0	0	0
56	SLALOM_AFTER_ACCEL: SLALOM – Speed Max	90	80	68	50
57	ACCEL2SLALOM_A: Accel - Xavg	76	70	60	48

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58	ACCEL2SLALOM_A: Accel - Xmax	102	92	76	60
59	ACCEL2SLALOM_A: Accel - Delta Speed	50	45	38	25
60	ACCEL2SLALOM_A: SLALOM - Yavg	140	125	105	90
61	ACCEL2SLALOM_A: SLALOM - Ymax	0	0	0	0
62	ACCEL2SLALOM_A: SLALOM - Speed Max	90	80	68	50
63	ACCEL2SLALOM_T: Accel - Xavg	76	70	60	48
64	ACCEL2SLALOM_T: Accel - Xmax	102	92	76	60
65	ACCEL2SLALOM_T: Accel - Delta Speed	50	45	38	25
66	ACCEL2SLALOM_T: SLALOM - Yavg	140	125	105	90
67	ACCEL2SLALOM_T: SLALOM - Ymax	0	0	0	0
68	ACCEL2SLALOM_T: SLALOM – Speed Max	90	80	68	50
69	BRAKE: Xavg	102	92	76	50
70	BRAKE: Xmax	138	125	105	90
71	BRAKE: Delta Speed	60	54	45	30
72-74	BRAKE: Spare	Zeros	Zeros	Zeros	Zeros
75	BRAKE2TURN: Brake - Xavg	102	92	76	50
76	BRAKE2TURN: Brake - Xmax	138	125	105	90
77	BRAKE2TURN: Brake - Delta Speed	60	54	45	30
78	BRAKE2TURN: TURN - Yavg	115	102	88	60
79	BRAKE2TURN: TURN - Ymax	153	138	115	95
80	BRAKE2TURN: TURN – Speed Avg	100	90	75	50
81	TURN_AFTER_BRAKE: Brake - Xavg	102	92	76	50
82	TURN_AFTER_BRAKE: Brake - Xmax	138	125	105	90
83	TURN_AFTER_BRAKE: Brake - Delta Speed	60	54	45	30
84	TURN_AFTER_BRAKE: TURN - Yavg	115	102	88	60
85	TURN_AFTER_BRAKE: TURN - Ymax	153	138	115	95

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86	TURN_AFTER_BRAKE: TURN - Speed Avg	100	90	75	50
87	SLALOM_AFTER_BRAKE: Brake - Xavg	102	92	76	50
88	SLALOM_AFTER_BRAKE: Brake - Xmax	138	125	105	90
89	SLALOM_AFTER_BRAKE: Brake - Delta Speed	60	54	45	30
90	SLALOM_AFTER_BRAKE: SLALOM - Yavg	140	125	105	90
91	SLALOM_AFTER_BRAKE: SLALOM - Ymax	0	0	0	0
92	SLALOM_AFTER_BRAKE: SLALOM - Speed Max	90	80	68	50
93	BRAKE2SLALOM B: Brake - Xavg	102	92	76	50
94	BRAKE2SLALOM B: Brake - Xmax	138	125	105	90
95	BRAKE2SLALOM B: Brake - Delta Speed	60	54	45	30
96	BRAKE2SLALOM B: SLALOM - Yavg	140	125	105	90
97	BRAKE2SLALOM B: SLALOM - Ymax	0	0	0	0
98	BRAKE2SLALOM B: SLALOM - Speed Max	90	80	68	50
99	BRAKE2SLALOM T: Brake - Xavg	102	92	76	50
100	BRAKE2SLALOM T: Brake - Xmax	138	125	105	90
101	BRAKE2SLALOM T: Brake - Delta Speed	60	54	45	30
102	BRAKE2SLALOM T: SLALOM - Yavg	140	125	105	90
103	BRAKE2SLALOM T: SLALOM - Ymax	0	0	0	0
104	BRAKE2SLALOM T: SLALOM - Speed Max	90	80	68	50
105	TURN: Yavg	115	102	88	60
106	TURN: Ymax	153	138	115	95
107	TURN: Speed Avg	100	90	75	50
108-110	TURN: Spare	Zeros	Zeros	Zeros	Zeros
111	TURN2BRAKE: Turn - Yavg	115	102	88	60

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112	TURN2BRAKE: Turn - Ymax	153	138	115	95
113	TURN2BRAKE: Turn - Speed Avg	100	90	75	50
114	TURN2BRAKE: Brake - Xavg	102	92	76	50
115	TURN2BRAKE: Brake- Xmax	138	125	105	90
116	TURN2BRAKE: Brake - Delta Speed	60	54	45	30
117	BRAKE_AFTER_TURN: Turn - Yavg	115	102	88	60
118	BRAKE_AFTER_TURN: Turn - Ymax	153	138	115	95
119	BRAKE_AFTER_TURN: Turn - Speed Avg	100	90	75	50
120	BRAKE_AFTER_TURN: Brake - Xavg	102	92	76	50
121	BRAKE_AFTER_TURN: Brake- Xmax	138	125	105	90
122	BRAKE_AFTER_TURN: Brake - Delta Speed	60	54	45	30
123	TURN2ACCEL: Turn - Yavg	115	102	88	60
124	TURN2ACCEL: Turn - Ymax	153	138	115	95
125	TURN2ACCEL: Turn - Speed Avg	100	90	75	50
126	TURN2ACCEL: Accel - Xavg	76	70	60	48
127	TURN2ACCEL: Accel - Xmax	102	92	76	60
128	TURN2ACCEL: Accel - Delta Speed	50	45	38	25
129	ACCEL_AFTER_TURN: Turn - Yavg	115	102	88	60
130	ACCEL_AFTER_TURN: Turn - Ymax	153	138	115	95
131	ACCEL_AFTER_TURN: Turn - Speed Avg	100	90	75	50
132	ACCEL_AFTER_TURN: Accel - Xavg	76	70	60	48
133	ACCEL_AFTER_TURN: Accel - Xmax	102	92	76	60
134	ACCEL_AFTER_TURN: Accel - Delta Speed	50	45	38	25
135	SLALOM: Yavg	140	125	105	90
136	SLALOM: Ymax	0	0	0	0
137	SLALOM: Speed Max	90	80	68	50

