Cellocator Cello Programming Manual - Cello-CANiQ-M

Proprietary and Confidential

Version 5.4.8.1

Revised and Updated: Sept 13, 2021

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1 Introduction

1.1 About this Document

This document defines the contents of the Cellocator Unit's Configuration Memory (CM). The CM is a non-volatile memory, which is used to store different parameters that affect the behavior of the unit, as well as communication parameters, which are necessary for the Cellocator unit's correct operation.

The CM can be read and written both from the wireless channel as well as from the direct wire interface. Refer to the Wire and Wireless Protocols in order to learn how to read and write to the CM. Note that if the stored communication parameters are not correct, the wireless channel might not work, so the only way to program the CM might be via the direct wire interface.

1.2 Applicability Table

Device	Comments
Cello-4	FW version 81a and up.

1.3 Document Conventions

Unless otherwise specified:

- All multiple bytes values are stored and treated Intel-style (meaning, "little endian", least significant bytes first).
- All the parameters are loaded from CM upon reset. **In other words, changing the programming parameters will take effect only after unit reset.**

This document defines the common programmable features, supported by all the modifications of Cellocator units, as well as the specific programmable options, supported by specific modifications only. The non-common options are highlighted.

2 Accessing the Configuration Memory via Wireless Channel (OTA)

When done over the air (OTA), CM access is performed in blocks. The 4096 bytes are partitioned to aligned, non-overlapping blocks of 16 bytes. This means the whole CM space contains 256 different blocks, assigned with block codes of 0 (zero) to 255 (decimal).

The first block (which represents CM locations 0 to 15 decimal) is assigned with block code 0 (zero). The following blocks are assigned with successive numbers (block 1 for locations 16 to 31 and so on).

Refer to the *Cellocator Wireless Communication Protocol* document for more information about accessing the CM via the wireless channel.

3 Accessing the Configuration Memory via Direct Wire Interface

The CM cells are accessed via the direct wire interface in a linear manner. This means that cells are identified by their actual addresses – there are no blocks or pages.

Refer to the *Cellocator Serial Communication Protocol* for more information about accessing the CM via the direct wire interface.

4 Event Types generated by Cellocator devices

Every event (like trigger on input, violation of speed any other), generated by the Cellocator unit can be threaded in 4 ways, as per the descriptions below. Every enabled event causes the unit to generate a location message type 0 (see description in *Cellocator Wireless Communication Protocol*) with the appropriate transmission reason. The various event types are described in the following sections.

4.1 Logged (Plain) Event

If the condition for the specific event is met, the unit will create an event and store it into its non-volatile memory. The event will be uploaded to the Control Center only during the GPRS session and will be deleted from the memory of the unit only after reception of an Acknowledge. Note: Plain events will never be delivered by SMS.

4.2 Distress Event

If the condition for the specific event is met, the unit will create a series of messages (session) with the same transmission reason. The messages will be uploaded to the Control Center immediately with the first available communication transport (during IP session – over IP, otherwise by SMS). The messages are not stored in the memory and if there is no cellular coverage at the moment of sending the message will be lost. Distress events do not require ACK from the control center.

The number and time between messages in a Distress transmission session is defined in a Time between Transmissions section of that document.

Distress sessions caused by the same trigger, which occurred while the first session is not over, restarts the session from the beginning.

Distress sessions caused by a different trigger, which occurred while the first session is not over, causes a new distress session (up to 5 distress sessions can be maintained concurrently).

A 6th distress session, while the previous 5 are still active, will be lost.

It is also possible to initiate an endless (or specified duration) distress session by command from the CCC. Upon starting, this session cancels all active distress sessions. The session will be stopped by any other distress session or by a command from the OTA.

Distress sessions may be prolonged by up to 20 seconds after the transmission of the last distress message.

4.3 Security Event

As per the Distress Event, but in this instance the condition for event generation is only checked when the alarm of the unit is armed (only applicable for security modification of the Cellocator unit). If the condition for the specific event is met, the unit will create a series of messages with the same transmission reason.

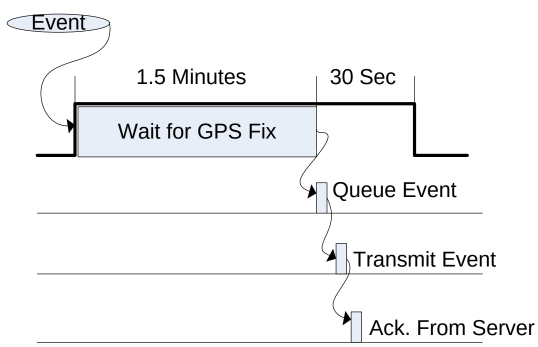
The number and time between messages in a Security transmission session is defined in a Security Section of that document.

IMPORTANT: Any event can be created in multiple ways simultaneously.

4.4 Active Logged (Plain) Event

The "Active Logged Event" is a new configurable feature designed to enhance the functionality of legacy logged events. The feature affects all events configured as logged (or plain). Enabling the "Active Logged Event" feature changes the behavior of the system 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.



- **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.

The "Active Logged Event" feature is important for units, such as CelloTrack, which are battery operated and mostly hibernating while periodically communicating with the server. Prior to this feature, users had to configure both "Event" and "Distress" bits to achieve this functionality.

5 Address and Bitmask Field Allocation Tables

This section describes the addresses and bit mask field allocations. Where relevant, there are references to corresponding sections, where you can find further information.

- **Address allocation table**, see below
- **Bitmask Field allocation tables**, page 38

5.1 Address Allocation Table

Address	Purpose
0	Application Configuration byte 1
1	Application Configuration byte 2
3 - 4	Hibernation mode communication settings
5	Network keep-alive period
6	Application Configuration byte 3
7	Application Configuration byte 4
8 - 31	Operational Sever - PPP Username
32-34	Trip for a Distance event in Roaming mode
35	Time/Distance alert multipliers for High Speed in Roaming GSM
36 - 65	Operational Sever - APN
66 - 69	Default Target IP Address (for GPRS)
70 - 71	Time between Idle Transmissions
72 - 73	Time between Distress Transmissions
74	Operational Server - Modem type code
75	Number of Distress transmissions
76 - 79	GPS odometer's current value
80 - 83	Base unit (measurement factor of GPS odometer)
84	Max Time between GPS readings for SxT calculation
85 - 88	GPS odometer - Last Distance Event (in base units)

Address	Purpose
89 - 91	Trip for a Distance event (in base units)
92	Time/Distance alert multipliers for High Speed in Home GSM
93	Over Speed velocity threshold for GPS Over Speed Start event
94	Over Speed velocity threshold for GPS Over Speed End event
95	Over Speed time event filter
96	Idle Speed Velocity threshold for GPS Idle End event
97	Idle Speed Velocity threshold for GPS Idle Speed Start event
99	GPS Events Mask Bitmap
100 - 101	Inputs Logic Invert Mask
102	GPS Distress Triggers Bitmapped mask
104	Journey Start Event time filter
105	Journey Stop Event time filter
107 - 108	Listening UDP Port (while connected to both operational server or maintenance server)
109 - 110	Operational server TCP/UDP Target Port
111	Maximum time without authentication
112	Time to Authentication loss
115	Main Power Low threshold - high level (Doesn't exist in Solar)
116	Main Power Low threshold - low level
119	Backup Battery Low threshold - high level
120	Backup Battery Low threshold - low level
121	Mask of Analog Inputs Events
122	Mask of Analog Inputs Distress
123	Mask of Authentication events
124 - 125	Inputs Events mask – on Falling
126 - 127	Inputs Events mask – on Rising

Address	Purpose
128 - 129	Inputs Distress mode mask - on Falling
130 - 131	Inputs Distress mode mask - on Rising
132 - 133	Towing detection – Speed threshold
134 - 135	Towing detection – Geo-Fence perimeter
136	Common Discrete Inputs change Time filter
137	Towing Detection and Towed Mode Time Filter
138	Maximum Backup Battery extra charge time
139	Message Transit Acknowledge timeout
140	Outputs pulse width period
141 - 164	Operational Sever - PPP Password
165 - 166	Modem Reset Period
167 - 176	BCALL (Brake down) Destination number
177 - 186	SMS Center Address
187 - 196	SMS Default Destination Address
197 - 200	SIM PIN code
201 - 202	Communication settings in Home GSM Network Mode
203 - 204	Communication settings in Roam GSM Network Mode
205	Advanced GSM Jamming Detection – Ignition Off - 1st activated output (Infrastructure)
206	Advanced GSM Jamming Detection – Ignition Off - Template of 1st activated output (1st byte) (Infrastructure)
207	Advanced GSM Jamming Detection – Ignition Off - Template of 1st activated output (2nd byte) (Infrastructure)
208	Advanced GSM Jamming Detection – Ignition Off – 2nd activated output
209	Advanced GSM Jamming Detection – Ignition Off - Template of 2nd activated output (1st byte) (Infrastructure)
210	Advanced GSM Jamming Detection – Ignition Off - Template of 2nd activated output (2nd byte)

Address	Purpose
211	Advanced GSM Jamming Detection – Ignition Off - Delay for output activation for the 1st output (Infrastructure)
212	Advanced GSM Jamming Detection – Ignition Off - Delay for output activation for the 2nd output (Infrastructure)
213	Advanced GSM Jamming Detection – Jamming Detection Time Filter: Jamming detection time in resolution of 3 Seconds. Ranges between 3 Seconds to 765 Seconds. Default 10 Seconds (Infrastructure)
214	Advanced GSM Jamming detection – Ignition On and Ignition Off Jamming End Time Filter (15 Sec resolution) (Infrastructure)
215	Logged Events Amount for Upload Offline Events
216-217	Unused
218-219	Logged Events Upload Periodic Timer
220	Timeout before switching off the modem
221	Number of Logged Events Upload Retries
222	Time Between Logged Events Upload Retries
223-224	Local Timer to Upload Logged Events
225-226	Movement Timer Before Local Timer Activation
255	Offline Tracking - Auto Upload configuration
259-260	Offline Tracking - Time to Auto Upload after Trip Stop
261	Trailer Connected mode: Over-speed Start Velocity threshold
262	Trailer Connected mode: Over-speed End Velocity threshold
263	GPS Peeking – Max. On Time
264 - 265	GPS Peeking – Off Time
266	Power Management mode
267	GSM Peeking – Maximum Modem On Time
268 - 269	GSM Peeking – Off Time
270	GSM Peeking – Maximum Network Registration Time

Address	Purpose
271 - 272	Hibernation Mode Delay
285	
295	Date and time features
296-299	Unused
300-309	White List Number 1
310-319	White List Number 2
320-329	White List Number 3
330-339	White List Number 4
340-349	White List Number 5
350	Unused
351-371	Operational Server APN Extension
381-401	Maintenance Server APN Extension
407-409	Unused
429 - 434	Dallas 01 code
435 - 440	Dallas 02 code
441 - 446	Dallas 03 code
449	Feedback bitmap
450	CelloAR: Alarm Cadence outputs bitmask
451	Time zone (for Cellocator MDT synchronization)
455	Velocity threshold for HIGH SPEED mode
465	Additional inputs functionality control bitmask
466	Analog Measurement Averaging Time
467	Accelerometer Configuration
468	Voltage Level Threshold IgnitionOn Detection

Address	Purpose
469	Internal variable: AHR counter
470	Towed Mode
471	UART Baud rate
473	Speed Range Threshold V0
474	Speed Range Threshold V1
475	Speed Range Threshold V2
476	Harsh Braking Threshold for Speed range 0
477	Harsh Braking Threshold for Speed range 1
478	Harsh Braking Threshold for Speed range 2
479	Harsh Braking Threshold for Speed range 3
480	Course Delta Threshold for Speed range 0
481	Course Delta Threshold for Speed range 1
482	Course Delta Threshold for Speed range 2
483	Course Delta Threshold for Speed range 3
484	Mask of Authentication Distress
485	Time Based Alert Period Multiplier for NOIP mode
492	Idle Speed Alerts Control Bitmask
493	Time Based Events Mask Bitmap
494	Time Based Distress Mask Bitmap
496	GPS Events Mask (second byte, the first is on 99)
497	Active GPS Distress Triggers Bitmapped mask (second byte, the first is on 102)
499	Time event period in Roaming
500	GPS Navigation Start/Stop Filter
501	Restore Output State after Reset and Shipment mode Bitmask
502 - 503	Outputs Inversion Mask

Address	Purpose
504	Maximum number of AHR retries
509	GPS management bitmap
510	Vehicle's Driver speed delta relative to GPS speed
511	Acceleration Threshold for Speed range 0
512	Acceleration Threshold for Speed range 1
513	Acceleration Threshold for Speed range 2
514	Acceleration Threshold for Speed range 3
515	Registration Lack Timeout (for Modem's AHR)
516	Local RPM Calibration Input/output selection
517	Local RPM Calibration 1st Measurement Point
518	GNSS Internal Antenna No-Fix-Time Timeout (Only Cello-IQ GNSS)
519	GNSS External Antenna No-Fix-Time Timeout (Only Cello-IQ GNSS)
520	CFE - Analog measurements update period – Home Network
521	CFE - Analog measurements update period – Roam Network
522	GSM Jamming Detection – Activated outputs release configuration
523	Momentary Driver Behavior events: First output
524	Momentary Driver Behavior events: Second output
525	Application Configuration byte 9
526	Application Configuration byte 10
528	Outputs by OTA monitoring
533	Application configuration 12
534-539	Reserved for Application configuration
604	Communication Events Mask
606	Crash event activate output
607	Master and Reservation Slots Allocation

Address	Purpose	
609	Input change activate output	
650	Auxiliary Satellite Unit- Enable Periodic Distress Events Auxiliary Satellite Unit- Satellite Operational Mode	Advanced Auxiliary Satellite Unit
656	Auxiliary Satellite Unit- Periodic Distress Report Period	
661-990	Dallas codes 31 to 85	
916	Zeppelin Off Battery Voltage Threshold	
1004	Geo-Fence Alert Mask for events	
1005	Geo-Fence Alert Mask for distress	
1006	Geo-Fence violation filter	
1008	Roaming Operator’s Management - Timer of Auto-Search	
1009	Roaming Operator’s Management - Number of PLMNs programmed	
1010-1012	Roaming Operator’s Management - PLMN 1	
1013-1015	Roaming Operator’s Management - PLMN 2	
…	…	
1307-1309	Roaming Operator’s Management - PLMN 100	
1314 - 1317	Reserved for Customer’s Use designed to store customer’s proprietary data (like specific EEPROM content identifier)	
1320	PSP - Polling Interval	
1321	PSP - Allowed number of communication failures	
1322-1325	Geofence Outputs activation 0-3	
1326-1329	New SIM PIN	
1330	First Usage Counter input	
1331	Second Usage Counter input	
1332	Usage Counter Reporting interval	

Address	Purpose
1343	PSP – Echo Timeout
1344	Wake Up message configuration
1345	Auxiliary Satellite Unit (Only Cello-IQ GNSS)
1347	Application Configuration byte 5
1348	Application Configuration byte 6
1349	Application Configuration byte 7
1350	Application Configuration byte 8
1351	Violation of additional GP Frequency thresholds
1354	GSM band and authentication type
1355	Periodic transparent mode peek time
1356	Periodic transparent mode cycle time
1357	Door Event Begin Additional Time Filter
1358	Door Event End Additional Time Filter
1359	Shock Event Begin Additional Time Filter
1360	Shock Event End Additional Time Filter
1361	Distress Event Begin Additional Time Filter
1362	Distress Event End Additional Time Filter
1363	Unlock Event Begin Additional Time Filter
1364	Unlock Event End Additional Time Filter
1365	Lock Event Begin Additional Time Filter
1366	Lock Event End Additional Time Filter
1367	Ignition (as GP) Event Begin Additional Time Filter
1368	Ignition (as GP) Event End Additional Time Filter
1369	CFE In 1 Event Begin Additional Time Filter
1370	CFE In 1 Event End Additional Time Filter

Address	Purpose
1371	CFE In 2 Event Begin Additional Time Filter
1372	CFE In 2 Event End Additional Time Filter
1373	CFE In 3 Event Begin Additional Time Filter
1374	CFE In 3 Event End Additional Time Filter
1375	CFE In 4 Event Begin Additional Time Filter
1376	CFE In 4 Event End Additional Time Filter
1377	CFE In 5 Event Begin Additional Time Filter
1378	CFE In 5 Event End Additional Time Filter
1379	CFE In 6 Event Begin Additional Time Filter
1380	CFE In 6 Event End Additional Time Filter
1387-1388	Go / Halt Speed Detection threshold
1389	Go / Halt Time threshold filter
1390	Go / Halt – Session Control Bitmask
1391	Modem type code for Maintenance Server
1392-1395	Maintenance Server IP address
1396-1397	Maintenance Server Target Port
1398	Maintenance Server configuration bitmask
1399	Maintenance Server connection period
1400	Maintenance Server Session Time Update
1403-1432	Maintenance Server APN
1433	Vector Change Detection Bitmask
1434	Compressed Vector Change Report Timeout
1435	Vector Change Detection angle
1438	CFE multiplexer protocol assignment for serial interface 3
1439	CFE multiplexer protocol assignment for serial interface 4

Address	Purpose	
1440	CFE multiplexer protocol assignment for serial interface 5	
1443	Unused	
1444	Cellular Network Selection	
1445	IoT Technology	
1448-1609	Dallas codes 04 to 30	
1620	Select Measurement source reported in Byte 26 of OTA Msg type 0	
1621	Select Measurement source reported in Byte 27 of OTA Msg type 0	
1622	Select Measurement source reported in Byte 28 of OTA Msg type 0	
1623	Select Measurement source reported in Byte 29 of OTA Msg type 0	
1625	GPS DOP Threshold	
1626-1649	Maintenance Server APN Username	
1650-1673	Maintenance Server APN Password	
1674	Input Type / Assigned function	Door (pin 14)
1675-1676	Scaling Factor for Frequency report on Door input	
1677	Freq./ Analog Input Configuration Byte	
1678-1679	Frequency / Analog Low Threshold / Discrete Wet/Dry Threshold (1678)	
1680-1681	Frequency / Analog High Threshold	
1682	Violation Time Filter (Frequency / Analog)	
1685	Function buttons events- Door input	
1686	Averaging factor for Door Input	
1687	Input Type / Assigned function	
1688-1689	Scaling Factor for Frequency report on Shock input	
1690	Freq./ Analog Input Configuration Byte	