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138-140	SLALOM: Spare	Zeros	Zeros	Zeros	Zeros
141	SLALOM2BRAKE_B: Slalom - Ymax	140	125	105	90
142	SLALOM2BRAKE_B: Slalom - Yavg	0	0	0	0
143	SLALOM2BRAKE_B: Slalom - Speed Max	90	80	68	50
144	SLALOM2BRAKE_B: Brake - Xavg	102	92	76	50
145	SLALOM2BRAKE_B: Brake - Xmax	138	125	105	90
146	SLALOM2BRAKE_B: Brake - Delta Speed	60	54	45	30
147	SLALOM2BRAKE_T: Slalom - Ymax	140	125	105	90
148	SLALOM2BRAKE_T: Slalom - Yavg	0	0	0	0
149	SLALOM2BRAKE_T: Slalom - Speed Max	90	80	68	50
150	SLALOM2BRAKE_T: Brake - Xavg	102	92	76	50
151	SLALOM2BRAKE_T: Brake - Xmax	138	125	105	90
152	SLALOM2BRAKE_T: Brake - Delta Speed	60	54	45	30
153	SLALOM2ACCEL_A: Slalom - Ymax	140	125	105	90
154	SLALOM2ACCEL_A: Slalom - Yavg	0	0	0	0
155	SLALOM2ACCEL_A: Slalom - Speed Max	90	80	68	50
156	SLALOM2ACCEL_A: Accel - Xavg	76	70	60	48
157	SLALOM2ACCEL_A: Accel - Xmax	102	92	76	60
158	SLALOM2ACCEL_A: Accel - Delta Speed	50	45	38	25
159	SLALOM2ACCEL_T: Slalom - Ymax	140	125	105	90
160	SLALOM2ACCEL_T: Slalom - Yavg	0	0	0	0
161	SLALOM2ACCEL_T: Slalom - Speed Max	90	80	68	50
162	SLALOM2ACCEL_T: Accel - Xavg	76	70	60	48
163	SLALOM2ACCEL_T: Accel - Xmax	102	92	76	60
164	SLALOM2ACCEL_T: Accel - Delta Speed	50	45	38	25

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165-170	BUMPERS: Spare	Zeros	Zeros	Zeros	Zeros
171-176	SPEEDING: Spare	Zeros	Zeros	Zeros	Zeros
177-182	OFF_ROAD: Spare	Zeros	Zeros	Zeros	Zeros
183-188	IDLE EVENT: Spare	Zeros	Zeros	Zeros	Zeros
189-194	STATES_RPM: Spare	Zeros	Zeros	Zeros	Zeros
195-200	CRASH: Spare	Zeros	Zeros	Zeros	Zeros
201	Weight ACCEL: Xavg	25	25	25	25
202	Weight ACCEL: Xmax	55	55	55	55
203	Weight ACCEL: Delta speed	20	20	20	20
204	Weight BRAKE: Xavg	20	20	20	20
205	Weight BRAKE: Xmax	50	50	50	50
206	Weight BRAKE: Delta speed	30	30	30	30
207	Weight TURN: Yavg	35	35	35	35
208	Weight TURN: Ymax	45	45	45	45
209	Weight TURN: Avg speed	20	20	20	20
210	Weight SLALOM: Yavg	50	50	50	50
211	Weight SLALOM: Ymax	0	0	0	0
212	Weight SLALOM: Speed max	50	50	50	50
213-214	Status Bar Threshold 1	800	760	650	650
215-216	Status Bar Threshold 2	2800	2500	2000	1700
217-218	Status Bar Threshold 3	8400	7000	5500	5000
219-220	Status Bar Threshold 4	17000	14000	11000	10000
221	Trip Eco Total RPM Score Green	100	100	100	100

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222	Trip Eco Total RPM Score Yellow	50	50	50	50
223	Trip Eco Total RPM Score Red	0	0	0	0
224	Trip Eco Score Highway Speed Score 1	0	0	0	0
225	Trip Eco Score Highway Speed Score 2	35	35	35	35
226	Trip Eco Score Highway Speed Score 3	70	70	70	70
227	Trip Eco Score Highway Speed Score 4	80	80	80	80
228	Trip Eco Score Highway Speed Score 5	90	90	90	90
229	Trip Eco Score Highway Speed Score 6	100	100	100	100
230	Trip Eco Score Highway Speed Threshold 1	140	140	140	120
231	Trip Eco Score Highway Speed Threshold 2	120	120	120	110
232	Trip Eco Score Highway Speed Threshold 3	110	110	110	100
233	Trip Eco Score Highway Speed Threshold 4	100	100	100	90
234	Trip Eco Score Highway Speed Threshold 5	90	90	90	85
235	Trip Eco Score Highway Speed Threshold 6	80	80	80	80
236	Trip Eco Score Highway Speed RPM Weight (%)	20	20	20	20
237	Trip Eco Score Highway Speed Weight (%)	80	80	80	80
238-239	Spare	Zeros	Zeros	Zeros	Zeros

4.2.43 *Over Speed Maneuver Statistics*

Byte	Description
0	Module 58 – Over Speed Maneuver Statistics
1	Length of module – 69
2-4	Trip ID
5-7	Maneuver ID

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8	Maneuver Type (9)	
9-16	Start Location (longitude and latitude of maneuver start)	
17-24	End Location (longitude and latitude of maneuver end)	
25-31	Start Time and Date (of maneuver start)	
32-33	Maneuver Duration [Seconds]	
34	Speed Average [km/h]	
35	Speed Max [km/h]	
36	Speed Delta [km/h]	
37	Maneuver Severity 1 – Green 2 – Yellow 3 – Red	
38	Speed Average in Zone – Green [km/h]	
39-40	Time in Over Speeding Zone – Green [Seconds]	
41	Total Events in Over Speeding Zone – Green	
42-43	Speed Average in Zone – Yellow [km/h]	
44	Time in Over Speeding Zone – Yellow [Seconds]	
45	Total Events in Over Speeding Zone – Yellow	
46	Speed Average in Zone – Red [km/h]	
47-48	Time in Over Speeding Zone – Red [Seconds]	
49	Total Events in Over Speeding Zone – Red	
50-51	X Acceleration Max	Accelerations are sent on 16 bits, while only the 12 LSBits should be considered (the upper nibble is used for sign only). A 16/4096 (=0.00390625) coefficient should be applied to convert to decimal.
52-53	Y Acceleration Max	
54-55	Z Acceleration Max	
56-57	RPM Max	
58-59	RPM Average	
60	Risk Score (0-100)	
61-70	Spare	

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4.2.44 *RPM Continuous Maneuver Statistics*

Byte	Description	
0	Module 59 – RPM Continuous Maneuver Statistics	
1	Length of module – 71	
2-4	Trip ID	
5-7	Maneuver ID	
8	Maneuver Type (12)	
9-16	Start Location (longitude and latitude of maneuver start)	
17-24	End Location (longitude and latitude of maneuver end)	
25-31	Start Time and Date (of maneuver start)	
32-33	Maneuver Duration [Seconds]	
34-35	RPM Max	
36-37	RPM Average	
38-39	Spare	
40	Speed Average during RPM Event [km/h]	
41	Speed Max during RPM Event [km/h]	
42-43	Time in Low RPM (Coasting) Zone	
44	Speed Average in Low RPM (Coasting) Zone	
45-46	Number of Low RPM (Coating) Events	
47-48	Time in High RPM Zone	
49	Speed Average in High RPM Zone	
50-51	Number of High RPM Events	
52-53	Time in Excessive RPM Zone	
54	Speed Average in Excessive RPM Zone	
55-56	Number of Excessive RPM Events	
57-58	X Acceleration Max	Accelerations are sent on 16 bits, while only the 12 LSBits should be considered (the upper nibble is used for sign only). A 16g/4096 (=0.00390625) coefficient should be applied to convert to decimal.
59-60	Y Acceleration Max	
61-62	Z Acceleration Max	

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63-72	Spare

4.2.45 *Idling Continuous Maneuver Statistics*

Byte	Description
0	Module 60 – Idling Continuous Maneuver Statistics
1	Length of module – 56
2-4	Trip ID
5-7	Maneuver ID
8	Maneuver Type (13)
9-16	Start Location (longitude and latitude of maneuver start)
17-24	End Location (longitude and latitude of maneuver end)
25-31	Start Time and Date (of maneuver start)
32-33	Maneuver Duration [Seconds]
34-35	Short Idling Duration [Seconds] (from "Short idling TO" to end of Idling session or until "Long Idling TO')
36	Spare
37-38	Long Idling Duration [Seconds] (from "Long idling TO" to end of Idling session)
39	Spare
40-41	Number of Seconds Idling Detection is Based On (Valid GPS)
42-43	Number of Seconds Idling Detection is Based On (Accelerometer)
44-45	Number of Seconds Engine is On during Idling
46-47	Number of Seconds Ignition is On during Idling
48-57	Spare

4.2.46 *Off Road Continuous Maneuver Statistics*

Byte	Description
0	Module 61 – Off Road Continuous Maneuver Statistics
1	Length of module – 50
2-4	Trip ID

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5-7	Maneuver ID	
8	Maneuver Type (11)	
9-16	Start Location (longitude and latitude of maneuver start)	
17-24	End Location (longitude and latitude of maneuver end)	
25-31	Start Time and Date (of maneuver start)	
32-33	Maneuver Duration [Seconds]	
34	Speed Average during Off Road Event [km/h]	
35	Speed Max during Off Road Event [km/h]	
36-37	X Acceleration Max	Accelerations are sent on 16 bits, while only the 12 LSBits should be considered (the upper nibble is used for sign only). A 16g/4096 (=0.00390625) coefficient should be applied to convert to decimal.
38-39	Y Acceleration Max	
40-41	Z Acceleration Max	
42-51	Spare	

4.2.47 *General CSA Control Command*

This module is sent in message type 4 in order to implement common unit control commands.

Byte	Description
0	Module 62 – General CSA Control Command
1	Length of module – 3
2	Control Byte 0 – Unit Reset Command (this command will initiate the fleet reset procedure. The unit will be restarted after delay of 10 Seconds)
3	Spare
4	Spare

4.2.48 *Crash Maneuver Statistics*

Crash Maneuver Statistics will be sent by the unit when the EDR is disabled and the crash events are detected by the normal maneuver detection mechanism. Crash maneuver doesn't record crash logs and only supports crash maneuver statistics.

Byte	Description
0	Module 63 – Crash Maneuver Statistics

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1	Length of module – 46
2-4	Trip ID
5-7	Maneuver ID
8	Maneuver Type (2)
9-16	Start Location (longitude and latitude of maneuver start)
17-24	End Location (longitude and latitude of maneuver end)
25-31	Start Time and Date (of maneuver start)
32-33	Maneuver Duration [Seconds]
34	Crash ID
35	Spare
36	Spare
37	Vehicle Type (as configured in PL) 0 – Private 1 – Large Van 2 – Light Truck/Bus 3 – Heavy Truck
38	Crash Type 1 – Light Crash 2 – Heavy Crash
39-40	Acceleration Max (X or Y) during Crash

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<table>
<tr><td>41</td><td>Crash Information
<table>
<tr><td colspan="2">Spare</td><td>Parking Indication
0 – Crash while Driving
1 – Crash while Parking</td><td>Roll Indication
0 – Roll Event
1 – No Roll Event</td><td colspan="4">Crash Orientation
0 – Info Init
1 – Front
2 – Front Left
3 – Front Right
4 – Side Left
5 – Side Right
6 – Rear
7 – Rear Left
8 – Rear Right
9 – Down
10 – Up</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>42-43</td><td>Crash Duration [Seconds]</td></tr>
<tr><td>44-47</td><td>Spare</td></tr>
</table>

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4.3 FTP/TFTP Files Structure

4.3.1 *Raw Data Files*

The CSA can generate raw data files of different types. File types contain the following optional data parts: accelerometer data with configurable sampling rate, time/location GPS stamps, and statistics of maneuvers and trip with list of maneuvers.