Address	Purpose	
1691-1692	Frequency / Analog Low Threshold / Discrete Wet/Dry Threshold (1691)	Shock (pin 15)
1693-1694	Frequency / Analog High Threshold	
1695	Violation Time Filter (Frequency / Analog)	
1698	Function buttons events- Shock input	
1699	Averaging factor for Shock Input	
1700	Assigned function	Panic (Distress) (pin 16)
1701	Threshold for Panic Input	
1702	Averaging factor for Panic Input	
1703	Assigned function	Unlock (pin 11)
1704	Threshold for Lock Input	
1705	Averaging factor for Lock Input	
1706	Assigned function	Lock (pin 5)
1707	Threshold for Unlock Input	
1708	Averaging factor for Unlock Input	
1709-1710	CelloAR: Keyboard Configuration Bitmask	
1711	Reserved for manufacturer usage (Timer of retry of SIM operation upon failure)	
1712-1713	CelloAR: Alarm Cadence duration and cycles	
1714-1715	CFE COM 1 (Cello Port) configuration	
1716-1717	CFE COM 3 configuration	
1718-1719	CFE COM 4 configuration	
1720-1721	CFE COM 5 configuration	

Address	Purpose
1722-1725	CFE Spare
1726	CFE Control
1727	CFE Hibernation setting bitmask
1728-1753	CFE Reserved
1754	CFE Bluetooth Page Mode
1755-1756	CFE Reserved
1757	CFE Page scan mode
1758-1766	CFE Bluetooth Pin Code
1767-1768	CFE Infrastructure for COM 2 (Bluetooth) configuration
1769-1777	CFE Bluetooth Configuration (Infrastructure)
1778-1809	CFE Local Bluetooth device’s friendly name.
1810	CFE Input1 Type / Assigned function
1811	CFE Averaging factor for Input1
1812-1813	CFE Scaling Factor for Frequency report 1
1814	CFE Discrete Wet/Dry Threshold
1815	CFE Spare
1816	CFE Input2 Type / Assigned function
1817-1818	CFE Averaging factor for Input2
1819	CFE Scaling Factor for Frequency report 2
1820	CFE Discrete Wet/Dry Threshold
1821	CFE Spare
1822	CFE Input3 Type / Assigned function
1823	CFE Averaging factor for Input3
1824-1825	CFE Scaling Factor for Frequency report 3

Address	Purpose
1826	CFE Discrete Wet/Dry Threshold
1827	CFE Spare
1828	CFE Input4 Type / Assigned function
1829	CFE Averaging factor for Input4
1830-1831	CFE Scaling Factor for Frequency report 4
1832	CFE Discrete Wet/Dry Threshold
1833	CFE Spare
1834	CFE Input5 Type / Assigned function
1835	CFE Averaging factor for Input5
1836-1837	CFE Scaling Factor for Frequency report 5
1838	CFE Discrete Wet/Dry Threshold
1839	CFE Spare
1840	CFE Input6 Type / Assigned function
1841	CFE Averaging factor for Input6
1842-1843	CFE Scaling Factor for Frequency report 6
1844	CFE Discrete Wet/Dry Threshold
1845	CFE Spare
1846	CFE Inputs state update configuration
1847-1913	CFE Reserved for future use
1911-1919	PointerCept Base – Mobile App Password
1914	Lock to Certain IMSI
1917-1920	Speed Limiting Geo-Fence Thresholds: Each Geo-Fence can select 1 of 4 Speed Limit thresholds by setting bits 30-31 in the fence configuration
1921-2020	Geo Fence heading angle (Infrastructure)
2044	Tilt Tamper Messaging

Address	Purpose
2045	Tilt Tamper Angle Change Threshold
2046	Tilt Tamper Time Filter
2050	Orientation Change Messaging
2051	Orientation Change Angle Change Threshold
2052	Orientation Change Time Filter
2084	PointerCept Base – Specific RF Component Control
2085	PointerCept Base – Enable PLL AFC, Enable Adaptive Channel Filter BW, RSSI Averaging Method
2086	PointerCept Base – RSSI Latch Method
2087	PointerCept Base – Preamble Timeout
2088	PointerCept Base – Hop Conditions
2089	PointerCept Base – RSSI Threshold
2090	PointerCept Base – RSSI Timeout
2091	PointerCept Base – Enable Charging During Ignition Off
2092	PointerCept Base – Manual Power Control of Main Modules
2093	PointerCept Base – End Unit Preamble Length
2084	EBLE enable
2368-2369	Maximum Possible Scaled Frequency
2370	Violation Timer for 1st additional GP Frequency threshold
2371	Violation Timer for 2nd additional GP Frequency threshold

Address	Purpose
2372-2373	1st additional GP Frequency threshold
2374-2375	2nd additional GP Frequency threshold
2376	Feedback for driver behavior violations bitmask
2377-2379	Configuration of 1st output for continuous driver behavior violation
2380-2382	Configuration of 2nd output for continuous driver behavior violation
2383	Driver behavior- continuous violation feedback Logic
2384	Light crash detection threshold
2385	Heavy crash detection threshold
2386	Coasting detection - Coasting Violation period
2387	Coasting detection - Speed threshold
2388-2389	Coasting detection - Engine Speed threshold
2390	Enable crash detection feature, Enable EDR event for Light/Heavy crash, Enable EDR distress for Light/Heavy crash
2391	Alternative Over-Speed threshold for Input Dependent mode
2392	Timeout for Trailer Connection status change
2393	Dallas Family of Trailer Identifier
2394 -2425	Default target DNS Address (for Maintenance Server)
2426	GSM Jamming Detection - 1st activated output
2427	GSM Jamming Detection - Template of 1st activated output (1st byte)
2428	GSM Jamming Detection - Template of 1st activated output (2nd byte)
2429	GSM Jamming Detection – 2nd activated output
2430	GSM Jamming Detection - Template of 2nd activated output (1st byte)
2431	GSM Jamming Detection - Template of 2nd activated output (2nd byte)
2432	GSM Jamming Detection - Delay for output activation for the 1st output
2433	GSM Jamming Detection - Delay for output activation for the 2nd output

Address	Purpose
2434-2437	Pulse Counter: Shock Input: Current Pulse Count (32 bits, Little Endian-LSByte on 2438)
2438-2441	Pulse Counter: Door Input: Current Pulse Count (32 Bits, Little Endian-LSByte on 2442)
2442-2443	Pulse Counter: Door Input: Scaling Factor: Multiplying this 16 bit Little Endian value with the current Door pulse count will translate the pulse count into Volume units (For example a scaling factor of 1 indicates 1 pulse represents 1 litter)
2444-2445	Pulse Counter: Shock Input: Scaling Factor: Multiplying this 16 bit Little Endian value with the current Shock pulse count will translate the pulse count into Volume units (For example a scaling factor of 1 indicates 1 pulse represents 1 litter)
2446-2447	Pulse Counter: Defines the Pulse Counter periodic Transmission Period This 16 Bits Little Endian value has a time resolution of 15 Minutes or 15 Seconds (configurable, address 2461).
2448	Excessive RPM events Config
2449-2451	Feedback for Excessive RPM event 1
2452-2454	Feedback for Excessive RPM event 2
2455-2456	Excessive RPM (Engine Speed) threshold 1
2457-2458	Excessive RPM (Engine Speed) threshold 2
2459	OneWire Temperature msg 9 update rate. Home Network
2460	OneWire Temperature msg 9 update rate. Roam Network
2461	Pulse Counter Periodic Transmission Resolution
2462	1-Wire Temperature Sensor High Threshold
2463	1-Wire Temperature Sensor Low Threshold
2464-2495	Operational Server DNS Address
2496-2516	Geo-Fence 1 Configuration
….	….
4080-4095	Geo-Fence 100 Configuration
4097	Application configuration byte 13

Address	Purpose
4100	CAN operational mode select
4101	OBD2 CAN Physical layer Configuration
4102	CAN Application Control 1
4103-4104	Vehicle's Fuel tank capacity
4105	Speed Correction Delta
4106	CAN Application Control 2
4107	CAN Application Control 3
4119-4123	K-Line
4124	J1708 features
4125	CAN Application Control 4
4530-4525	CAN bus filters configuration
5234-5237	Time Report Period
5238-5239	Fuel Level IIR Filter Factor
5240-5241	Filter of Idle speed duration
6498	CAN application control 4 (CAN #2 Configuration)
6499	CAN application control 5 (CAN #2 Configuration)
6500–6541	Dallas codes 86 to 92
6550-6574	Geo-Fences priority
6575-6622	Dallas codes 93 to 100
6643	Especial Speed Threshold 1
6644	Especial Speed Threshold 1 Timeout
6645	Especial Speed Threshold 2
6647-6649	Distance Event when the speed is below the threshold
6650-6652	Distance Event when the speed is above the threshold
6654-6655	Spare

Address	Purpose
6656-8191	Cello-IQ GNSS, Cello-CANiQ New GNSS programming parameters: (See CSA Programming Manual.docx for details)
8199	GPIO1/2 Configuration

5.2 Bitmask Field Allocations

This field describes the allocation of configuration bits in the bitmap configuration bytes. The description of each bit is provided in other sections in this document.

5.2.1 *Application Configuration*

Address: 0, Application Configuration byte 1

Enable Transparent Mode		Enable warning output activation during Gradual immobilization	Ignition filter source for starting Driver Authentication time calculations	Presentation of inputs in wireless Cellocator protocol	Enable conditional activation of immobilizer	Enable infinite driver notification when Driver is not identified	_D2HLink_1184351
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1, Application Configuration byte 2

Wake up from hibernation upon periodical Usage counter update timer expiration	Enable Command Authentication	Enable Immobilizer activation while there is no Authentication code	Enable modem's power control by Door input	Generate an event per AHR	Ignore Geo-Violations on Boot	Shorten cellular registration timeout	
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 3, Hibernation mode communication settings

Reserved		Reserved			Renew GPRS upon drop in (in semi-hibernation)	Enable Unit Ignition-ON and activate CAN#2 upon Connecting Electrical Vehicle to Charging Source	Enable Unit Ignition-ON and activate CAN#1 upon Connecting Electrical Vehicle to Charging Source
Bits 7	Bits 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 4, Hibernation mode communication settings

Enable Pre-Hibernation distress	Enable Pre-Hibernation event	Enable Data Forwarding From Serial Port By SMS in semi-hibernation	Enable Active SMS in Hibernation	Enable Incoming Voice Call in semi-hibernation	Reserved	Enable Intermediate state of Anti-flooding in semi-hibernation	Enable Auto Answering Incoming call in semi-hibernation
Bits 7	Bits 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 5, Network keep-alive period

Reserved		Enable network keep-alive by FW	Network keep-alive period (in minutes, 0 will take effect as 1)				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 6, Application Configuration byte 3

Automatic CFE Power mode control (Infrastructure)	Enable CFE	Overlapping Geo-Fence logic: Global/ Discrete	Enable Privacy Mode	GPS Reset on ignition off When not in navigation	GPS Reset on ignition off When in Navigation	Disable Active Transmissions	Enable CFE as I/O Extender
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 7, Application Configuration byte 4

Reserved for CAN Bus related parameters		Forward data, received from COM port as a text SMS	LED Management disable 1-Disable 0-Enable		Enable Usage Counters	PSP Enable	
Bit 7	Bit 6	Bit 5	Bit 4	Bit3	Bit 2	Bit 1	Bit 0

Address: 1347, Application Configuration byte 5

Enable RemoteCamera	Enable CFE data updates during Ignition Off	Enable Auto-programming of CFE due to CRC32 error		Enable CFE connected& disconnected distress	Enable CFE connected& disconnected events		Enable Max Speed Report
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1348, Application Configuration byte 6

	Enable Offline tracking	Consider Unknown Operators As Forbidden		Disable GSM Jamming Event (Legacy + Ignition On)		Enable Auto SIM PIN locking	Enable OTA Ack to Forward from OTA to Serial Data Packet
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1349, Application Configuration byte 7

Enable controlling of employees work time	Enable Trailer Connection Distress	Enable Trailer Connection Event	Enable differentiation between the driver and the passenger	Enabling reading a 256-bit EEPROM of DS1971	Backward compatible OTA msg type 8	Enable Dallas White and Black Lists support	Enable Monitoring logical status of Ignition in OTA packets
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1350, Application Configuration byte 8

Driver Behavior (CSA) Disable 0-Enable 1-Disable	Enable event for additional freq. threshold violation 0 – Disable 1- Enable	Transmit OTA FIFO method 0 – Parallel method (Legacy) 1 – Serial method	Coasting detection configuration				
			Enable Distress for Coasting 0 – Disable 1- Enable	Enable event for Coasting 0 – Disable 1- Enable	RPM threshold type 0 – Lower than (default) 1- Higher than	Speed threshold type 0 – Lower than 1- Higher than (default)	
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 525, Application Configuration byte 9

Disable GSM Jamming Event (Ignition Off) 0-Do not Disable 1-Disable	Advanced GSM Jamming Detection (Ignition On/Off behavior)	Enable Advanced Recovery (Disable Dallas Based Driver ID Support) 0- Legacy Fleet mode 1 – Legacy Fleet and Advanced Recovery Mode (External KeyPad)	Universal Radio Communication Tester 0-Disable 1-Enable Production tester only		USIM application (Relevant for 2G modem variants only) 0- USIM application Disabled 1- USIM application Enabled, SIM Application Toolkit disabled	Infrastructure Robbery Mode while driving 0-Disable 1-Enable

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

Address: 526, Application Configuration byte 10

				Enable Report on engine hours from engine RPM enable (supported by 40,50 variants only) 0-Disable 1-Enable	Local RPM Calibration Enable 0-Disable 1-Enable	Force one second resolution for Roam 0-Legacy resolution 1- one Second resolution	Force one second resolution for Home 0-Legacy resolution 1- one Second resolution
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 533, Application Configuration byte 12

						Std. Immobilizer can be changed only when speed is low	Selected output can be restored only by OTA command
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 4097, Application Configuration byte 13

		GPS first samples to filter out					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.2 *Communication Events Mask*

Address: 604

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

5.2.3 *Communication Settings in Home/Roam GSM Network Mode*

Address: Home GSM: 201; Roam GSM: 203; Hibernation: 3

Enable SMS			Generate Cell ID packet (RT) with any distress while there is no valid GPS	Generate Cell ID packet (logged) with any event while there is no valid GPS	GPRS Enable		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: Home GSM: 202; Roam GSM: 204; Hibernation: 4

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

5.2.4 *WAKE UP Message Configuration*

Address: 1344

Enable GPRS Wake up message	Enable SMS Wake up message	Number of repetitions, Value of zero set number of retries to 64					
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.5 *GPS Management Bitmap*

Address: 509

		Not used			Reset last known location on Ignition off	Enable Pythagoras Calculation	Enable Speed x Time Calculation (SxT)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.6 *Maintenance Server Configuration Bitmap*

Address: 1398

Reserved		Enable Modem FW Upgrade from the Maintenance Server	Enable auto connection to maintenance server	Reconnect to the maintenance server after firmware upgrade	Enable connection to the maintenance server on each power up.	Enable firmware upgrade from the maintenance server	Enable programming updates from the maintenance server
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.7 GSM Band / GPRS Auth Type Programming

Address: 1354

	PPP GPRS Connection Authentication Selection Mode					PPP GPRS Connection Authentication type (only for Manual Authentication type Selection mode)	
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.8 UART Configuration

Address: 471

Reserved				Baud rate			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.9 Alternative Inputs Usage Bitmap

Address: 465

1-Wire Temperature Sensor Filter	Enable 1-Wire Temperature Sensor Distress Events	Enable 1-Wire Temperature Sensor Logged Events	"Private"/"Business" mode toggling	Enable modem's power control by shock input	
Bits 5-7	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.10 Inputs Triggering Distress Voice Call

Address: 505

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

5.2.11 *Speaker of Hands Free - Mute settings*

Address: 506

Spare					Spare	Temporary Mute Speaker During Distress Calls 0-Don't Mute 1-Mute	Temporary Mute Speaker during auto-answered incoming calls 0-Don't Mute 1-Mute
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Default value:

Bit 0: Do not mute

Bit 1: Do not mute

5.2.12 *Time Based Mask Bitmap*

Address: 493 for events

494 for distress

Only in 494 Do not wake up from hibernation upon comm.idle distress	Enable Comm.Idle during modem off	Reserved				Enable Time events	Enable event for Communication Idle
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.13 *Over (and Idle) Speed Session Control Bitmap*

Address: 492

Create Idle/Over Speed End event for open session per ignition Off	Start Idle speed timer with ignition On	Don't use time filter to close Idle speed session	Don't use time filter to close Over speed session				
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.14 *Go/Halt Session Control Bitmap*

Address: 1390

Spare			Don't use time threshold filter for "Go" detection	Multiplier for Go/Halt Time Threshold filter For "Halt" detection			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.15 *GPS Alerts Mask Bitmap*

Address: 99 For events

102 For distress

Enable event upon location change detection when Ignition Off	Enable event upon speed detection when Ignition Off	Enable Sudden Course Change Sensor	Enable Sudden Speed Change sensor	Enable Idle Speed Events	Enable Over Speed Events	Enable Distance Events	Enable GPS Navigation Start/Stop Events
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 496 For events

497 For Distress

	Not used				Enable Go/Halt Events 0 – Disable 1 - Enable		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.16 *Time/Distance Alert Multipliers for High Speed Mode*

Address: For Home GSM: 92

For Roam GSM: 35

				Distance Event Multiplier for HIGH SPEED mode			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.17 *Date and Time features*

Address: 295

Not used							Enable proximity reader date updating
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.18 *Mask of Authentication Alerts*

Address: 123 for events

Enables Dallas Bus 0 –Bus mode 1 –Point to point (Bus mode disabled) Not used	Enable resending "Driver Authentication" upon each detection	Enable Authentication confirmation output activation	Enable Authentication reminder output activation	Enable "Dallas ID updated" event even if it is not in the list	Enable Pre-defined driver ID's list	Authentication updated event	Driving without Authentication
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 484 for distress