Files are uploaded to the server via FTP or TFTP automatically, as per the unit configuration or by command.

Files containing RAW data (i.e. GPS and acceleration samples) will be compressed to optimize both transmission time and server file system storage size.

4.3.2 *File Naming Convention*

The file name is built according to the following convention:

- The name is constructed from a variable number of fields, each of variable length.
- The file extension indicates if it's compressed (.cpr or uncompressed .raw).
- Each field begins with a dedicated Latin letter (case sensitive, see the table below).
- Each field, except the last one, ends with a minus sign ("-").

The file name structure is: **U*-R*-I*-D*-T***, where:

U: Unit ID (variable size) – contains Cello unit ID in decimal format.

R: File type, as shown in the table below:

Code	Type	Description
1	Maneuver	Maneuver file containing single maneuver
2	Trip	Trip file containing multiple maneuvers
3	Crash	Accident record (crash file)
4	Raw	Raw Accelerometer/GPS/RPM records generated during Raw Logger Mode

I (Trip/Maneuver/Raw/Crash ID):

For maneuvers the number of the trip is followed by the maneuver ID, each one 3 hexadecimal bytes. For example I0004D1-0000F2 means trip 0x4D1, maneuver 0xF2.

D (Date):

Year: 2 chars

Month: 2 chars

Day: 2 chars

T (Time):

Hour: 2 chars

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Minute: 2 chars

Second: 2 chars

mSecond: 3 chars

Example: U9999-R1-I0004D1-0000F2-5-D110728-T115843001.raw

- Unit ID: 9999
- File type: 1 (maneuver)
- Trip ID: trip 0x4D1, maneuver 0xF2
- Date: 11/07/28
- Time: 11:58:43:001

4.3.2.1 File Name Examples

File Type	Uploaded Upon	File Format	File Name
Crash file	Accident	Compressed	U9999-R3-I0004D1-0000F2-5-D110728-T115843001.cpr
Trip Statistics	End of Trip	Raw data	U9999-R2-I0004D1-0000F2-5-D110728-T115843001.raw
Trip Statistics + RAW	End of Trip	Compressed	U9999-R2-I0004D1-0000F2-5-D110728-T115843001.cpr
Maneuver Statistics + RAW	Request	Compressed	U9999-R1-I0004D1-0000F2-5-D110728-T115843001.cpr
Raw Logger Mode	Raw Logger Mode enabled and Ignition is On	Compressed	U9999-R4-I0004D1-0000F2-5-D110728-T115843001.cpr

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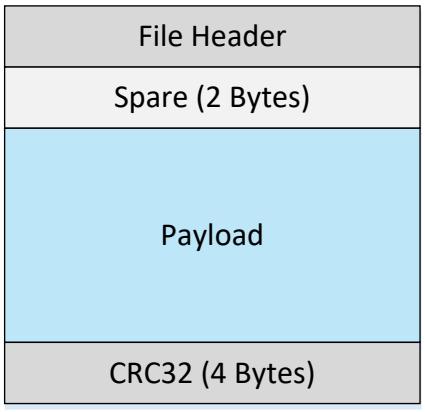
4.3.3 *File Structure*

The CSA file is structured as following:



4.3.3.1 File Header

The File Header is structured as following:

Byte	Description
1	Total File Length (total number of bytes from byte 5 till the end of file, including CRC)
2	
3	
4	
5	File Version (always 1)
6	File Type 1 – Maneuver 2 – Trip 3 – Crash 4 – Raw
7	File Creation Date – Year (-2000)
8	File Creation Date – Month
9	File Creation Date – Day
10	File Creation Time – Hour
11	File Creation Time – Minute
12	File Creation Time – Second
13	File Creation Time – 10 mSecond

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4.3.3.2 File Payloads

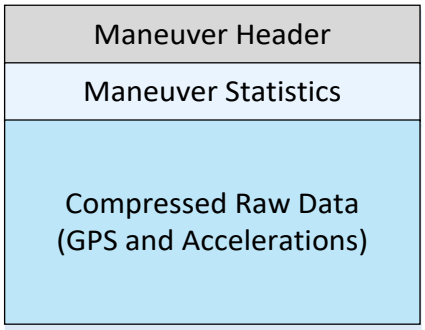
The File payloads are described below in dedicated sections.

4.3.3.3 File CRC

The File CRC is CRC 32 with Ethernet polynomial (0x4C11DB7), or X32 + X26 + X23 + X22 + X16 + X12 + X11 + X10 +X8 + X7 + X5 + X4 + X2+ X +1

4.3.4 *Maneuver File Payload Structure*

Maneuver file payload contains a single maneuver record, which is comprised of maneuver header, optional maneuver statistics record and optional maneuver compressed raw data (maneuver dependent).



4.3.4.1 Maneuver Header

The Maneuver Header is structured as following:

Byte	Description
0	Maneuver Type 0 – ABC Maneuver 1 – Speeding Continuous 2 – Off Road Continuous 3 – Idling Continuous 4 – RPM Continuous 5 – Speeding Logging 6 – Crash
1	Maneuver Sample Rate [Hz] (usually 20)
2	Maneuver Length (Maneuver records with raw data are identified by maneuver length which is larger than the maneuver statistics)
3	

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4.3.4.2 Maneuver Statistics

The Maneuver Statistics is maneuver type dependent:

Maneuver Type	Maneuver Name	Maneuver Statistics
0	ABC Maneuver	As in ABC Maneuver Statistics (without module name/length)
1	Speeding Continuous	As in Over Speed Maneuver Statistics (without module name/length)
2	Off Road Continuous	As in Off Road Continuous Maneuver Statistics (without module name/length)
3	Idling Continuous	As in Idling Continuous Maneuver Statistics (without module name/length)
4	RPM Continuous	As in RPM Continuous Maneuver Statistics (without module name/length)
5	Speeding Logging	As in No Maneuver Statistics
6	Crash	As in Crash Maneuver Statistics (without module name/length)

4.3.4.3 Maneuver Compressed Raw Data

The Maneuver compressed raw data is maneuver type dependent:

Maneuver Type	Maneuver Name	Maneuver Compressed Raw Data
0	ABC Maneuver	Accelerometer and GPS records
1	Speeding Continuous	GPS records
2	Off Road Continuous	GPS records
3	Idling Continuous	No raw data
4	RPM Continuous	No raw data
5	Speeding Logging	GPS records
6	Crash	No raw data

In maneuver records, the raw data accelerations represent the average accelerations of 4 consecutive 20Hz samples, i.e. the acceleration sampling rate is actually reduced from 20Hz to 5Hz.

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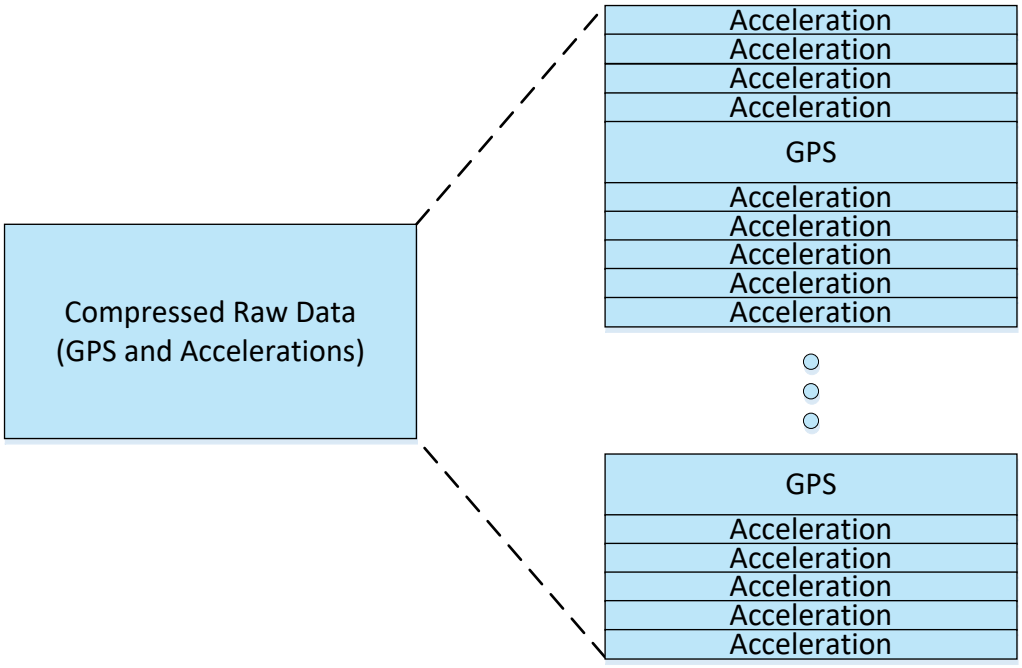
The raw data will start with 1-5 acceleration records (indicated in the Number of Init Frames field (byte 55) of ABC Maneuver Statistics (module 31)), and then 1 GPS record, 5 acceleration records, 1 GPS record, 5 acceleration records, and so on.



4.3.4.4 GPS and Acceleration Frames Compressed Format

The raw data is compressed, for reducing file transmission time and storage space. The compression is achieved by reordering the GPS and accelerations records to minimize unallocated bits.

Compressed GPS record is structured as following:

Byte	Description
0	Longitude (7-0)
1	Longitude (15-8)
2	Longitude (23-16)
3	Longitude (31-24)
4	Latitude (7-0)
5	Latitude (15-8)
6	Latitude (23-16)
7	Latitude (31-24)
8	Altitude (7-0)

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9	Altitude (15-8)						
10	Minutes (2-0)			Hours (4-0)			
11	Seconds (4-0)				Minutes (5-3)		
12	Speed (6-0)						Seconds (5)
13	Spare	Mode 2	DOP (4-0)				Speed (7)
14	Course (7-0)						
15	Spare				Mode 1 (2-0)		Course (8)

Compressed 3-axis signed 12 bit acceleration record is structured as following:

Byte	Description		
0	X Acceleration (7-0)		
1	Y Acceleration (3-0)		X Acceleration (11-8)
2	Y Acceleration (11-4)		
3	Z Acceleration (7-0)		
4	Spare	Last	X Acceleration (11-8)

The "Last" bit indicates it' is the last acceleration record before GPS record (only relevant to Crash files).

Example:

Compressed acceleration record is F3 5F FD F3 00

After conversion to decimal and applying coefficient (±16g on signed 12 bit):

X acceleration = FF3 = (-13) * (16/4096) = -0.05078125g

Y acceleration = FD5 = (-43) * (16/4096) = -0.16796875

Z acceleration = 0F3 = 243 * (16/4096) = 0.94921875

4.3.5 *Trip File Payload Structure*

Trip file payload contains a trip header, trip statistics, and multiple maneuver records.

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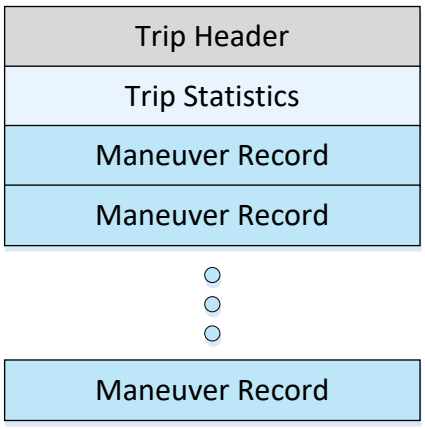

4.3.5.1 Trip Header

The Trip Header is structured as following:

Byte	Description
0	Spare (0x00 or 0x03)
1	File Version
2	Trip Records Length (Holds the length of all the maneuvers records)
3	
4	
5	

4.3.5.2 Trip Statistics

The trip statistics is as in Trip Statistics (without module name/length).