Not used						Authentication updated event	Driving without Authentication
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.19 *Discrete Inputs Masks*

Address: For Inversion 100-101

Inputs Events on Falling 124-125

Inputs Events on Rising 126-127

Inputs Distress on Falling 128-129

Inputs Distress on Rising 130-131

Lower byte

Unlock	Panic	Driving Status (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

Upper Byte

Ignition Input as GP input	Accelerometer status	CFE In 6	CFE In 5	CFE In 4	Lock	CFE In3	CFE In2
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.20 *Mask of Analog Inputs Alerts*

Address: 121 for events, 122 for distress

Ignition Switch On				Ignition Switch Off			
Backup battery Low level	Backup battery disconnected	Main Power Low Level	Main Power Disconnected	Backup battery Low level	Backup battery disconnected	Main Power Low Level	Main Power Disconnected
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.21 *GP Frequency Input Configuration Byte*

Address: 1677 for Door input

1690 for Shock input

Ignore violation on Ignition On	Don't use time filter for voltage / frequency violation end	Enable voltage / frequency violation end distress	Enable voltage / frequency violation end event	Enable voltage / frequency violation start distress	Enable voltage / frequency violation start event	Input violation type	
						0 – Thresh.	0 – Low 1 - High
0-Ignore 1 – Start violation on Ignition On	0-Use 1 – Don't use	0-Disable 1 - Enable	0-Disable 1 - Enable	0-Disable 1-Enable	0-Disable 1-Enable	1 – Range	0 – Keep In 1 - Keep Out
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.22 *Violation of Additional GP Frequency Thresholds*

Address: 1351

2nd additional GP frequency threshold				1st additional GP frequency threshold			
Enable distress for falling violation	Enable Event for falling violation	Enable distress for rising violation	Enable Event for rising violation	Enable distress for falling violation	Enable Event for falling violation	Enable distress for rising violation	Enable Event for rising violation
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.23 *Restore Output State after Reset and Shipment mode Bitmask*

Address: 501

Backup immobilizer state	Reserved	Blinkers	LED	St. Immobilizer	GPIO2	Siren	Gradual Stop
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.24 *Outputs Inversion Mask*

Address: 502

CFE Out 5	CFE Out 4	CFE Out 3	CFE Out 2		Gradual Stop	Unused	CFE Out1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 503

Unused	CFE Out 6	Stand. Immobilizer	GPIO2	Blinkers	Unused	Unused	LED
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.25 *Geo-Fence Alert Mask*

Address: 1004 - For events

1005 - For distress

Unused		Speed Limiting Geo-Fence Event	No Modem Zone Entry	Geo Hot Spot Traversal	Way Point violation	Keep Out Fence violation	Keep In Fence violation
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.26 *Silent Delay Configuration*

Address: 1401

Trigger Silent delay upon Door open detection	Trigger Silent delay upon Ignition On detection	Time between Silent Delay expiration beeps			Number of Silent Delay expiration beeps		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.27 *Offline Tracking - Auto Upload Configuration*

Address: 255

Unused						Memory Full	Ignition Off Event
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.28 *Feedbacks / Alarm Triggered / Alarm Cadence Outputs*

Address: 449 For Feedbacks

450 For Alarm Triggered outputs (CelloR) / Alarm Cadence outputs (CelloAR)

Unused			Blinkers	Unused			Siren Note: this output is unavailable for CAN variants
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.29 *Active Correlation Lines*

Address: 287

Unused					Shock (pin 15)	Unlock (pin 11)	Lock (pin 5)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.30 *Vector Change Detection Bitmask*

Address: 1433

Reserved				Prevent Curve Smoothing Message generation during "Halt" mode	*Enable* Compress Vector change Detection	Enable Vector change Detection Distress	Enable Vector change Detection Events
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.31 *Feedback for Driver Behavior Violations Bitmask*

Address: 2376

Reserved	Excessive RPM	Idle Speed	Sudden course change	Harsh Acceleration	Harsh Breaking	Coasting	Over Speed (irrespective of the source of threshold)

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

5.2.32 *Driver Behavior Continuous Violation - Feedback Bitmask*

Address: 2377 for first output

2380 for second output

reserved		Output Activation Pattern (Upon Driver behavior violation)			Output, auto-activated upon Driver behavior violation detection		
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.33 *Driver Behavior Continuous Violation - Output Activation Template*

Address: 2378 for first output

2381 for second output

Number of activations in a session				Activation length			
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 2379 for first output

2382 for second output

Time between the activation sessions				Number of activation sessions			
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.34 *Driver Behavior Continuous Violation - Feedback Logic*

Address: 2383

Feedback Violation Deactivation time threshold In seconds					Sustain Excessive RPM violation feedback till violation ends	Sustain Coasting violation feedback till violation ends	Sustain Speeding violation feedback till violation ends
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bits 0, 1, 2:

- **Name in Programmer:**
  - Sustain Speeding violation feedback till violation ends
  - Sustain Coasting violation feedback till violation ends

- Sustain Excessive RPM violation feedback till violation ends

- **Description**: These bits enable the user to sustain continuous violation feedbacks (according to template) till violation ends. If it is cleared then the feedback template will be generated once. They are considered only if Output Activation Pattern (upon continuous driver behavior violation) is set to option number 5 (Warning of delayed violation registration).
- **Type:** Flag
- **Default value**: 10
- **Range**:

Bits 3 to 7:

- **Name in Programmer:** Feedback Violation Deactivation time threshold
- **Description**: if Output Activation Pattern (upon continuous driver behavior violation) is set to option number 5 (Warning of delayed violation registration) Continuous violations will be deactivated when the violation time will be longer than the time defined in this field. Please refer to Feedback Violation Deactivation time threshold
- **Type:** Decimal
- **Default value**: 10
- **Range**: 0 – 255
- **Units**: 1 Second

5.2.35 *Driver Behavior Momentary Violation - Output Activation Template*

Address: 523 for first output

524 for second output

Number of repetitions (Duty cycle 50%)		Activation length (in resolution of 0.5 seconds).			Output number		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.36 *Outputs, Auto-Activated upon Jamming Detection*

GSM jamming detection can activate outputs for Driver feedback. The configurable options enable the selection of one of the unit's outputs, and define the patterns sent over the selected output. It is possible to activate up to two outputs for a jamming event. When the advanced jamming mode is enabled (see Advanced GSM Jamming Detection Mode), the unit differentiates between GSM jamming detection during Ignition-ON and Ignition-Off. Each jamming condition can activate up to two outputs. The advanced mode reuses the same outputs activation configuration used in the non Advanced mode for jamming Outputs activation during Ignition-On.

5.2.36.1 Outputs, Auto-Activated upon Jamming Detection (while in Ignition-On state)

Output Activation Pattern upon jamming detection

Addresses: 2426 (and 2429 for second output)

			Activation Pattern			Output number		
Bit 7	Bit 6		Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Template of Output Activation upon Jamming Detection byte 1

Address: 2427 (and 2430 for second output)

Number of Activation pattern cycles in a session				Output Activation length			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Template of Output Activation upon Jamming Detection byte 2

Address: 2428 (and 2431 for second output)

Time between the activation sessions				Number of sessions			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Delay for output activation upon jamming detection

Address: 2432 (and 2433 for second output)

Delay for output activation							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.36.2 Outputs, Auto-Activated upon Jamming Detection while in Ignition-Off

Output Activation Pattern upon jamming detection – Ignition-Off

Addresses: 205 (and 208 for second output)

			Activation Pattern			Output number		
Bit 7	Bit 6		Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Template of Output Activation upon Jamming Detection byte 1 – Ignition-Off

Address: 206 (and 209 for second output)

Number of Activation pattern cycles in a session				Output Activation length			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Template of Output Activation upon Jamming Detection byte 2 – Ignition-Off

Address: 207 (and 210 for second output)

Time between the activation sessions				Number of sessions			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Delay for output activation upon jamming detection – Ignition-Off

Address: 211 (and 212 for second output)

Delay for output activation							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.36.3 Release Options of Jamming Detection

Address: 522

Enable release by Authorized Dallas	Enable release by Ignition Activity	Advanced Jamming detection: Enable release by Jamming End in Ignition-On	Advanced Jamming detection: Enable release by Jamming End in Ignition-Off	Only first Driver-ID deactivate output after jamming			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.37 *Accelerometer Configuration*

Address: 467

Start & Stop Detection using Voltage Level and Ignition Input State 0 - Disable 1 - Enable	Enable Towed mode 0 - Disable 1 - Enable	Start & Stop Detection Using Voltage Level and Accelerometer 0 – Disable 1 – Enable	Detection Sensitivity 0 - Very insensitive 1 - Normal 2 - Very sensitive 3 - spare	Movement Detection type: (movement / engine status) 0 – movement 1 – engine status	Enable GPS wake up upon movement for towing detection (don't care if bit 0 is set) 0 – Don't use 1 – Use.	Use "movement detection" by accelerometer for Start/Stop 0 – Start/Stop alerts by status of Ignition switch (legacy), 1 – Start/Stop alerts by movement detection using accelerometer. If this bit is enabled, all the logic normally dependent on status of Ignition Switch will be re-linked to the status of Movement detection.
Bit 7	Bit 6	Bit 5	Bits 3-4	Bit 2	Bit 1	Bit 0

5.2.38 *Towed Mode Configuration*

Address: 470

Bits 6-7	Bit 5	Bits 2-4	Bit 1	Bit 0

5.2.39 *Cello AR Keyboard Configuration Bitmask*

Address: 1709

Keyboard disconnection Disable (0) Enable (1)	Wrong keyboard detection Disable (0) Enable (1)	Keyboard message type 9 data	Enable Keyboard

Log	Distress	Alarm Cadence	Log	Distress	Alarm Cadence	source (Log or Direct) Log (0) Real time (1)	Disable (0) Enable (1)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1710

Unused		Disable pairing When paring is disabled an Keyboard communication lost detected the same paring event will Enable (0) Disable (1)	Generate Msg. Type 0 reply for a commands addressed to Keyboard Disable (0) Enable (1)	Activate Alarm Cadence upon Hot Wiring detection Disable (0) Enable (1)	Malfunction report (Cello-AR Messages) Disable (0) Enable (1)		Enable Forwarding data from keyboard to Serial Port Disable (0) Enable (1)
					Log	Distress	
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.40 *Cello AR: Alarm Cadence duration and cycles*

Address: 1712

Reserved				Number of cycles			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 1713

On Time of Alarm Cadence activation (3 Seconds/bit)					Off time (between activations, 3 seconds/bit)		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.41 *Output activation*

Address: 606

Reserved	Passive Arming Immobilizer Control	Crash detection indication output selection	Crash type to output

Bit 7	Bit 6	Bits 2-5	Bits 0-1

Address: 609

Input-to-output feature output selection	Input to output selection
Bits 4-7	Bits 0-3

5.2.42 *GPS power mode*

Address: 402

Spare	Enable adding a fresh GPS to the last chunk of the file	GPS power mode			
Bits 5-7	Bit 4	Bits 3	Bit 2	Bit 1	Bit 0

1.1.1 Zeppelin Configuration 1

Address: 1714

Zeppelin Postpone Mount event until verified after short drive	Enable SNR Mount/Unmount Report Event		Spare				Zeppelin Unmount by SNR During Drive
Bit 7	Bit 6	Bit 5	Bit4	Bit 3	Bit 2	Bit 1	Bit 0

5.2.43 *Zeppelin Configuration 2*

Address: 235

Zeppelin Mount by SNR During Drive	Zeppelin Mount/Unmount Only Inside Geo-Fence	Enable Mount/Unmount Candidate by Impact Event	Enable Mount/Unmount by Drive Noise Event	Spare

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

5.2.44 *OTA Type 11 Additional configuration*

Address: 2367

	Add Module 41 to Module 28 Event-Code-30 (Zeppelin Detection)	Address 2367 Bit 1: Add Module 41 to Module 28 BLE Event	Add File Numerator to Module 68
	Bit 2	Bit 1	Bit 0

6 Communication and Configuration

6.1 Communication Events

6.1.1 *Enable Voice Call Events*

Address: [604, bit 1]

Description: This parameter enables to send logged events upon start/stop of incoming/outgoing voice calls.

Whenever a voice session is started and ended, the unit will create a type-0 event with **TR=18**:

- Upon start of incoming voice call, the unit will transmit a "Start Incoming Voice Call" event (**Type 0, TR 18, STR 1**).
- Upon stop of incoming voice call, the unit will transmit a "Stop Incoming Voice Call" event (**Type 0, TR 18, STR 0**).

Data Range: 1 - Enable, 0 - Disable

Default value: 0 - Disable

6.2 Communication Settings

6.2.1 *GPRS Settings*

6.2.1.1 Acknowledge OTA

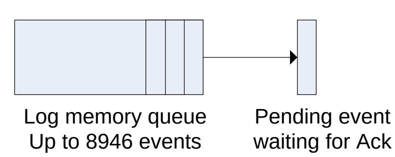
1.1.1.1.1 *Message Transit Acknowledge Timeout*

Address: 139

This parameter defines the maximum time the unit will wait for server to acknowledge a plain event (plain events are one of the four available event generation patterns proposed by Cellocator unit; refer to the Event Types section in this document). If no ACK is received by this time, the event will be retransmitted.

Event Delivery Algorithm

Once generated, a plain event is stored in the unit's Log memory.
This Log memory can store up to 8946 **plain** events.
When the Log memory is full, newer events will push out the older ones (FIFO). Events will be uploaded to the Control Center only when GPRS is available and will be deleted from the unit's Log memory only when acknowledgment is received



from Central Control. ***NOTE: Plain events will never be delivered by SMS!***

The unit supports one pending event waiting for server acknowledgment. When server acknowledgment is received, the pending event is deleted from the Log memory head, and the next event is moved to the pending event data structure in order to be sent to the server.

NOTE: Legacy units used to have 16 concurrent pending events.

If the Acknowledge is not received during the time defined in Message Transit Acknowledge Timeout, the event is resent.

Data format: 8-bit unsigned. Resolution is 1 Second.

Note that there is a separate control of ACK to forward data message from server to 3rd party device connected to the serial port of the unit (application configuration byte 5).

Value span: 1-255 Seconds

Default value: 32 Seconds

1.1.1.1.2 *Transmit OTA FIFO method*

Address: 1350 bit 5

Description: When this parameter is set to '1' the unit will send its transmit FIFO (queue) sequentially (serially), so no new message will be sent before the last one is acknowledged, unlike the legacy method which is in "parallel" (burst of messages, value of '0').

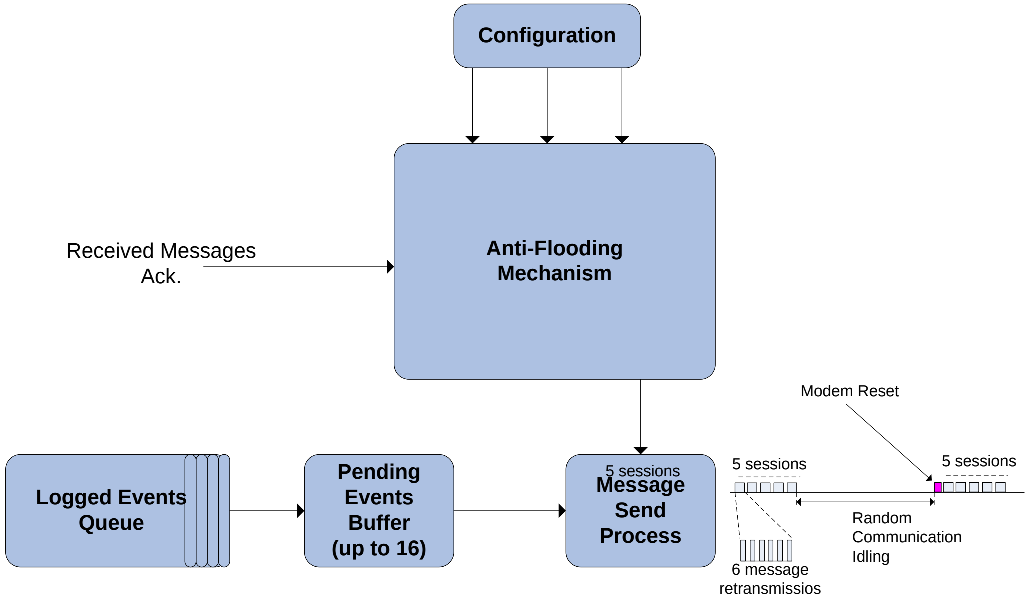
0 = Parallel method (Legacy)

1 = Serial method

Default value: 0 = Disable

6.2.1.2 Anti-flooding

The Anti-Flooding mechanism is designed to minimize the unit's message Retransmissions in situations where GPRS connection is available but the server is unreachable.
The Anti-flooding will randomize the idle communication time between message retransmission sessions to avoid server overloading in situations where the server becomes available after period of server unavailability and to avoid network overloading.



The block diagram above describes the Anti-Flooding mechanism. The Anti-Flooding mechanism's most important input is the received server acknowledgment; in case there are no acknowledge messages returned from the server, the Anti-Flooding mechanism will implement the following retry patterns:

Send each pending message 6 times while waiting for ack. between each transmission.

Repeat the above sessions 5 times.

Stop transmissions for a random time . This random period is defined in the diagram as "Random Communication Idling".

Reset the modem.

Go to step 1.

Hardcoded to 15 minutes ±15 minutes of randomization.

1.1.1.1.3 *Enable IP Up Alert (Event)*

Address: 202, bit 2 for home network

204, bit 2 for roam network

Description: The "IP up" alert is generated with every dial-up to GPRS in order to update the Central Control with the resent IP address of the unit. In cases when SIM card is associated with static IP, it is possible to cancel IP up events.

Note that "IP Up event" CANNOT be disabled if Intermediate state of Anti-flooding is enabled.

Default value: 1 – both enabled

6.2.1.3 Operational Server Support

The operational communication server is used for uploading positions and other events from the end unit. Normally this will be a communication gateway of the Central Control application.

1.1.1.1.4 *Operational Server APN*

Address: 36-65

Name in Programmer: APN

Description: This parameter contains an APN used upon dialing to an operational communication server.