4.3.5.3 Maneuvers Records

The trip file payload contains multiple maneuvers records, each is structured as described in Maneuver File Payload Structure.

4.3.6 *Crash File Payload Structure*

Crash files are generated when accident is detected. The crash file represents the vehicle behavior before and after the accident in 2 sampling resolutions. Before the accident event the data is recorded in 20Hz sampling rate, while from the accident and after the resolution is raised to 100Hz.

The crash file payload includes crash attributes and dual resolution compressed crash raw data.

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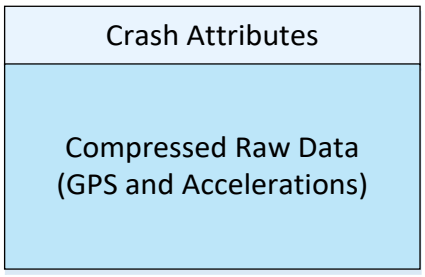

4.3.6.1 Crash Attributes

The crash attributes are as in EDR Crash Attributes (without module name/length).

4.3.6.2 Crash Compressed Raw Data

The crash compressed raw data is divided to pre-crash and post-crash. The pre-crash period (configurable) includes true 20Hz accelerometer samples (i.e. 20 accelerometer samples between 2 GPS records). The post-crash period (also configurable) includes true 100Hz accelerometer (i.e. 100 accelerometer samples between 2 GPS records).

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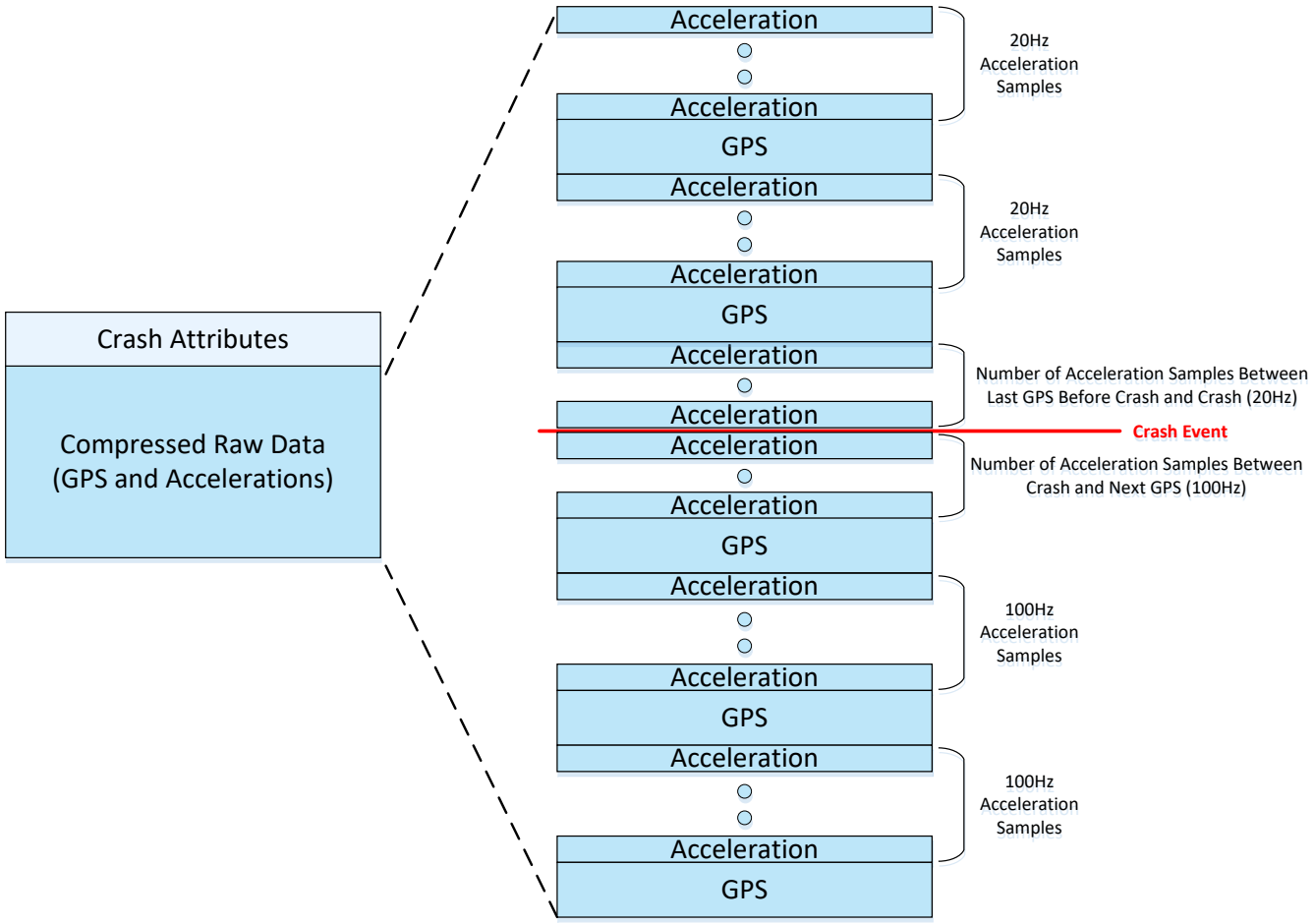

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4.4 Files Structure Detailed Examples

4.4.1 *Trip File Structure Detailed Example*

This example shows the bytes allocation for a trip file with the following properties:

- The example trip has one ABC maneuver
- The ABC maneuver has raw data
- The raw data has one acceleration before the first GPS