Data format: 30 bytes string, first byte is length

Value span: First byte 0 to 0x1D, second to 30th - ASCII characters

Default value: ASCII "internet"

1.1.1.1.5 *Operational Server APN Extension*

Address: 351-371

Description: This parameter contains the extension of the operational APN server name. If the legacy operational APN server name is full (i.e. its length equal to 29), this extension will be concatenated with the legacy operational server APN name.

Data format: 21 bytes string, first byte is length

Value span: 1st byte - 0 to 0x14, 2nd to 21th – ASCII characters

Default value (Hex): Null

1.1.1.1.6 *Operational Server APN Username*

Address: 8-31

Name in Programmer: GPRS PPP Username

Description: This parameter contains a PPP username used upon dialing to an APN defined for operational server.

Data format: 24 bytes string, first byte is length

Value span: First byte 0 to 0x17, second to 24th - ASCII characters

Default value: ASCII "test"

1.1.1.1.7 *Operational Server APN Password*

Address: 141-164

Name in Programmer: GPRS PPP Password

Description: This parameter contains a PPP password, used upon dialing to an APN defined for operational server.

Data format: 24 bytes string, first byte is length

Value span: First byte 0 to 0x17, second to 24th ASCII characters

Default value: zeroes

1.1.1.1.8 *Operational Server IP Address*

Address: 66 to 69

Name in Programmer: Default Target IP Address (for GPRS)

Description: Stores an IP address of the operational server. All the messages (both active and passive, irrespectively to the source of the incoming command) during normal operation will be sent to this IP address.

If this parameter contains zeros, the unit will use an operational DNS instead.

Data format: 4 bytes IP address, Intel order (low significant bytes first)

Default value: 0.0.0.0 (change to the IP address of central command)

1.1.1.1.9 *Operational Server DNS Address*

Address: 2464-2495

Name in Programmer: Default target DNS Address (operational server)

Description: The Domain Name System (DNS) is a hierarchical naming system for computers, services, or any resource connected to the Internet or a private network. It translates domain names meaningful to humans into the numerical (binary) identifiers associated with networking equipment for the purpose of locating and addressing these devices worldwide.

In our case the DNS support is required in order to prevent a necessity to assign a static IP to each of the servers (operational and maintenance).

A domain name usually consists of two or more parts (technically labels), which are conventionally written separated by dots, such as example.com.

- Cello supports down to 2 levels subdomains (e.g. XXX.XXX.XXX.XXX), maximum length is 32 chars.
- Labels are restricted to a small subset of the ASCII character set known as LDH, the Letters A–Z in upper and lower case, Digits 0–9, Hyphen, and the dot to separate LDH-labels; see RFC 3696 section 2 for details.

The DNS will be used for dial up only if the IP address field of the corresponding server (in programming memory) is set to zero (e.g., 0.0.0.0).

If the IP address field of the corresponding server is not set to zero – the unit shall use this IP address for dial up.

Data format: 32 bytes string, first byte is length.

1.1.1.1.10 *Listening UDP Port (while connected to both Operational Server or Maintenance Server)*

Address: 107-108

Name in Programmer: GPRS Self Port

Description: This parameter stores the listening UDP port. This should be the "destination port" of incoming UDP messages, it will also be sent as a "source port" of an outgoing transmissions.

Value resolution & span: 0- 65535'

Default value: 231

1.1.1.1.11 *Operational Server Target Port*

Address: 109 -110

Description: This parameter stores the "destination port" of outgoing UDP or TCP (depends on Modem Type code) messages while connected to the operational server. This will be the also listening UDP or TCP port of target host.

Value resolution & span: 0- 65535'

Default value: 231

1.1.1.1.12 *Modem Type Code for Operational Server*

Address: 74

Description: This parameter defines dial up type, which is differs according to the communication platform and modem connected.

Valid values: According to the table below:

Value	Network
0	UDP/IP over GPRS
1-3	Not supported
4	TCP/IP over GPRS

Default value: 4 - TCP/IP over GPRS

6.2.1.4 Maintenance Server Support

The Cellocator unit supports a periodic connection to the maintenance server, which is used as a Service & Support Server.

It is possible to set an additional APN, IP address, ports and dial up type for the Maintenance Server; this server will be used for a periodical service communication sessions.

It is also possible to force the unit to connect to the specific server manually, using the OTA command (SMS or GPRS). If the command to connect to maintenance server is received during the communication peak of full hibernation – the unit will connect to maintenance server upon the end of the peeking.

The unit periodically connects (completely drop an existing connection and redial using the dedicated APN) to this server in order to check for the latest firmware and/or programming update. It is possible to enable auto connection to the maintenance server upon power up and upon firmware upgrade.

The connection to the maintenance server:

- In TCP mode - TCP socket establishment and a Maintenance Platform Manifest* packet paste into this socket.
- In UDP mode - it will be just a Maintenance Platform Manifest* UDP packet delivery to the Maintenance server and use listening port according to the configuration of the maintenance server.

An acknowledge (OTA message type 4) should be received in with a defined timeout; otherwise the platform manifest will be resent.

In case the unit cannot establish a connection to the maintenance server while the GPRS is available, it will use a dial up retry algorithm defined in Anti-Flooding section of this document.

If all the retries fail, the unit will stop trying and connect back to an operational server (instead of entering Anti-Flooding, as it would do while connected to an operational server).

If the timeout of periodical connection to the maintenance server expires while the unit is hibernating, it will not wake up; instead it will dial the maintenance server immediately after the next COM glancing.

It is possible to disable firmware upgrades or programming from the maintenance server.

The unit automatically disconnects from the maintenance server and connects back to its operational communication server after 3 minutes after the last communication transaction.

The unit does NOT send logged or distress events to the maintenance server. It keeps logging events as usual during the maintenance session (except during firmware upgrades) but does not upload them. The unit will reply to commands sent from a maintenance server.

Distress alerts and real time based alerts that occurred during the maintenance session **will be lost**.

The unit will ignore the incoming voice calls and the incoming SMS notification during the maintenance session (the SMS will be processed after the maintenance session end). Outgoing voice call initiation attempts (both plain and emergency) are ignored during the maintenance session.

After any reset occurred during the maintenance session (except the final reset of firmware upgrade procedure, see bitmap below) the unit will connect back to the primary server.

1.1.1.1.13 *Enable Programming Updates from the Maintenance Server*

Address: 1398, Bit 0

Description: If this bit is enabled the unit will accept updates of programming parameters from maintenance server.

Default value: 0 - Disable

1.1.1.1.14 *Enable Firmware Upgrade from the Maintenance Server*

Address: 1398, Bit 1

Description: If this bit is enabled the unit will perform firmware upgrade if the process will be initiated from maintenance server.

Default value: 0 – Disable

1.1.1.1.15 *Enable Connection to the Maintenance Server on each Power-Up.*

Address: 1398, Bit 2

Description: If this bit is enabled the unit will automatically connect to the maintenance server upon each power up.

Default value: 0 - Disable

1.1.1.1.16 *Reconnect to the Maintenance Server after Firmware Upgrade*

Address: 1398, Bit 3

Description: If this bit is enabled the unit will automatically reconnect to the maintenance server after firmware upgrade (irrespectively from what server, main or backup, the upgrade was performed).

If this bit is disabled the unit will connect back to an operational server immediately upon the end of the upgrade, without even validation of the upgrade process success.

Reconnection to the maintenance server after firmware upgrade is normally required in order to validate successful firmware upgrade and to set up new added configuration parameters.

Default value: 0 - Disable

1.1.1.1.17 *Enable Auto Connection to Maintenance Server*

Address: 1398, Bit 4

Description: If this bit is disabled the unit will never try connecting to the maintenance server automatically (even if enabled in previous bits), but it will still be possible to force the unit to connect to the maintenance server by a command from OTA.

Default value: 0 - Disable

1.1.1.1.18 *Maintenance Server Connection Period*

Address: 1399

Description: This parameter defines a time between automatic maintenance sessions. Maintenance server connection period will automatically randomize, in order to prevent a load on the maintenance server, caused by simultaneous connection of multiple units.

The randomization is affected by a unit's ID in the following way:

Real period = Programmed Period + {last 2 digits of decimal representing of unit's ID} [min]

Data format: 1 byte with a resolution of 90 minutes (1.5 hours).

In case of zero, the real period will be only {last 2 digits of decimal representing of unit's ID} [min]

Value span: 0-15.9 days

Default value: 16 dec (1 day)

1.1.1.1.19 *Maintenance Server APN*

Address: 1403-1432

Description: This parameter define a dedicated APN, used by the unit during GPRS dial up only during a connection to the maintenance server.

Data format: 30 bytes string, first byte is length

Value span: 1^{st} byte – 0 to 0x1D, 2^{nd} to 30th - ASCII characters

Default value (Hex): 08 69 6E 74 65 72 65 61 6C 00 …

1.1.1.1.20 *Maintenance Server APN Extension*

Address: 381-401

Description: This parameter contains the extension of the maintenance APN server name. If the legacy maintenance APN server name is full (i.e. its length equal to 29), this extension will be concatenated with the legacy maintenance server APN name.

Data format: 21 bytes string, first byte is length

Value span: 1^{st} byte - 0 to 0x14, 2^{nd} to 21th – ASCII characters

Default value (Hex): Null

1.1.1.1.21 *Maintenance Server APN Username*

Address: 1626-1649

Description: This parameter contains a PPP username used upon dialing to an APN defined for the maintenance server.

Data format: 24 bytes string, first byte is length

Value span: First byte 0 to 0x17, second to 24th - ASCII characters

Default value (Hex): 04 74 65 73 74 00 00 00 00 00 00 00 …. 00

1.1.1.1.22 *Maintenance Server APN Password*

Address: 1650-1673

Description: This parameter contains a PPP password, used upon dialing to an APN defined for the maintenance server.

Data format: 24 bytes string, first byte is length

Value span: First byte 0 to 0x17, second to 24th ASCII characters

Default value (Hex): 00 00 00 00 00 00 00 00 00 00 00 00

1.1.1.1.23 *IP Address (for GPRS) for Maintenance Server*

Address: 1392 to 1395

Description: Stores the target IP address used by the unit during a maintenance session.

Data format: 4 bytes IP address, Intel order (low significant bytes first)

Default value: 62.90.141.201 (current main maintenance server)

1.1.1.1.24 *Default Target DNS Address (Maintenance Server)*

Address: 2394-2425

Description: As per the DNS for the operational server, described earlier in this document.

The DNS will be used for dial up only if the Maintenance Server IP Address field is set to zero (e.g., 0.0.0.0). If the IP address field is not set to zero, the unit will use this IP address for dial up.

Data format: 32 bytes string, first byte is length

1.1.1.1.25 *GPRS Target Port for Maintenance Server*

Address: 1396-1397

Description: Those EEPROM cells store the "destination port" of outgoing UDP or TCP messages (during the maintenance session). This will also be the listening UDP or TCP port of target host.

Value resolution & span: 0 - 65535

Default value: 7435

1.1.1.1.26 *Listening UDP Port for Maintenance Server*

Address: 107 -108

Name in Programmer: Listening UDP Port

Description: As per for the operational server.

1.1.1.1.27 *Modem Type Code for Maintenance Server*

Address: 1391

Description: This parameter defines the connection type of the maintenance server.

Valid values: According to the table below:

Value	Network
0	UDP/IP over GPRS
1-3	Not supported
4	TCP/IP over GPRS

Default value: 0

1.1.1.1.28 *Maintenance Server Session Time Update*

Address: 1400

Description: The maintenance server will use default 3 Min session timeout when first connecting to the C+ server. After the first message arrives from the maintenance server to the unit, the FW will cancel the 3 Min time out, or what is left of it, and replace it with a new session timeout value defined by this parameter.

Valid values: Min time 30 Sec: 3

Resolution: 10 Sec

Default value: 90 Seconds

6.2.1.5 Network keep-alive

1.1.1.1.29 *Enable network keep-alive by FW*

Address: 5 bit 5

Description: When this parameter is set to '1', the unit will send to the network periodically a keep-alive message instead of the modem.

0 - Disable

1 - Enable

Default value: 0 - Disable

6.2.2 *SMS Settings*

6.2.2.1 SMS Destination Address

Addresses: 187-196

Description: Stores the default target address used by the unit. Under normal circumstances, this will be the SMS number of the SMS server of central control.

Note that this parameter defines only the default target address, which will be used only for active transmissions (i.e. transmissions that are automatically generated by the unit). Passive transmissions (i.e. replies for commands and queries) will be sent to the address that generated the command/query.

Data format (GSM-SMS): First byte should contain the total amount of digits that make up the actual address (not including address type byte). Second byte is the address type byte, which should be 91h for international address (recommended type to use, to allow roaming) or 81h for local address. The rest of the bytes contain the actual address, encoded in BCD. The order of the transmission is bytes with lower address first, lower nibbles (nibble = 4 bit) first. If only the lower nibble of a byte is used (this is legal only in the last byte – in case this is the last digit of the address), the higher nibble should have all of its bits set (the nibble should contain 15 dec). The rest of the bytes that are not used should contain FFh.

Default value: NULL.

6.2.2.2 SMS Center Address

Addresses: 177 – 186

Name in Programmer: SMSC Address

Description: This parameter stores the address of the cellular operator's SMS center. This parameter is applicable only for units that make use of SMS.

Data format (GSM-SMS): First byte should contain the total amount of bytes that actually contain the address (including address type byte). Second byte is the address type byte, which should be 91h for international address (recommended type to use, to allow roaming) or 81h for local address. The rest of the bytes contain the actual address, encoded in BCD. The order of the transmission is bytes with lower address first, lower nibbles (nibble = 4 bit) first. If only the lower nibble of a byte is used (this is legal only in the last byte – in case this is the last digit of the address), the higher nibble should have all of its bits set (the nibble should contain dec 15). The rest of the bytes that are not used should contain FFh.

This number has to be either left blank or set to the correct value; otherwise the unit will not be able to send any SMS message.

Example: If the parameter contains 07h 91h 79h 52h 14h 32h 54h F6h FFh, the address that will be used is the international address +972-54-123456, from left to right.

Default value: NULL (blank).

6.2.2.3 Forward Data Received from COM Port as a Text SMS

Address: 7 bit 5

Description: This parameter is designed to enable usage of MDT 850/860 through SMS brokers, normally allowing plain text SMS only.

If this bit is enabled (set to 1), the payload of every Forward Data packet received from COM port will be immediately sent as a plain text SMS (ASCII) to the SMS Destination Address.

Every text SMS received by the unit will be forwarded to the COM port in a "Forwarded Data" format as a payload.

Default value: disabled (0)

6.2.2.4 Enable Active SMS in Hibernation

Address: 4, bit 4

Description: This bit enables preventing of an Active SMS generation in one of available hibernation modes (during parking).

This bit can also be disabled when it is required to prevent SMS during GSM peeks (in full hibernation only).

Default value: 1 (Enable)

6.2.3 *Comm. Permissions in Home/Roam Network*

6.2.3.1 Enable GPRS

Address: In home network 201 bit 2, in Roam network 203 bit 2, in hibernation 3, bit 2 (see the following parameter).

Description: If this parameter is enabled the unit will utilize GPRS whenever possible as a default communication channel.

Default value: Enabled (1) In Home network, Disabled (0) in Roaming

6.2.3.2 Renew GPRS upon Drop (in Hibernation, GPS Peeking)

Address: 3, bit 2

Description: If GPRS is enabled, the unit will try maintaining GPRS session active all the time, even if there is no data to transfer (for example on parking, during one of the hibernation modes).

Due to resource reasons the GPRS network is searching for an idling connections and actively shutting them down. Once the connection is down - the unit will try redialing the network and generate an additional useless traffic and charge.

If this bit is disabled, the unit will not renew the GPRS session during hibernation upon drop. The session will be restored only in case the unit is leaving hibernation due to an Ignition On or Distress Session.

This bit can also be disabled when it is required to prevent GPRS dial up during GSM peeks (in full hibernation only).

Default value: 1 (renew session)

6.2.3.3 Enable SMS

Address: In home network 201 bit 7, in Roam network 203 bit 7

Description: If this parameter is enabled the unit will respond to a valid incoming SMS commands and generate an active distress and real-time messages (if enabled in the next parameter) when GPRS is not available.

Default value: Enabled in both Home and Roaming (1)

6.2.3.4 Enable Active Transmissions via SMS

Address: In home network 202 bit 4, in Roam network 204 bit 4

Description: If this parameter is disabled, the unit will not generate any active SMS traffic (distress or real-time, except the "Wake Up" SMS messages, see description below), even if SMS communication is enabled in previous parameter.

Default value: Disable (1)

6.2.4 *COM port settings*

Note that not all the available options are currently supported.

6.2.4.1 Baud rate

Address: 471, bits 0-3

Description: Defines the baud rate of unit's COM, as per the table below:

Note: If CFE device is enabled on this port, the unit will fixate on 460800 baud rate, ignoring the configured value.

Value (dec)	Baud rate (bps)	Currently supported
0	110	
1	300	
2	600	
3	1200	
4	2400	
5	4800	
6	9600	√
7	14400	
8	19200	√
9	38400	
10	56000	
11	57600	
12	115200	√ (default)
13	128000	
14	256000	
15	460800	√

Default value: 12

6.2.5 *1-Wire port settings*

6.2.5.1 Enabling Reading 256-bit EEPROM of DS1971 and Authentication by Group ID

Address: 1349, bit 3

Description: By default the unit is supporting reading unique iButton identifier from any family of iButtons and using it as a driver authentication. In most cases DS1990A Dallas keys (family ID 01) are used for this purpose.

The DS1971 (the family code of DS1990A is 01h; the family code of DS1971 is 14h) provides, in addition to the unique iButton identifier, a 256-bit EEPROM, containing 10 decimal digits.

In our unit we use this storage in order to store group ID and User ID (refer to Extended Driver Authentication section below in this document).

If this bit is enabled (1), and DS1971 is attached, the unit will:

1) Ignore the unique iButton identifier of the attached DS1971
2) Read 10 decimal digits from the 256-bit EEPROM of the attached DS1971
3) Treat them as User ID and Group ID: high digits represent a Group ID and lower digits a User ID.