Byte	Description	
1-4	File Length	File Header
5	File Version	
6	File Type	
7-13	File Creation Date and Time	
14	Spare	
15	Spare	
16	Trip Type	Trip Header
17	File Version	
18-21	Trip Records Length	
22-24	Trip ID	Trip Statistics
25-27	Driver ID	
28-34	Start Time and Date (of trip start)	
35-37	Trip Duration (0.2 seconds/bit resolution)	
38-41	Distance Traveled (in CSA base units)	
42-45	Movement Time [Seconds] (between Ignition On and Ignition Off, or until driver was replaced)	
46-49	Idle Time – Short [Seconds] (based on GPS + accelerometer information, according to 1st level threshold)	
50-53	Idle Time – Long [Seconds] (based on GPS + accelerometer information, according to 2nd level threshold)	
54-55	X Acceleration Max	
56-57	Y Acceleration Max	

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Byte	Description	
58-59	Z Acceleration Max	
60-63	"RMS" Acceleration Max ($X^2+Y^2+Z^2$, Server completes to $\frac{1}{\sqrt{3}} * \sqrt{X^2 + Y^2 + Z^2}$)	
64	Speed Max	
65	Speed Average	
66	Trip Start Fuel Level [%]	
67	Trip End Fuel Level [%]	
68	Weighted Safety Score (0-100)	
69	Weighted Eco Score (0-100)	
70	Eco Scoring – Idle Score	
71	Eco Scoring – Urban Driving Score	
72	Eco Scoring – Highway Driving Score	
73-75	Eco Scoring – Idle Score Time [Seconds]	
76-78	Eco Scoring – Urban Score Time [Seconds]	
79-81	Eco Scoring – Highway Score Time [Seconds]	
82-85	Trip End Odometer	
86-87	Trip Delta Engine Time [Minutes]	
88-89	Trip Movement Fuel Consumption [100ml/bit resolution]	
90-91	Trip Idle Fuel Consumption [100ml/bit resolution]	
92	Maneuver Type	Maneuver Header
93	Maneuver Sample Rate [Hz]	
94-95	Maneuver Length	
96-98	Trip ID	ABC Maneuver Statistics
99-101	Maneuver ID	
102	Maneuver Type	
103-110	Start Location (longitude and latitude of maneuver start)	
111-118	End Location (longitude and latitude of maneuver end)	
119-125	Start Time and Date (of maneuver start)	

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Byte	Description	
126-127	Maneuver Duration (0.2 seconds/bit resolution)	
128-129	X Acceleration Average	
130-131	Y Acceleration Average	
132-133	X Acceleration Max	
134-135	Y Acceleration Max	
136-137	Z Acceleration Max	
138	Speed Average [km/h]	
139	Speed Max [km/h]	
140	Speed Delta [km/h]	
141-142	RPM Max (Infrastructure)	
143-144	Fuel Flow Max (Infrastructure)	
145-146	Fuel Consumed (Infrastructure)	
147	ABS State (Infrastructure)	
148	Risk Score (0-100)	
149	Number of Init Frames (Indicates the sample ID correlated with GPS reading, relevant for raw data files only)	
150-154	Compressed Acceleration Record	Maneuver Compressed Raw Data
155-170	Compressed GPS Record	
171-175	Compressed Acceleration Record	
…	…	
…	CRC32	

Example file (U0000001142-R002-I00002d_000000-D121218-T122717096.cpr):

Data	Description	
00 00 08 18	File Length	File Header
01	File Version	
02	File Type	
0C 0C 12 0C 1B 11 60	File Creation Date and Time	
00	Spare	

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Data	Description	
00	Spare	
03	Spare	Trip Header
01	File Version	
03 08 00 00	Trip Records Length	
00 2D 00	Trip ID	Trip Statistics
00 00 00 00 00 00	Driver ID	
00 01 18 19 0C 12 0C	Start Time and Date (of trip start)	
0C 70 00	Trip Duration (0.2 seconds/bit resolution)	
00 00 00 00	Distance Traveled (in CSA base units)	
00 5B 00 00	Movement Time [Seconds] (between Ignition On and Ignition Off, or until driver was replaced)	
00 00 00 00	Idle Time – Short [Seconds] (based on GPS + accelerometer information, according to 1st level threshold)	
00 00 00 00	Idle Time – Long [Seconds] (based on GPS + accelerometer information, according to 2nd level threshold)	
46 00	X Acceleration Max	
4E 00	Y Acceleration Max	
C0 00	Z Acceleration Max	
25 94 00 00	"RMS" Acceleration Max ($X^2+Y^2+Z^2$, Server completes to $\frac{1}{\sqrt{3}} * \sqrt{X^2+Y^2+Z^2}$)	
0B	Speed Max	
09	Speed Average	
00	Trip Start Fuel Level [%]	
00	Trip End Fuel Level [%]	
37	Weighted Safety Score (0-100)	
3A	Weighted Eco Score (0-100)	
64	Eco Scoring – Idle Score	

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Data	Description	
32	Eco Scoring – Urban Driving Score	
00	Eco Scoring – Highway Driving Score	
08 00 00	Eco Scoring – Idle Score Time [Seconds]	
63 00 00	Eco Scoring – Urban Score Time [Seconds]	
00 00 00	Eco Scoring – Highway Score Time [Seconds]	
F7 EA 01 00	Trip End Odometer	
54 00	Trip Delta Engine Time [Minutes]	
93 00	Trip Movement Fuel Consumption [100ml/bit resolution]	
36 00	Trip Idle Fuel Consumption [100ml/bit resolution]	
00	Maneuver Type	Maneuver Header
14	Maneuver Sample Rate [Hz]	
22 02	Maneuver Length	
2D 00 00	Trip ID	ABC Maneuver Statistics
03 00 00	Maneuver ID	
08	Maneuver Type	
DA 4D A3 03 E8 8E A4 03	Start Location (longitude and latitude of maneuver start)	
DA 4D A3 03 49 8F A4 03	End Location (longitude and latitude of maneuver end)	
01 31 19 0C 12 0C 0C	Start Time and Date (of maneuver start)	
1C 00	Maneuver Duration (0.2 seconds/bit resolution)	
00 00	X Acceleration Average	
44 00	Y Acceleration Average	
00 00	X Acceleration Max	
B2 FF	Y Acceleration Max	
BB 00	Z Acceleration Max	