The Group ID length is variable and set up during unit's initialization (refer to the *Extended Driver Authentication* section).

Assuming that the number programmed in the EEPROM of DS1971 is 1234567890, and Group ID length is considered upon initialization as 4 digits, the Group ID of the same iButton will be 1234 and User ID will be 567890.

Otherwise, if the corresponding bit is enabled but other type of iButton is attached (different from DS1971), the unit will use the 48 bits of the unique ID of the attached iButton as a driver or passenger ID and 9999 as a group number.

Upon recognition of the new iButton, the unit generates an OTA message type 0, with Transmission reason (Byte 19) = 46 - Driver Authentication Update.

Byte 18 (STR) of the same message includes notifications of Group recondition and user type.

Group ID status "1" – authenticated, "0" – not authenticated	Unused	User Type "0" – Driver ID "1" – Passenger ID
Bit 7	Bits 1-6	Bit 0

The entire 10 bytes number (Group and User) received from the EEPROM of DS1971 will be transmitted by the unit in any outgoing message type 0 in a six bytes Dallas field as follows (after applying Little Endian):

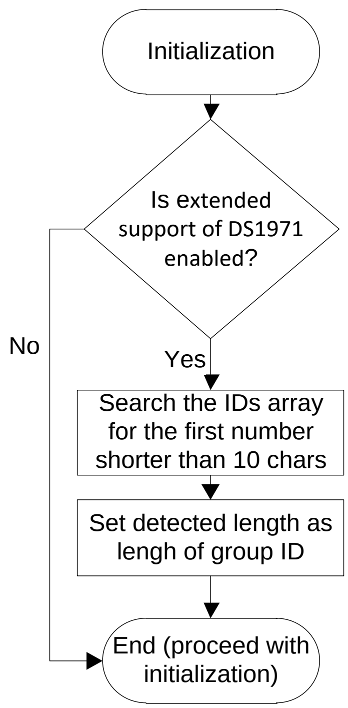
90	78	56	34	12	00
Byte 33	Byte 34	Byte 35	Byte 36	Byte 37	Byte 38

If the "Reading EEPROM of DS1971" Programming bit is disabled (0), and DS1971 (or any other type of iButton) is attached, the unit will work according to the legacy Driver ID algorithms.

6.2.5.2 Driver Authentication by Group ID

If the "Reading EEPROM of DS1971" Programming bit is enabled (1), the Group ID is used to enable cancellation of vehicle's immobilization by any company driver without programming code of each one to unit's memory.

The Group ID is programmed as one of the Dallas codes (in the array of 30), its length 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. Any additional number, shorter than 10 digits but with length different from the first Group ID length, is considered a driver id.



NOTE: Group ID numbers never begin from zero.

If Reading EEPROM of DS1971 is enabled in the programming, upon reception of data from DS1971 first bytes will be considered the "Group ID".

If Reading EEPROM of DS1971 is enabled in the programming and other type of iButton is attached (not DS1971), upon reception of data from iButton the 9999 is recorded as a

Group ID, but the unit will use the 48 bits of the unique ID of the attached iButton as a driver or passenger ID.

The received "Group ID" is compared with programmed Dallas codes and if it matches:

- The status of Group ID recognition in the last bit of TR Specific byte of "Driver Authentication Update" event changes to "1" – authenticated
- The unit releases immobilizer (only if the immobilizer was activated automatically), even if the Driver/Passenger ID is not in the list.

If Reading EEPROM of DS1971 is NOT enabled in the programming – the unit will not use Group ID at all

6.2.5.3 Enable proximity reader date updating

Address: 295, bit 0

Description: When this parameter is enabled ('1'), the unit will update the proximity reader with the RTC date after every midnight.

0 - Disable

1 - Enable

Default value: 0 = Disable

6.2.6 *Data Forwarding from COM Port*

In previous versions (prior to FW 31c) the only OTA transport of forwarded data was OTA msg type 8.

The length of payload in this message was limited to 82 bytes in all the cases except transparent data forwarding, where this limit was extended to 235 bytes.

It was not possible to link between the packet forwarded from COM port and location update.

From version 31c the data forwarding capabilities extended in the following way:

- Capability to escort messages, forwarded from 3rd party terminal (or Garmin) with plain fleet management (FM) data (like Dallas, status of inputs, location and time), normally supplied in OTA message type 0. The new structure, containing forwarded data with FM packet and unique ID is called "container"
- Capability to forward up to 512 bytes of forwarded from 3rd party terminal data or the entire container encapsulated into a single message over Cellocator Wireless Protocol (without logging).
- Capability to log forwarded from 3rd party terminal data (or the entire container) as a set of fragments (OTA message type 7). In this case the forwarded from 3rd party

terminal data (or the entire container) will be delivered similarly to a delivery of the plain events.

It is possible to introduce features 2 to 4 as a 2x2 selection table, where only one cell can be selected at any time:

	Forward as pure data	Forward as container including the pure data, FM data and unique ID
Forward in single packet OTA w/o logging		
Forward as set of logged fragments		

6.2.6.1 Forward Data as a Container

Address: 285, bit 6

Description: If this bit is enabled (1), once the forwarded data packet is received in a RAM buffer, the payload is escorted by additional fields and converted in a structure called "the container".

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

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

Every container is assigned by 6 bits numerator (increased every packet reception from COM port), used in fragmentation process and reported with the container. The indication bit of report Forwarded Message Code byte in this case will contain '1' - Container.

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

<table>
<tr><td colspan="8">The Container</td></tr>
<tr><td colspan="2">Length of container
(2 bytes)</td><td colspan="3">The payload of forwarded data X</td><td colspan="3">48 bytes of fleet management data</td></tr>
<tr><td>Byte 1</td><td>Byte 2</td><td>Byte 3</td><td></td><td></td><td>Byte 3 + X</td><td></td><td>Byte 3+ X+48</td></tr>
</table>

If this bit is disabled (0), the payload is forwarded as is received from COM port, without any additional conversion. The indication bit of report Forwarded Message Code byte in this case will contain zero.

Default value: 0 - Disable

6.2.6.2 Enable Data Forwarding Through Log

Address: 285 bit 7

Description: If this bit is Disabled (0), the system will forward data (the pure payload or the container) using OTA message type 8 directly from the RAM buffer.

Single OTA type 8 messages can contain the following:

- Pure forwarded payload up to 512 bytes
- The container, where 512 bytes of forwarded data payload are escorted by 48 bytes of fleet management data and 2 more bytes of container length (total 562 bytes);

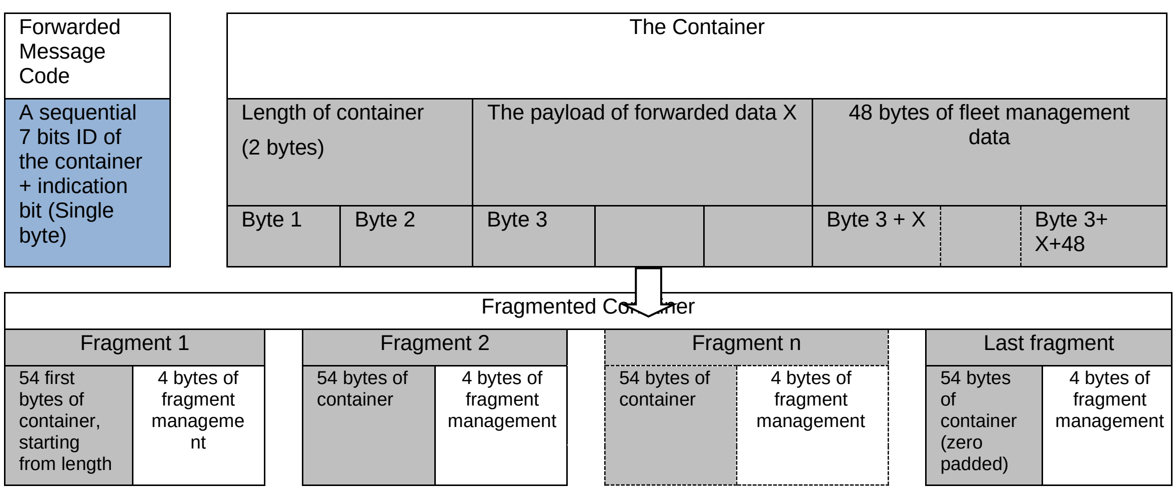
If it is set (1), the received data will be fragmented.

The container (or the payload to forward, as per the programming) is fragmented by chunks of 54 bytes long (last one is zero-padded); chunks are enumerated and equipped by new fragmentation control fields, stored in an events log memory and then uploaded using an existing infrastructure as message type 7.

As per existing message types which are utilizing log memory (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.

1.1.1.1.30 *Data Path Chart*



Default value: 0 - Disable

6.2.6.3 Enable Backward Compatible OTA Msg 8

Address 1349, bit 2

The legacy data forwarding mechanism was utilizing a data fragmentation due to a small buffer size (Garmin mode only).

In current implementation legacy fragment control byte of OTA message type 8 is not used, since the unit is able to forward "the container" in a single message.

The Fragment Control byte of OTA message type 8 will therefore always contain value of 0xC0.

If this bit indicates backward compatible (0) the unit will restore legacy structure of OTA Msg type 8 by:

1. Fragmenting Garmin traffic to fragments of max 82 bytes of payload and using Fragment Control byte for fragmentation control.
2. Limiting size of forwarded payload in Transparent Mode to 235 bytes.

If this bit indicates extended (1) the unit will use extended structure of OTA Msg type 8 by allowing size of forwarded payload in Transparent Mode to 512 bytes.

Default value: 0 - Backward compatible

6.2.6.4 Enable OTA ACK to Forward from OTA to Serial Data Packet

Address 1348 bit 0

Description: If this bit is enabled (1) the ACK (Msg type 0, TR31) will be sent from Cellocator unit to the CCC upon reception of Data forwarding frame.

Default value: Enabled (1)

6.2.7 *PSP Configuration*

The integration of Pointer Serial Protocol (PSP, refer to the appropriate documentation) into Cellocator units which are not security oriented is carried over the Cellocator protocol via SMS or/and GPRS link layers.

PSP is not implemented on the Security edition in order to avoid dual alarm system state machines.

PSP support is provided on top of the existing serial protocols on Cellocator units such as Cellocator Serial protocol (CSP) and the transparent protocol.

6.2.7.1 PSP Enable

Address: 7, bit 1

Description: The PSP support is activated when this bit is enabled. Status of Parameter "PSP Enable" can be changed without reset

Default value: 0 (Disabled)

6.2.7.2 PSP "# Polling" Interval

Address: 1320

Name in Programmer: Polling interval

Description: This parameter is only implemented if PSP support is enabled.

Cellocator unit periodically polls the updated status of the alarm system via the serial port (in all its modes including the hibernation mode).

The unit polls the information by sending the ASCII character '# to the serial port every configurable time period, programmed in this parameter.

NOTE: If the reply to polling indicates an 'Alarm', the unit will enter Distress Mode with transmission reason "PSP triggered". The unit will restart Distress Mode every time a reply to polling indicates 'Alarm' (irrespective of the Distress Mode setting).

Resolution: Seconds

Default value: 15

Range: 0-255; "0" will cause the unit to stop polling the data, values between 1 and 5 will set this interval to 5 seconds

6.2.7.3 PSP Echo Timeout

Address: 1343

Name in Programmer: Echo timeout

Description: This parameter is only implemented if PSP support is enabled.

Every character sent by the alarm system is echoed by the Cellocator unit, so the alarm system waits for it before it sends the next one. The interval between every two characters should not exceed time out, programmed in this parameter. If a problem occurred, the Compact returns a "?" character and the alarm system should retransmit the last string from its beginning.

NOTE: All DL commands transmitted from the CCC to the alarm system are forwarded by the Cellocator unit to the Alarm system in Burst fashion and not in Echo mode as the rest of the communication protocol parts. Current time indication is also transmitted from the unit to the alarm system upon request in a burst fashion without echo.

If the Cellocator unit fails to receive successful acknowledgment (proper Echo) from the alarm system during a timeout, defined in this parameter, this attempt will be considered as a communication failure.

Number of allowed communication failure is limited and defined in the next parameter.

Resolution: Seconds

Default value: 3

Range: 0-255; "0" will cause the unit to stop polling the data

6.2.7.4 PSP Allowed Number of Communication Failures

Address: 1321

Name in Programmer: Allowed number of communication failures

Description: This parameter is only implemented if PSP support is enabled.

If communication failures (see the parameter above) occur more than programmed in this parameter, the Cellocator unit will notify CCC about the loss of communication.

Default value: 10

Range: 0-255; "0" will cause the unit to ignore all communication failures

6.2.8 *Transparent Data Mode over COM Port*

6.2.8.1 Periodic Transparent Mode Peek Time

Address: 1355

In this mode the unit open a window for the given peek time and passes all COM messages transparently in a periodic manner.

The session will be between ignition ON to ignition OFF only.

If the Peek Time is different from the value 0 and the period time is 0 the transparent mode will be for unlimited time during the ignition ON session. If the Peek Time is 0, the periodical transparent mode feature will not work during the ignition ON session.

After downloading the new configuration by PL file, the unit will start working only after reset event.

Upon receiving transparent mode OTA command, while the feature is active, the current feature will work according to the OTA command (Activate/deactivate the transparent mode) immediately while time changes will be updated only after completion of the current cycle (after the previous "Periodic transparent mode cycle time" will expire).

Default value: 2 seconds

Resolution: 1 second

6.2.8.2 Periodic Transparent Mode Cycle Time

Address: 1356

This sets the period of time between peeks, as mentioned in the previous parameter.

Default value: 60 seconds

Resolution: 10 seconds

6.2.9 *Distress Session Configuration*

A Distress Session is one of four possible ways to deliver data to a Central Control (refer to the *Event Types generated by Cellocator devices* section).

If the condition for the specific event is met, the unit will create a series of messages with the same transmission reason. The messages will be uploaded to the Control Center immediately with the first available communication transport (during IP session – over IP, otherwise by SMS). The messages are not stored in the memory and if there is no cellular coverage at the moment of sending – the message will be lost. Distress events do not require any kind of acknowledge.

The number and time between messages in Distress Session is defined in parameters below, but can be temporary overwritten by Distress Session initiation OTA command.

Distress session caused by the same trigger, occurred while the first session is not over yet restarts the session from the beginning.

Distress session caused by different trigger, occurred while the first session is not over yet causes new distress session (up to 5 distress sessions might be maintained concurrently). The 6th distress session, while previous 5 are still active, will be lost.

It is also possible to initiate an endless (or specified duration) distress session by command from CCC. Upon start, this session cancels all active distress sessions. The session will be stopped by any other distress session or by a command from OTA.

6.2.9.1 Time between Distress Transmissions

Address: 72-73

Description: This parameter defines the amount of time between two consecutive Distress Transmissions in distress session initiated by trigger of distress event.

The amount and the period of distress events generated during session initiated by OTA command is defined by the command itself.

Data Format: 16-bit unsigned integer, 0.01 seconds resolution

Legal values span: 01h to FFFFh – 65535 (~11minutes)

Default value: 1000 (10 seconds)

6.2.9.2 Number of Distress Transmissions

Address: 75

Description: This parameter defines the amount of transmissions that will be generated in a single distress session triggered by internal logic, if no more sensors are triggered.

The maximum time of single distress session is [this parameter]*[time between transmissions]. Take into account up to another second per transmission (this is the time that it takes the unit to prepare and arrange a transmission).

NOTE: A Distress session initiated by OTA command will contain the number of messages specified in a command.

Legal values span: 01h (one transmission) through 00FFh (255 transmissions). 0 is illegal.

Default value: 1

6.2.10 *Wake Up Messages*

In most of the cases the unit is sent to the installation site programmed with operational PL file, but without a SIM card. The SIM card is being inserted on installation site.

In order to create an automatic association of the unit with the SIM number in CCC application, the unit initiates a real-time message using SMS or GPRS, according to the bitmap below.

In case Wake Up message has not been sent due to server side issue triggering Anti flooding condition, The Wake Up message counter will be reset and the Number Of Repetition counting will start again from 0.

6.2.10.1 Enable SMS Wake Up

Address: 1344, bit 6

Description: An SMS message/s (number is set in repetitions field of the same byte) will be sent to the Default Destination SMS address upon power up, after successful registration into Home or Roam GSM network, respectively to SMS rules (like pre-programmed GSM operator's selection, active transmissions block etc).

The "SMS Wake up" event does not require any type of ACK. The message shall be retransmitted in case error.

NOTE: The "wake up" message will be transmitted even if active transmissions are disabled. In addition, the time between Wake up SMS repeated messages will be 40 seconds (except for the CelloTrack Nano, in which the time between emergency transmissions will be shorter but still dependent on network responses).

NOTE: In CelloTrack and CelloTrack-T, Wake up SMS will be sent every time the unit is moved between Inactive to Active states.

Default value: 0 - disabled

6.2.10.2 Enable GPRS Wake Up

Address: 1344, bit 7

Description: The message will be sent to the Default Destination IP address upon power up, after successful registration into Home or Roam GSM network, and dial up to GPRS, respectively to GPRS rules (like pre-programmed GSM operator's selection etc). The message requires ACK (standard type 4 message). If ACK is not received, it will be resent limited number of times, as configured in "Number of Repetitions" parameter (address 1344, bits 0-5).

Default value: 0 - disabled

6.2.10.3 Number of Repetitions

Address: 1344, bits 0-5

Description: This parameter defines the amount of SMS/GPRS Wake Up messages. In case of failure during sending Wake Up event via GPRS (ACK is not received), the unit will try to resend the message with a period configured in "Time between Distress Transmissions" parameter (address 72). Every power cycle, the repetition counter is reset to 0 and the count is restarted.

Default value: 5

6.2.11 *Offline Tracking*

This mode is designed to enable offline data logging. During this mode the modem of the unit remains off, although the GPS, processor and all the peripherals are managed by unit's logic as usual. The unit is generating and storing logged events in its non-volatile memory and once a day (for example, or as configured) establishes a connection to upload all of them during a single communication session.

The modem is also temporarily switches on upon trigger of distress session (in this session only the distress event itself is sent).

The communication session for accumulated data upload will be initiated in the following cases:

- At the end of trip (upon expiration of the dedicated timeout after the Stop alert)
- Upon filling of 90% of memory capacity
- Upon expiration of Logged Events Upload Periodic Timer
- Upon reaching a certain amount of logged events
- Upon activation of Input
- Upon movement in a certain time
- Due to FOTA process

In case of failure of upload process when the unit tries to upload the logged events (i.e. if not all the events were uploaded for any reason), the will perform a configurable number of retries, with a configurable time between the retries.

If during a retry session one of the 5 upload modes is triggered again, the retry mechanism will be "restarted" (e.g. if the number of upload retries was configured to 5, and in the current retry session 3 retries were done, and an upload mode is triggered again, the unit will perform the upload sequence again, i.e. first upload try + 5 retries).

If a retry session was "expired" (i.e. the unit performed all the retries as configured, and still failed to upload all of the logged events), the unit will return to silent offline tracking, until the next upload mode is triggered.

6.2.11.1 Enable Offline Tracking

Address: 1348, bit 6

If this bit is enabled (1) the unit switches the modem on and initiate the GPRS session only when data download is required (see below). The rest of the time the modem remains off.

Upon the end of data upload process the session and the modem is shut down.

The modem will also be switched on during distress sessions and real time alerts (Wake up etc.).

In case of wake up due to distress session (or real time alert) the modem will be switched off after transmission of the last message (any valid Cellocator message will extend this timeout by an additional 10 seconds).

Switching the modem on followed by GPRS dial up is initiated by the unit upon:

- At the end of trip (upon expiration of the dedicated timeout after the Stop alert)
- Upon filling of 90% of memory capacity
- Upon expiration of Logged Events Upload Periodic Timer
- Upon reaching a certain amount of logged events
- Upon activation of input
- Upon movement in a certain time
- Due to FOTA process

After modem's wake up it will try to register into a GSM network. If the registration is not accomplished during timeout, defined in "Maximum Network Registration Time" (address 270), the modem will be switched off until next wake up.

Any modem reset, occurred during the upload session, will be followed by modem wake up and registration attempt as per "Maximum Network Registration Time" (address 270).

If the GSM registration is successful, the unit will get more time to dial up GPRS and deliver the first message from the log (the total time from modem wake up is "Maximum Network Registration Time" + 90 seconds, independently from the exact moment of GSM registration). If during this timeout the unit failed to establish GPRS session and deliver the first message - the modem shall be switched off until next wake up.

The unit will not switch off the modem while data transfer is in process;

The modem will be switched off:

- While log is not empty: 90 seconds after last message reception (in case of session drop or server failure).
- While log is empty: 10 seconds after last valid message reception (including ACK)

Once the dial up attempts stop for one of the reasons described above, no more GPRS dialup attempts (or modem wakes up followed by GPRS dial up attempts) will be made until Stop Journey is detected. After such an event, dial up attempts will start again as described above.

Maintenance Session, if enabled, will start immediately after ANY data session occurred after periodical maintenance timeout expiration. In such a case the modem will be switched off after the end of the maintenance session. There is no dedicated modem wake up for maintenance session.

Serial data Forward mechanism (MDT, Garmin, transparent data ...) will behave in following manner during offline mode:

- During modem wake up due to Emergency session, then the data forwarded from COM port will be forwarded to the server.
- During modem wake up due to Ignition OFF or memory overfilling, then the data will be lost.

Default value: 0 (Disable)

6.2.11.2 Timeout before switching off the modem

Address: 220

This timer is restarted every time a data packet is received (to allow the server time to send necessary commands to the unit, if needed), when the log is not empty (i.e. not all logged events were uploaded to the server). Note that the FW limits this parameter to be minimum 30 seconds, so any programmed value under 30 seconds would be treated as 30 seconds.

After completion of uploading all of the logged events (i.e. the log is empty), the unit is switching off the modem after 10 seconds (hardcoded).

Resolution: 2 seconds/bit

Default value: 90 seconds

6.2.11.3 Auto Upload after Ignition Off Event

Address: 255, bit 0

Description: If this bit is enabled (1), the unit will wake up the modem and establish GPRS session upon expiration of a timeout (Time to Auto-Upload) after a Stop alert.

Data Range: 1 - Enable, 0 - Disable

Default Value: 0 - Disable

6.2.11.4 Auto Upload upon Memory Overflow

Address: 255, bit 1

Description: If this bit is enabled (1), the unit will wake up the modem and establish GPRS session upon detection of memory overflow (90% full).

Data Range: 1 - Enable, 0 - Disable

Default Value: 0 - Disable

6.2.11.5 Time to Auto Upload after Trip Stop

Address: 259 – 260

Description: This parameter defines time interval between Trip Stop and GPRS dial up for data upload. Disabling the automatic upload at trip stop is done by "Auto Upload after Ignition Off Event" parameter (address 255, bit 0).

Value resolution & span: Resolution is 4 Seconds. Span from: 4 seconds (0x0001), to 18:12 Hours (0xFFFF).

Default value: 5400, (0x1518h), 1.5 Hours

6.2.11.6 Logged Events Auto Upload Timer

Address: 218 – 219

Description: This parameter defines the period for periodical auto-upload of events accumulated during Offline mode. 0 – cancels periodical auto upload.

Value resolution & span: Resolution is 1 minutes. Span from: 1 minute to 65535 minutes. 0 disables the periodic upload.

Default value: 0

6.2.11.7 Logged Events Amount for Upload Offline Events

Address: 215

Description: This parameter defines the amount of logged events for upload of events accumulated during Offline mode. 0 – cancels the amount dependent upload.

Value resolution & span: Resolution is 1 event. Span from: 1 to 255 events.

Default value: 0

6.2.11.8 Number of Logged Events Upload Retries

Address: 221

Description: This parameter defines the number of logged events upload retries (in case of no GSM connection when attempting to upload logged events). 0 – cancels the retry mechanism.

Value resolution & span: Resolution is 1 retry. Span from: 1 to 255 retries.

Default value: 0

6.2.11.9 Time Between Logged Events Upload Retries

Address: 222

Description: This parameter defines the time between logged events upload retries (in case of no GSM connection when attempting to upload logged events).

Value resolution & span: Resolution is 10 seconds. Span from: 10 to 250 seconds.

Default value: 0

6.2.11.10 Local Timer to Upload Logged Events

Address: 223-224

Description: This parameter, together with "Movement Timer Before Local Timer Activation" (address 225-226) define a time range for a local upload mode for logged events. The "Local Timer to Upload Logged Events" starts after previous upload session ends. After it expires, the "Movement Timer Before Local Timer Activation" starts. If during this time the unit moves, the logged events are uploaded, and the "Local Timer to Upload Logged Events" starts again.

Value resolution & span: Resolution is 1 minute. Span from: 0 to 65535 minutes.

Default value: 30 minutes

6.2.11.11 Movement Timer Before Local Timer Activation

Address: 225-226

Description: This parameter, together with "Local Timer to Upload Logged Events" (address 223-224) define a time range for a local upload mode for logged events. The "Local Timer to Upload Logged Events" starts after previous upload session ends. After it expires, the "Movement Timer Before Local Timer Activation" starts. If during this time the unit moves, the logged events are uploaded, and the "Local Timer to Upload Logged Events" starts again.

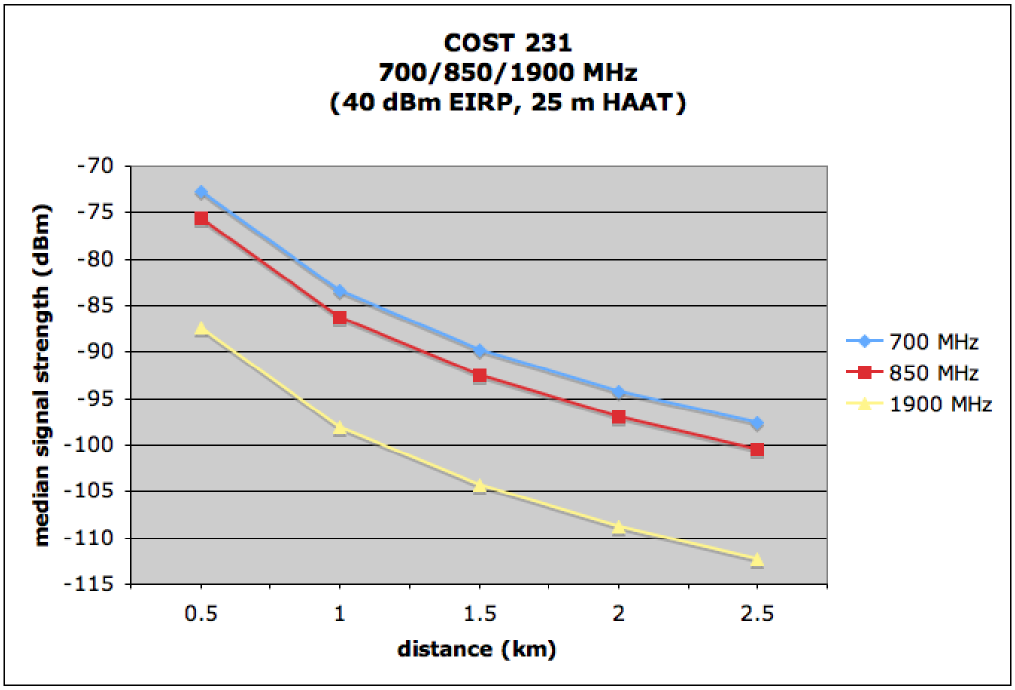
Value resolution & span: Resolution is 1 minute. Span from: 0 to 65535 minutes.

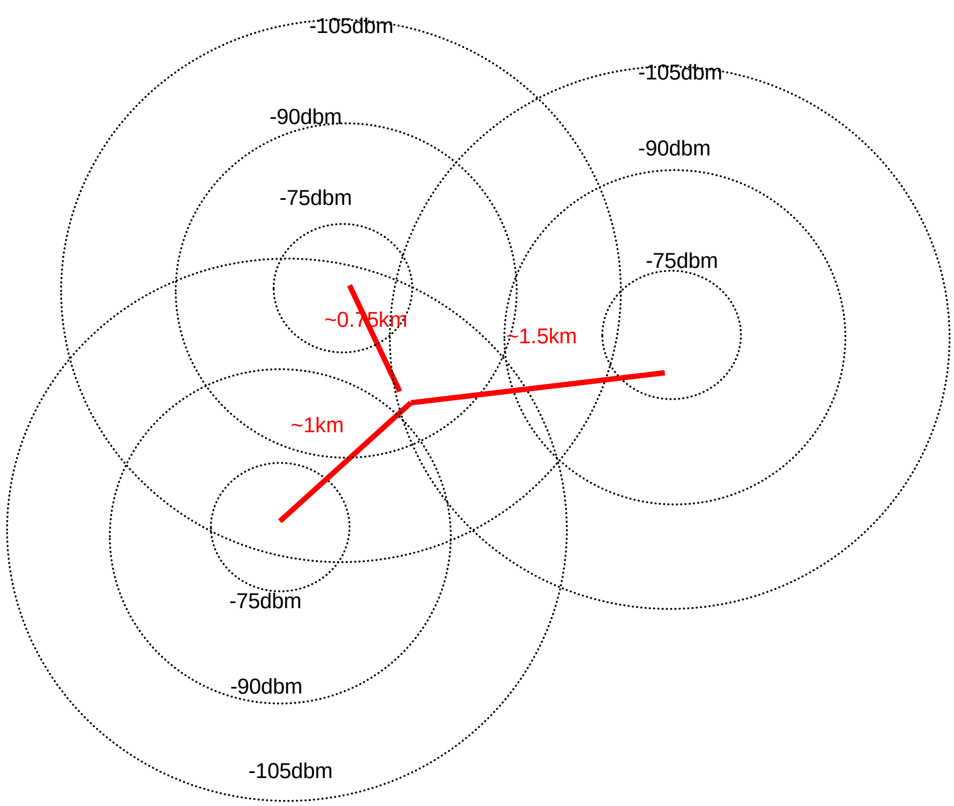
Default value: 10 minutes

6.2.12 *Cell ID Based Location (Neighborhood list of the serving GSM cell)*

Please note that CellID is not supported if “UMTS” band is selected in units with 3G modem.

The Cell ID triangulation is an alternative location method. In cases when the GPS is not available information regarding in-range cellular towers (Cells) with known location, along with signal power or SNR (Signal to Noise Ratio) indication, might be used for location approximation of the transmitting device.


COST 231
700/850/1900 MHz
(40 dBm EIRP, 25 m HAAT)
median signal strength (dBm)
-70
-75
-80
-85
-90
-95
-100
-105
-110
-115
0.5
1
1.5
2
2.5
distance (km)
700 MHz
850 MHz
1900 MHz


-105dbm
-90dbm
-75dbm
~0.75km
-105dbm
-90dbm
-75dbm
~1.5km
~1km
-75dbm
-90dbm
-105dbm

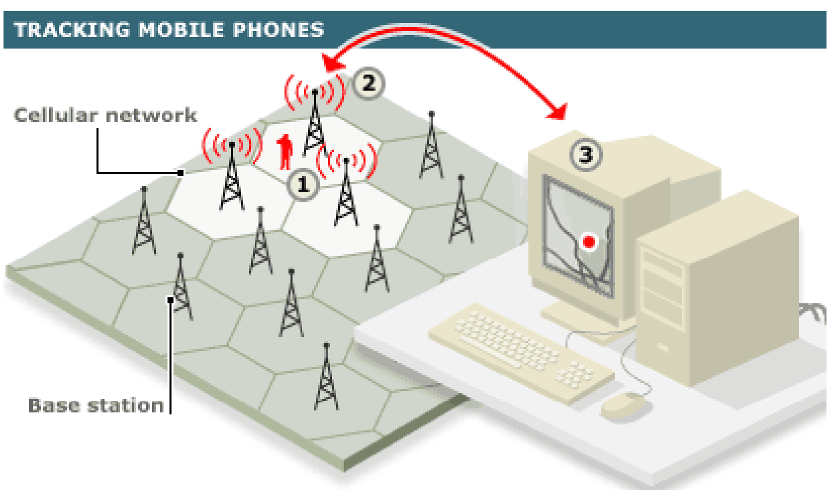
The location of the transmitting vehicle in respect with the "in-range" cells and the RF signal propagation attributes which can be significantly affected by reflectors, black spots, interference, etc. all of this may influence the relative "reliability" of the SNR indication as an estimator for the distance of the vehicle from the receiving Cell.

How does it work with Cellocator unit?

When the unit loses a GPS signal for longer than 2 minutes, it will poll modem for Cell ID information. The modem will update with the following parameters of up to 7 cells (the serving cells and up to 6 neighbor cells):

- Base station identification code
- Cell ID
- Location Area Code
- Received signal strength in dBm

The message, containing this information and CellID retrieval timestamp, will accompany any log or distress message (as per configuration) generated by Cellocator unit during GPS coverage loss.



Positioning software performs a triangulation calculation on the information and the data is converted into a geographical location: strongest reception signal theoretically defines closest cells.

Conditions to consider GPS coverage loss and restore

The GPS coverage loss in is considered when:

- The GPS is communicating (connected)
- The location appears as invalid for longer than 2 minutes in Standby mode or timeout, programmed in "GPS Max On time" parameter in hibernation mode.

The recovery from Cell ID state is to GPS coverage state, in standby (i.e. not Hibernation) mode, happens when the GPS location is considered valid continuously for more than 1 minute or as in PL parameter 500/1 "GPS Navigation Start_Stop filter" in hibernation mode.

Behavior during No GPS Mode

Once the "NO GPS" mode is started, the unit is polling Cell ID neighborhood information from modem periodically, every 1 minute.

The data session (to operational server only) is suspended during polling, the connection does not drop. Messages generated during Cell ID polling are delivered after data mode is restored.

The Cell ID neighborhood data is stored in a unit and delivered as an additional message to a central control after any event or distress message. The additional message contains the next sequential message numerator for easy correlation.

In 3G networks, information of the neighbor cells is not available. Thus, the modem is polled for current serving cell extended data, which may include sector data, which in turn may improve determining the unit location.

6.2.12.1 Enable Generation of Logged Cell ID Escorting Packet

Address: 201, bit 3 in Home Network

203, bit 3 in Roam Network

Description: If this flag is enabled, the unit will generate logged message, following any logged message Type-0 or Type-11 while the GPS location is considered as invalid.

The logged messages will be stored in the same buffer as corresponding messages Type-0 and use the same sequence of numerator for easy correlation.

The message will not be generated if the unit is not logged into GSM.

Default value: 0 - Disabled

6.2.12.2 Enable Generation of Real Time Cell ID Escorting Packet

Address: 201, bit 4 in Home Network

203, bit 4 in Roam Network

Description: If this flag is enabled, the unit will generate real time message following any distress message Type-0 or "Active log event" of Type-11 while the GPS reading is considered as invalid.

The real time messages will be delivered using the same rules as the corresponding distress messages Type-0 and use the same sequence of numerator for easy correlation.

Default value: 0 – Disabled

6.2.12.3 Enforce SMS Destination

Address: 201, bit 5 in Home Network

203, bit 5 in Roam Network

Description: Usually units have a predefined SMS destination ("SMS Destination Address" parameter) to which it sends it's initiated SMSs. As for SMS replies to transmissions from other addresses, the legacy logic dictates that they would be sent only to the originating address.

This parameter enable enforcing to send the ACK always (regardless of the origin of the command) to the same SMS destination number.

Default value: 0 – Disabled

6.2.13 *Internal Accelerometer Configuration*

Movement Detection: The Cello unit can reliably detect movement start /end using its onboard accelerometer, similarly to a technique implemented in CelloTrack. This capability shall allow releasing an Ignition input for general usage or add another dimension for movement detection: ignition switch separate from movement detection.

It is possible to select movement detection source programmatically: Ignition input (backward compatible mode) or accelerometer.

If Start/Stop detection using accelerometer is enabled, the unit reassigns all the functionality based on the status of Ignition to the status of movement.

Examples of such functionality: Start/Stop alerting, Driver Authentication, Hibernation mode change etc.