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Data	Description	
0B	Speed Average [km/h]	
0B	Speed Max [km/h]	
00	Speed Delta [km/h]	
00 00	RPM Max (Infrastructure)	
00 00	Fuel Flow Max (Infrastructure)	
00 00	Fuel Consumed (Infrastructure)	
00	ABS State (Infrastructure)	
4A	Risk Score (0-100)	
04	Number of Init Frames (Indicates the sample ID correlated with GPS reading, relevant for raw data files only)	
06 60 00 BE 00 06 80 00 BE 00 06 70 00 BE 00 06 70 00 BE 00	4 Compressed Acceleration Records	Maneuver Compressed Raw Data
DA 4D A3 03 A0 8E A4 03 E8 03 2C 7B 17 C0 00 F8	1 Compressed GPS Record	
06 80 00 BE 00 06 80 00 BE 00 06 90 00 BE 00 06 90 00 BE 00 06 A0 00 BE 00	5 Compressed Acceleration Records	
DA 4D A3 03 B8 8E A4 03 E8 03 2C 83 17 C0 00 F8	1 Compressed GPS Record	
06 A0 00 BE 00 06 A0 00 BE 00 06 90 00 BE 00 06 60 00 BF 00 04 20 00 C0 00	5 Compressed Acceleration Records	
DA 4D A3 03 D0 8E A4 03 E8 03 2C 8B 17 C0 00 F8	1 Compressed GPS Record	
02 50 FF BF 00 FF 1F FE BB 00	5 Compressed Acceleration Records	

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Data	Description	
FD 1F FD B7 00 FC 7F FC B6 00 FC 1F FC B5 00		
DA 4D A3 03 E8 8E A4 03 E8 03 2C 93 17 C0 00 E8	1 Compressed GPS Record	

4.4.2 *Crash File Structure Detailed Example*

This example shows the bytes allocation for a crash file.

Byte	Description	
1-4	File Length	File Header
5	File Version	
6	File Type	
7-13	File Creation Date and Time	
14	Spare	
15	Spare	
16	Crash ID	Crash Attributes
17	Spare	
18	Spare	
19	Vehicle Type	
20	Crash Type	
21-22	RMS Acceleration Max during Crash (16 bit)	
23	Crash Information	
24-25	Crash Duration [Seconds]	
26	Number of Acceleration Samples Between Last GPS Before Crash and Crash	
27	Number of Acceleration Samples Between Crash and Next GPS	
28	Number of Complete GPS Seconds Before Crash	
29	Number of Complete GPS Seconds After Crash	

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Byte	Description	
…	Compressed Acceleration and GPS Records	Crash Compressed Raw Data
…	CRC32	

Example file (U0000009999-R003-I000003_000000-D121223-T185546008.cpr):

Byte	Description	
00 00 1B 93	File Length	File Header
01	File Version	
03	File Type	
0C 0C 17 12 37 2E 08	File Creation Date and Time	
00	Spare	
00	Spare	
05	Crash ID	Crash Attributes
00	Spare	
00	Spare	
00	Vehicle Type	
02	Crash Type	
31 04	RMS Acceleration Max during Crash (16 bit)	
04	Crash Information	
19 00	Crash Duration [Seconds]	
13	Number of Acceleration Samples Between Last GPS Before Crash and Crash	
0A	Number of Acceleration Samples Between Crash and Next GPS	
0F	Number of Complete GPS Seconds Before Crash	
0A	Number of Complete GPS Seconds After Crash	

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Byte	Description	
DA 4D A3 03 67 19 57 03 E8 03 D2 1E B9 C0 00 E8	1 Compressed GPS Record	Crash Compressed Raw Data
F3 5F FD F3 00, F3 6F FD F4 00, F2 5F FD F3 00, F2 5F FD F3 00, F3 5F FD F2 00, F3 6F FD F2 00, F3 5F FD F3 00, F4 6F FD F4 00, F3 5F FD F4 00, F3 6F FD F3 00, F3 6F FD F4 00, F3 6F FD F4 00, F3 5F FD F4 00, F3 6F FD F5 00, F3 5F FD F5 00, F3 5F FD F5 00, F2 6F FD F4 00, F3 6F FD F3 00, F3 6F FD F3 00, F3 6F FD F3 10	20 Compressed Acceleration Records	
DA 4D A3 03 67 19 57 03 E8 03 D2 26 B9 C0 00 F8	1 Compressed GPS Record	
…	…	
DA 4D A3 03 67 19 57 03 E8 03 D2 8E B9 C0 00 F8	1 Compressed GPS Record	
F4 6F FD F4 00, F3 6F FD F4 00, F3 6F FD F4 00, F3 6F FD F3 00, F3 6F FD F3 00, F3 5F FD F3 00, F4 6F FD F3 00, F3 6F FD F3 00, F3 5F FD F2 00, F3 6F FD F3 00, F4 6F FD F2 00, F3 6F FD F4 00, F3 6F FD F4 00, F3 6F FD F4 00, F3 5F FD F4 00, F3 6F FD 1B 00, F4 5F FD F4 00, F3 6F FD F3 00, F3 5F FD F3 00, F8 4F 00 15 01 ED 8F FE 14 01 E7 3F FD 2A 01 FA 6F FD 36 01 EE 7F FC 3A 01 F3 0F FC 2D 01 F3 7F FC 2D 01 F7 DF FC 26 01 03 D0 FC 34 01 08 C0 FC 32 11	19 (0x13) 20Hz Compressed Acceleration Records before the accident impact. 10 (0x0A) 100Hz Compressed Acceleration Records after the accident impact. The accident impact Compressed Acceleration Record sample is highlighted in Red	
DA 4D A3 03 67 19 57 03 E8 03 F2 1E B9 C0 00	1 Compressed GPS Record	
…	…	

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