The ignition input becomes a general purpose discrete pulled down input, monitored in OTA and Serial messages. It might still be used for Ignition Switch status monitoring, but operational mode will be switched according to movement status:

- The unit changes its operational mode to STBEOn if movement is detected for longer than defined in "Start Event time filter" programmable parameter on address 104.
- The unit changes its operational mode to STBEOff if lack of movement is detected for longer than defined in "Stop Event time filter" programmable parameter on address 105.

Towing Detection: The Cello unit shall be able to reliably detect towing using its onboard accelerometer. The feature shall be applicable when:

- A movement detection source is selected from ignition input.
- The ignition switch is switched off, in other words - during parking.

Upon movement detection during parking the unit will wake up from hibernation, alternatively generate an alert, then trigger legacy towing detection feature, based on GPS data.

6.2.13.1 Movement detection type

Address 467, bit 2

Description: This bit enables selection of movement detection type: either actual vehicle movement detection or engine operational mode change detection (engine start and switch off).

Note: If accelerometer is set as an engine status detector – the Stop Event generation may be delayed for (up to) 8 seconds (after expiration of the Stop Event filter).

Values span: 0 - movement, 1 – engine status

Default value: 0 - movement

6.2.13.2 Accelerometer Sensitivity

Address 467, bits 3-4

Description: It is possible to calibrate the sensitivity of the internal accelerometer (3 levels) and to adapt it to any vehicle. The default value of 1 is adapted to detect movement start/end in standard private vehicle. In case of truck it is recommended to decrease the sensitivity level, in case of very silent vehicle – to increase it.

Values span: 0 - Very insensitive, 1 – Normal, 2 - Very sensitive, 3 - Spare

Default value: 1 – Normal

Note: The Accelerometer Sensitivity feature is applicable also in CelloTrack T units from FW version 61c.

6.2.13.3 Movement Detection Source

Address 467, bit 0

Description: This bit defines what source will be used for movement detection: internal accelerometer or Ignition input. If Accelerometer source is selected, all the logic normally dependent on status of Ignition Switch will be re-linked to the status of Movement detection.

Values span:

0 – Start/Stop alerts by status of Ignition switch (backward compatible mode)

1 – Start/Stop alerts by movement detection using accelerometer

Default value: 0 – backward compatible mode.

6.2.13.4 Start & Stop Detection Using Voltage Level and Accelerometer

Address 467, bit 5

Description: This bit enables (1) usage of voltage level in addition to "movement detection" by accelerometer for Start/Stop detection.

Values span:

0 – Disable

1 – Enable

Default value: 0 – Disable

6.2.13.5 Start & Stop Detection Using Voltage Level and Ignition Input State

Address 467, bit 7

Description: This bit enables (1) usage of voltage level in addition to ignition state for Start/Stop detection.

Values span:

0 – Disable

1 – Enable

Default value: 0 – Disable

6.2.13.6 Enable RPM as Ignition Assistant

Address: 4102, bit 0

Description: When this parameter is enabled ('1'), the unit will use the RPM value (from CAN) as assistance to identify vehicle ignition state.

0 - Disable

1 - Enable

Default value: 0 – Disable

6.2.13.7 Voltage Level Threshold for Ignition On Detection

Address 468

Description: This parameter allows to configure the main battery voltage for assisting accelerometer or Ignition input with Start/Stop detection, or for waking up the unit from hibernation upon connecting electrical vehicle to charging source. It only affects if bits 5 and/or 7 of address 467 and/or bit 0 of address 3 are set.

The Start Event shall be registered if movement by accelerometer is detected or Ignition input state is On, and the voltage of the main battery is higher than this parameter during the entire Start Event registration timeout.

The Stop Event shall be registered if NO movement by accelerometer is detected or Ignition input state is Off, and the voltage of the main battery is lower than this threshold during the entire Stop Event registration timeout.

Data format: 8-bit unsigned, 0.1176470588235V/bit

Default value: 12.81V

6.2.14 *Roaming List, GSM Operator Management*

The non-volatile configuration is storing a list of 100 Public Land Mobile Networks (GSM operators) with their priorities.

The end unit continuously* monitors a GSM operators (PLMNs) available on the air and dynamically selects the best cost effective operator according to the pre-programmed priority assigned to each one.

*The GSM operator selection mechanism is activated in 2 cases:

Periodically, according to pre-programmed timer

Upon new GSM registration, caused by reset or leaving the area covered by previously selected network.

After one of the conditions listed above becomes true the state machine takes control over the process and selects the best operator based on the list in the configuration memory.

6.2.14.1 Timer of Auto Search

Address: 1008

Description: This parameter defines a timer, used by the system to repeat search of available GSM networks in the air. The timer restarts each time when the unit is "taking decision" to register in a specific PLMN, irrespectively to the result of registration attempt.

Data format: The parameter is an 8-bit integer, resolution of 10 minutes.

Value span: 1 to 255 (10 minutes to 2550 minutes, zero is automatically translated into 30 minutes)

Default value: 6

6.2.14.2 Consider Unknown Operators as Forbidden

Address: 1348, bit 5

Description: If this flag is set, any PLMN not listed in the programming will be considered as forbidden.

Otherwise, if this bit is 0, any PLMN not listed in the programming will be considered as enabled with lowest priority.

Default value: zero (not forbidden)

6.2.14.3 Number of PLMNs Programmed

Address: 1009

Description: This parameter defines a number of active records in PLMN table.

Zero value cancel Roaming List Management feature.

Value span: 0 to 100

Default value: zero

6.2.14.4 Public Land Mobile Networks (PLMN)

Addresses:

Address	Value
1010-1012	PLMN 1
1013-1015	PLMN 2
….	….
1307-1309	PLMN 100

Description & Data Format:

Each PLMN number is composed of two fields:

MMC-Mobile Country Code

MNC-Mobile Network Code

It will be stored in the configuration memory together with its priority as a single parameter in the following way:

Priority			PLMN (MCC-MNC)			
Bit 23		Bit 20	Bit 19		Bit 1	Bit 0

The highest number in Priority field (15) is representing the most preferred network.

The value of 1 is the lowest priority, 2 - higher priority and so on.

The value of zero – is representing Forbidden PLMN.

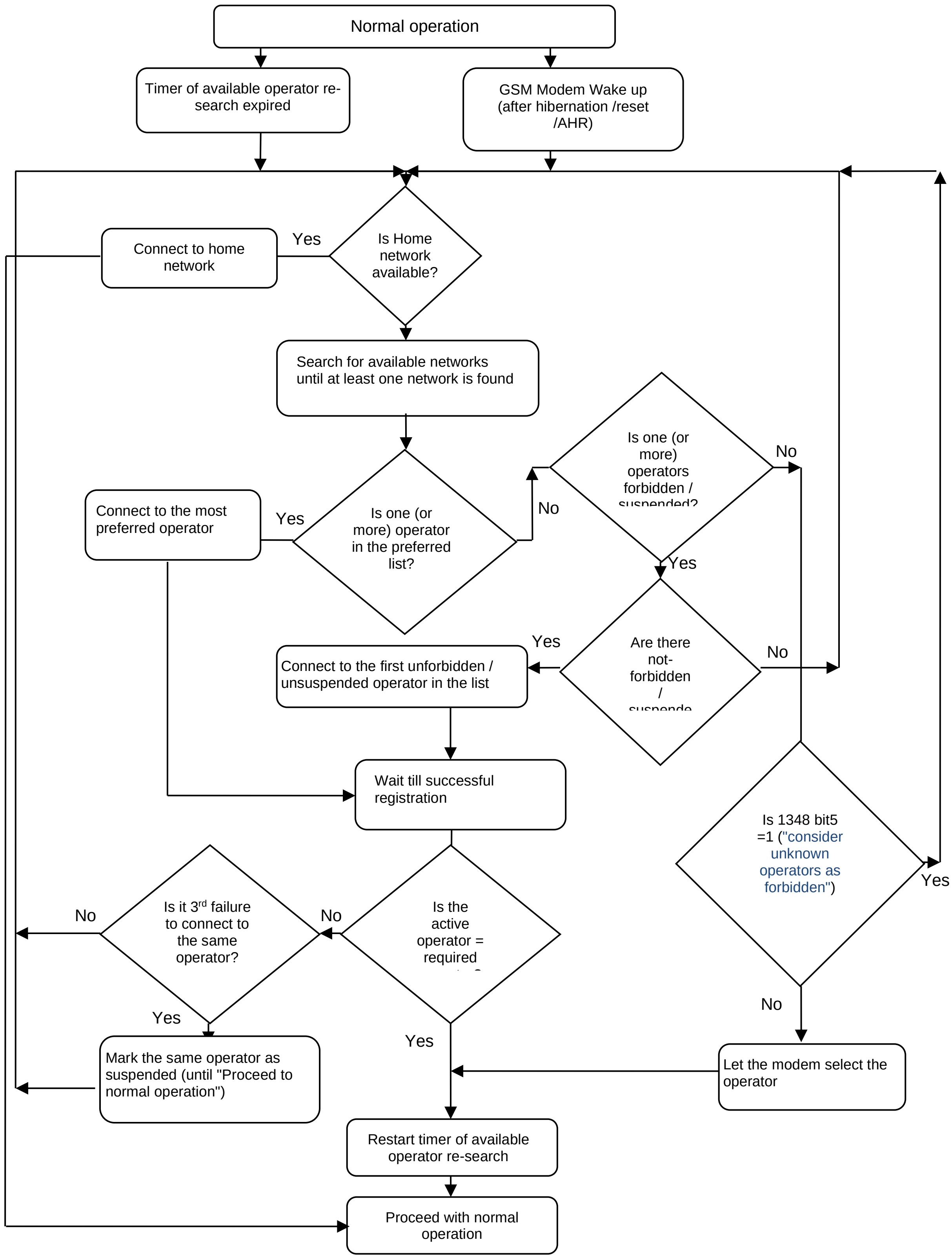
NOTE: The network available in the air, but not listed in the pre-programmed PLMN list will be treated as per configuration in "Consider Unknown Operators As Forbidden" above.

During searching of available networks (processing AT+COPS command) the modem is busy and not available for any type of communication. This process might take up to 3 minutes, but in majority of the cases will be accomplished in less than 20 seconds.

In case no available network found during search, or all the available networks are "forbidden" – the unit will hold and proceed with searching after expiration of Timer of Auto Search.

Default value: zeroes

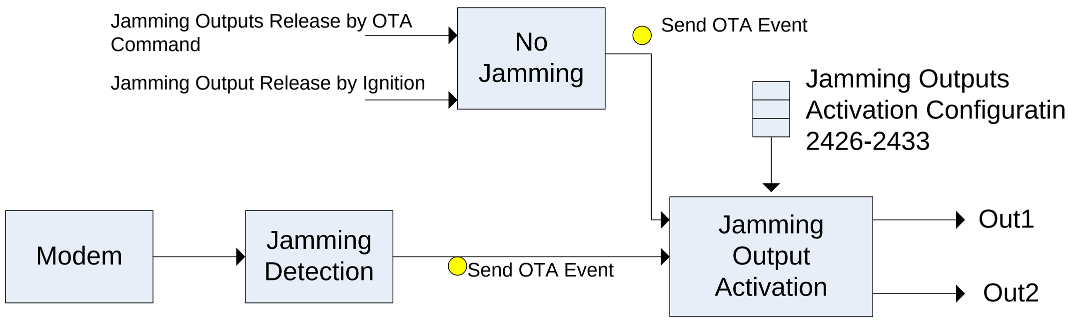
6.2.14.5 Operator Selection Flow Chart



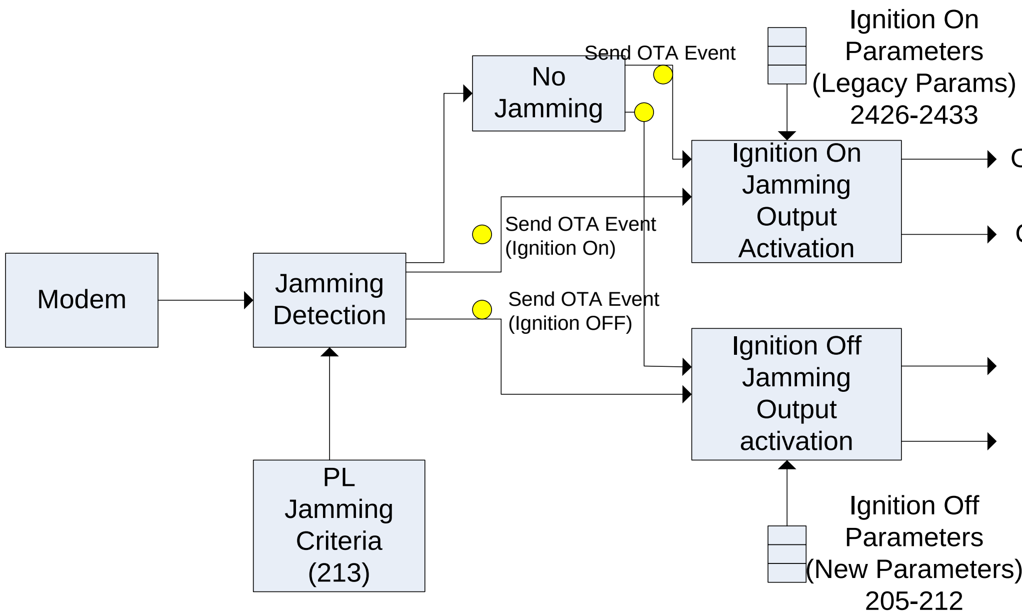
6.2.15 *GSM Jamming Detection & Reaction*

The GSM Jamming detection supports two modes of operation:

- **Legacy Jamming Detection mode**: Jamming is detected without any relation to the Ignition state of the vehicle. In this operational mode, jamming detection can activate up to two outputs for jamming driver feedback. The Jamming feedback is released by OTA command or Ignition Sequence.



- **Advanced Jamming Detection mode**: The jamming detection is depended on the vehicle's ignition state. Different outputs activations are allocated for Ignition On and Ignition Off states. Each Ignition state can drive up to two driver feedback outputs. Jamming Driver feedback outputs are released when jamming condition ends. The user can terminate the jamming state by the legacy sources (OTA commands and Ignition sequence). In the advanced mode, the user can configure the jamming detection time filter and the Jamming End condition time filter. Jamming events will be sent when jamming is detected or when jamming ends. The Jamming events will also reflect the vehicle's ignition state. The Ignition on jamming output activation configuration is the same configuration array used by the legacy jamming outputs activation.



The following responses to jamming detection are available and switchable by unit's programming:

- The unit allows activating a vehicle horn and / or blinkers in pre-programmed frequency and cadence.
- Each of the outputs (horn and blinkers) is equipped by independent activation time filter.
- The unit allows activating nested immobilization (after vehicle's stop) and / or immediate immobilization.
- Unconditionally the unit stores dedicated event for jamming detection into its non-volatile memory.
- The unit enables releasing activated outputs by valid Dallas or by certain activity of Ignition input.

6.2.15.1 GSM Jamming Detection

1.1.1.1.31 *Telit modems*

The cellular modem detects jamming and, if not during an active GPRS session, initiates periodical reports to a microcontroller while jammed (every 3 seconds).

The jamming status is considered as GSM JAMMED upon reception of 3 consecutive jamming detection notifications from the modem in 10 seconds. The unit stores a GSM JAMMED event (TR206, TR Specific data 0) upon jamming status changing to Jammed.

The jamming status is considered as GSM NOT JAMMED upon reception of a dedicated unsolicited message from the modem - "Operative". The unit stores a GSM JAMMED event (TR206, TR Specific data 1) upon jamming status change to Not Jammed.

Since during an active GPRS session unsolicited Jamming detection indications are not received, the microcontroller is temporary suspending GPRS session upon traffic jam (missing ACKs for at least 30 seconds and 3 lost ACKs minimum).

NOTE: In this case (GSM Jamming during GPRS Session) the Acknowledge Timeout directly affects time to Jamming Detection.

The unit will not suspend the GPRS session more than once; next session suspend can only happen in a subsequent GPRS session.

6.2.15.2 Disable GSM Jamming Event or Disable GSM Jamming Event during Ignition On

Address: 1348, bit 3

Description: This configuration parameter disables jamming OTA events. The functionality of this configuration bit depends on the state of the Jamming detection mode (See: Advanced GSM Jamming Detection Mode): If the advanced mode is configured, This configuration bit will only disable jamming events started during Ignition On, If the Advanced mode is not configured, this pin will disable all jamming events.

Note that Jamming detection started during Ignition On and ended while in Ignition Off will be reported even if “Disable GSM Jamming Event during Ignition off” is enabled.

In addition, output activation as a reaction to jamming is independent from registration of GSM JAMMED event.

Default value: zero (Jamming is NOT disabled)

6.2.15.3 GSM Jamming-End Time Filter

Address: 214

Description: The GSM Jamming-End Time Filter is only applicable if advanced jamming mode is enabled (See: Advanced GSM Jamming Detection Mode). The Jamming-End Time Filter defines the time required for declaring “End of Jamming” event. End of jamming will send a jamming end event and deactivate the associated outputs if configured by “Release by Jamming End” flag. Setting the Jamming End Time Filter to 0 will result in immediate outputs deactivation. The filter is common for both Ignition-on and Ignition-off jamming states. The timer resolution is 15 seconds.

Default value: 10 Minutes

Resolution: 15 second

6.2.15.4 GSM Jamming Detection Time Filter

Address: 213

Description: The GSM Jamming-End Time Filter is only applicable if advanced jamming mode is enabled (See: Advanced GSM Jamming Detection Mode). The Jamming detection Time Filter defines the basic criteria for declaring jamming condition. The time filter defines the minimal number of consecutive 3 seconds samples needed before jamming condition is detected. Each bit represents time delay of 3 seconds. The minimal value is 1 (0 will be translated to 1 by the Firmware). Typically this parameter will be set to 10, representing 30 Seconds time filter.

Default value: 30 Seconds (10)

Resolution: 3 second

6.2.15.5 Output Activation as a reaction to GSM Jamming Detection

Upon GSM jamming detection and expiration of activation timeouts, the unit can concurrently activate two outputs. Once activated by Jamming Detection logic, the output can only be deactivated by:

- A command (OTA or serial)
- Authorized Dallas
- Ignition activity pattern

Once deactivated by user or by command the output will be activated again only upon the next jamming detection. In other words: after the end of the active jamming session and beginning of the next one.

NOTE: Reset does not deactivate an output activated upon jamming detection.

1.1.1.1.32 *Output, Auto-Activated upon Jamming Detection*

Address: 2426 for first output and 2429 for second output, bits 0-2

Address: 205 for first output and 208 for second output, bits 0-2

Description: This pair of parameters defines a numbers of outputs that will be activated upon jamming detection.

Output name	Output number
Feature Disabled	0
Siren (GPIO1)	1
Gradual Stop	2
St. Immobilizer	3
LED	4

Blinkers	5
GPIO2	6

Value span: 1 to 5

Default value: zero

1.1.1.1.33 *Delay for Output Activation*

Address: 2432 for first output and 2433 for second output

Address: 211 for first output and 212 for second output

Description: This pair of parameters contain a time filters for output activation upon GSM Jamming.

The event of Jamming detection will still be generated w/o any timeout.

If this parameter contains any number, different from zero, the output will not be activated immediately upon Jamming detection, but after a pre-programmed timer. An activation of the output will only occur if upon expiration of this timer a jamming session is still active.

The timer for output activation will start upon detection of GSM Jamming and reset upon detection of GSM Jamming end.

Resolution: 15 seconds / bit, maximum 63.75 minutes

Default value: zero (immediate activation upon Jamming detection)

1.1.1.1.34 *Output Activation Pattern (Upon Jamming Detection)*

Address: 2426 for first output and 2429 for second output, bits 3-5

Address: 205 for first output and 208 for second output, bits 3-5 (Advanced Mode during Ignition-Off)

Description: This pair of parameters defines a activation pattern of outputs upon jamming detection.

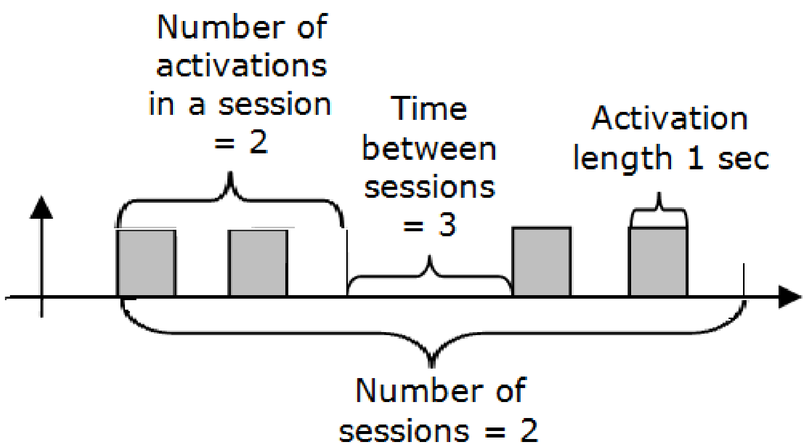
Setting	Action
0	Pulse Activation (The output shall be activated for the time, defined in "Pulse Outputs Width Period", addr. 140 dec
1	Change state to “active” upon jamming detection, change to inactive upon release (by command, Dallas or Ignition Activity)
2	Activate Gradually (only compatible with Gradual Stop output)
3	Activate Nested (executed upon jamming detection only after vehicle stops, e.g. Ignition off or 10 valid GPS packets showing speed lower than 1 km/h)

4	Template Activation (according to the settings described below)
5-7	Reserved

6.2.15.6 Template of Output Activation upon Jamming Detection

Example of template:

Two activations in a session, 1 second per activation, 2 sessions, 3 seconds between sessions:



1.1.1.1.35 *GSM Jamming - Output Activation Template - Activation Length*

Address: 2427 for first output and 2430 for second output, bits 0-3

Address: 206 for first output and 209 for second output, bits 0-3 (Advanced Mode, During Ignition-Off)

Description: This pair of parameters defines a length of activation of the selected output upon GSM Jamming detection.

0 for the time, defined in "Pulse Outputs Width Period", addr. 140 dec

Value resolution: 0.5 second

Default value: zero

1.1.1.1.36 *GSM Jamming - Output Activation Template - Number of Activations in a Session*

Address: 2427 for first output and 2430 for second output, bits 4-7

Address: 206 for first output and 209 for second output, bits 0-3 (Advanced Mode, During Ignition-Off)

Description: This pair of parameters defines a number of activations of the selected output upon GSM Jamming detection.

0 – cancels outputs activation upon jamming detection

Default value: zero

1.1.1.1.37 *GSM Jamming - Output Activation Template - Number of Activation Sessions*

Address: 2428 for first output and 2431 for second output, bits 0-3

Address: 207 for first output and 210 for second output, bits 0-3 (Advanced Mode, During Ignition-Off)

Description: This pair of parameters defines a number of sessions of output activations upon GSM Jamming detection.

0 – for cyclic activation all the time of jamming

Default value: zero

1.1.1.1.38 *GSM Jamming - Output Activation Template - Time between the Activation Sessions*

Address: 2428 for first output and 2431 for second output, bits 4-7

Address: 207 for first output and 210 for second output, bits 4-7 (Advanced Mode, During Ignition-Off)

Description: This pair of parameters defines a time between activation sessions of output activations upon GSM Jamming detection.

Zero value: If zero is programmed the unit will only perform one session of activation irrespectively to the programmed number of sessions.

Value resolution: 0.5 second

Default value: zero

6.2.15.7 GSM Jamming Outputs Release

GSM jamming outputs can be released by Dallas key authentication or by Ignition sequence. When advanced jamming mode is enabled (See: Advanced GSM Jamming Detection Mode), It is possible also to release the outputs when GSM jamming condition ends.

1.1.1.1.39 *Enable Output Release by GSM Jamming End condition while in Ignition-On*

Address: 522, bit 5

Description: GSM Jamming-end detection will deactivate the outputs if this parameter is enabled. The "Jamming-End" state is declared after no jamming detection is detected for the time defined in "GSM Jamming End Filter":

0 - Jamming-End doesn't affect the activation outputs.

1 - Jamming-End will deactivate the GSM Jamming activation outputs.

This bit is applicable for jamming end condition detected while the unit was in Ignition-On.

Values span: 0- Disable, 1 - Enable

Default value: Enable

1.1.1.1.40 *Enable Output Release by GSM Jamming End condition while in Ignition-Off*

Address: 522, bit 4

Description: GSM Jamming-end detection will deactivate the outputs if this parameter is enabled. The "Jamming-End" state is declared after no jamming detection is detected for the time defined in "GSM Jamming End Filter":

0 - Jamming-End doesn't affect the activation outputs.

1 - Jamming-End will deactivate the GSM Jamming activation outputs.

This bit is applicable for jamming end condition detected while the unit was in Ignition-Off.

Values span: 0- Disable, 1 - Enable

Default value: Enable

1.1.1.1.41 *Enable Output Release by Authorized Dallas*

Address: 522, bit 7

Description: This bit enables deactivation of an output, activated by Jamming Detection Logic, by an authorized Dallas key

Values span: 0 - Disable, 1 - Enable

Default value: zero

1.1.1.1.42 *Only first Driver-ID deactivate output after jamming*

Address: 522, bit 3

Description: When this parameter is set to '1', only Dallas/Driver-ID #01 can deactivate the output after following jamming detection. Otherwise all Dallas/Driver-IDs can do so. (Requires that also parameter of "Enable Pre-defined driver ID's list" at address 123 bit-2, will be enabled).

0 - Disable

1 - Enable

Default value: 0 - Disable

1.1.1.1.43 *Enable Output Release by Ignition Activity*

Address: 522, bit 6

Description: This bit enables deactivation of an output, activated by Jamming Detection Logic, by the below specified sequence on Ignition line:

1. From ignition off state Switch Ignition on for a period between 0.5 to 2 seconds (Ignore input change time filter)

Switch it back off for a period between 0.5 to 2 seconds (Ignore input change time filter)

Repeat 1 and 2 four times.

Upon detection of deactivation activity on Ignition the unit will:

- Activate feedback "beep" (using feedback output/s)
- Release an output

Values span: 0 - Disable, 1 - Enable

Default value: zero

6.2.16 *Other Parameters related to Communication Settings*

6.2.16.1 Disable Active Transmissions

Address: 6 bit 1

Description: If set to ‘1 the unit will not actively initiate any kind of connection - SMS, GPRS or voice. It will reply to incoming SMS commands, if the relevant flags for the current roaming/homing state are enabled.

Default value: 0 **–** Enable Active Transmissions

6.2.16.2 Enable Command Authentication

Address: 1 bit 6

Description: If this feature is enabled authentication of every incoming message to the unit (like command or acknowledge) will be verified. Each incoming message should include a unique code, generated as a function of two variables:

- Unit’s ID
- 8 bytes Auth Table, stored in non-volatile memory of the unit and concurrently in the Communication Center application.

If the code will not be verified as authentic – the unit will not perform / acknowledge the command and will erase it.

The unit supports dedicated Auth Table read/write commands over its wire protocol. See description of the commands in a corresponding documentation.

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

Default value: 0 **–** Disabled

6.2.16.3 Enable Driver's Privacy (Invisible) Mode

Address: 6 bit 4

Description:

NOTE: This mode is not supported by security variants.

This mode is designed to allow the driver to allow/disallow tracking of their vehicle. After entering Privacy mode, the unit will generate only Ignition On/Ignition Off events, no Time or Distance events will be generated. The unit will still reply to interrogations and perform commands from the Control center, but outgoing messages will not include position information.

If the unit enters Privacy mode during Ignition On, it will generate pair of events: "Ignition Off" with position information and "Ignition On" without position information. The purpose of event generation is to define stop of tracking session.

If the unit leaves Privacy mode during Ignition On, it will generate pair of events: "Ignition Off" without position information and "Ignition On" with position information. The purpose of event generation is to define start of tracking session.

In order to enter Privacy mode:

- The mode should be enabled by this configuration bit.
- All the plain and distress events as well as other functionality assigned to "Shock input" should be disabled.
- The "Shock" input should be triggered to enter Privacy mode and released to leave this mode.

Default value: 0 **–** Disabled

6.2.16.4 Enable Private-Business Mode Toggling

Address 465, bit 2

Description: It is possible to enable usage of an input as a Private-Business mode toggler. If this bit is enabled, every time the Lock/Shock input (in Cello-IQ/Cello-CANIQ units) is triggered, the unit switches to the opposite mode (Private to Business and vice versa).

The default mode is Business.

The Private mode is finished upon:

- The active ID is erased from RAM after journey end.
- Lock/Shock Input trigger.

During Private mode the unit is continually activating Gd. Stop (pin 17) output, which is serving as Private state monitoring LED.

During Private mode the unit is continually set bit 5 of byte 11 in every outbound OTA msg type 0. Upon entering Private mode the bit 5 of byte 11 is set BEFORE generation of the input trigger event/distress.

Data Range: 0 - Disable, 1 - Enable

Default value: 0 - Disabled

6.2.16.5 Private-Business Mode Switch upon Trip Start

Address 505, bits 6-7

Description: This parameter allows to manage the Private/Business automatic mode switch to depend on trip start. In addition this parameter allows to set a different default (not necessarily business) to switch back to upon trip start.

Note: This feature is applicable only if legacy "Enable Private-Business Mode Toggling" parameter is set to Enable.

Data range:

Value	Description
0	Business
1	Private
2	Keep Current Mode
3	Spare

Default value: 0 - Business

6.3 GPS Configuration

6.3.1 *Base Unit (Measurement Factor of GPS Odometer)*

Hardcoded to 0.1Km.

6.3.2 *GPS Odometer Current Value*

Address: 76 to 79

Description: This parameter stores the current "reading" of the vehicle odometer, in "base units" (see previous parameter). Normally this value is programmed upon installation (synchronization with vehicle odometer) and then maintained by the unit itself.

NOTES:

- This parameter does not require reset to be implemented.
- Upon 'Ignition OFF' ('Stop Event time filter' elapsed), the unit will update the PL ('GPS odometer's current value') with the odometer value reported OTA (same as the value serially found in 'Master Unit Status Request'), regardless of the 'GPS odometer's current value' in PL.
- Having the 'GPS odometer's current value' serially programmed requires Power recycle in order to take effect.
- OTA update of 'GPS odometer's current value' will take effect immediately.
- Upon new FW boot due to any type of FW upgrade (serial, OTA, 'Cellocator+' etc.), the unit will take the odometer value stored in PL, which is true for the last 'Stop Report'.

  This note is more relevant for those users, upgrading while vehicle is traveling (after FW upgrade, odometer skip back to the last 'Stop Report' value can be observed).

Data format: The parameter is a 32-bit integer

Value span: 00000000h to FFFFFFFFh

Default value: 00000000h

6.3.3 *Report Max. Speed instead of Real Time Speed*

Address: 1347 bit 0

Description: If this bit is enabled (0) the unit will report in each logged event (message type 0 and 9) the maximum speed recorded from the previous logged event. This is useful for comparison with police ticket report.

Even if this bit is enabled, any real time and distress events will still contain a snapshot of the speed at the moment of message generation.

There is a bit in every OTA messages, clarifying the type of the reported speed (real-time or maximum).

Default value: Disable (1)

6.3.4 *Enable IMEI Transmission via Type 0 Message*

Address: 1347 bit 4

Description: Enabling IMEI transmission will transmit the modem's IMEI (up to 15 digits decimal number or 50 bits) on each outbound type 0 message. Type 0 bytes 33-38 and byte 41 bits 5 and 6 will carry the IMEI number as explained in the wireless communication protocol under section 2.2.3.4, IMEA transmission. This feature was first introduced as CR200 feature.

Default value: Disable (0)

6.3.5 *Enable GPS Navigation Start-Stop updates*

Address: 99, bit 0 for plain event

102, bit 0 for distress

Description: If this bit is set (1) the unit will generate an event/distress upon every GPS reading validity status change.

Default value: Both Disable (0)

6.3.6 *GPS Navigation Start/Stop filter*

Address: 500

Description: This parameter defines number of invalid GPS packets, required for declaring a "GPS Navigation End"; it is also defines number of valid GPS packets required to declare "GPS Navigation Start".

Note that the GPS validity is automatically declared as "invalid" upon wake up or after reset.

Data format: The parameter is an 8-bits integer

Value span: 0-255 (value of zero cancels the filter)

Default value: 0x0A (10 seconds)

6.3.7 *GPS DOP Threshold*

Address: 1625

Description: Dilution of Precision (DOP) is a measure of how the geometry of the satellites affects the current solution's accuracy. This message provides a method to restrict use of GPS solutions when the DOP is too high.

This is actually an additional GPS solution validation tool: the GPS packets with an HDOP higher than the value in this parameter are marked as invalid.

Data format: unsigned 8 bits integer

Default value: 9

6.3.8 *Velocity Threshold for HIGH SPEED Mode*

Address: 455

Description: The unit can be configured to decrease frequency of Time and Distance events on high speeds automatically. The speed threshold considered as "high speed" is programmed into this parameter.

This parameter is used by Time based alert Period Multiplier for HIGH SPEED mode (Address 92 and 35, bits 4 to 7) and by Distance Event Period Multiplier for HIGH SPEED mode (Address 92 and 35, bits 0 to 3) parameters to define from what speed the number of the events should be decreased.

Note, that the in order to switch the operational mode of the unit from "Low Speed Mode" to "High Speed Mode" the system speed must raise 3km/h above the programmed speed. Same way, in order to switch the operational mode of the unit from "High Speed Mode" to "Low Speed Mode" the system speed must fall 3km/h below the programmed speed.

Data format: 8-bit unsigned, unit's [cm/sec]

Default value: 60 km/h

6.3.9 *GPS Maintenance Updates*

6.3.9.1 Enable GPS Navigation Start-Stop Updates

Address: 99, bit 0 for plain event

102, bit 0 for distress

Description: If this bit is set (1) the unit will generate an event/distress upon every GPS reading validity status change. (Refer to wireless protocol for GPS signal validity definition)

The validity status changes after 10 consecutive GPS frames with the same validity status, different from the current one.

Default value: Both Disable (0)

6.3.10 *GPS Odometer Management*

6.3.10.1 Enable Speed x Time Calculation (SxT)

Address: 509, bit 0

Description: As a default, the unit queries the GPS every second. If that flag is enabled, the unit multiplies the speed at a specific location by 1 second, the result being the distance traveled during this second.

Speed (m/s) x 1 sec = elapsed distance (m)

Whenever the unit does not receive new GPS data for time, defined in Max Time between GPS readings for SxT calculation it will not use the regular calculating algorithm. Instead, it will ignore the time during which no reception was available and will restart calculating the elapsed distance immediately when satellite reception reappears.

If both Pythagoras and SxT calculation are enabled, the unit will use SxT when there is a valid GPS fix and Pythagoras when there is no GPS coverage.

Default value: 1 - Enable

6.3.10.2 Enable Pythagoras Calculation

Address: 509, bit 1

Description: If this flag is enabled the unit will calculate the distance between 2 consistent GPS queries according to the Pythagoras theorem:

$$\text{Distance} = \sqrt{(\Delta Altitude)^2 + (\Delta Longtitude)^2 + (\Delta Latitude)^2}$$

If both Pythagoras and SxT calculation are enabled, the unit will use SxT when there is a valid GPS fix and Pythagoras when there is no GPS coverage (from last GPS fix to the next GPS fix).

Default value: 1 - Enable

6.3.10.3 Reset Last Known Location on Ignition Off

Address: 509, bit 2

Description: Relevant for Pythagoras and combined Pythagoras + SxT calculation. If that flag is set (logical '1') the unit will dismiss the last detected location per detection of Ignition off. For future calculation will be used the first GPS fix obtained after Ignition On.

In other words the unit will ignore the distance, passed by the vehicle during Ignition Off mode. The feature is useful in case when the vehicle is being towed from one place to another.

Note that in this case the vehicle will also ignore the distance, passed from Ignition On to first GPS fix obtained.

Default value: 0 - Disable

6.3.10.4 Max Time between GPS Readings for SxT Calculation

Address: 84

Description: This parameter stores the maximal time between two valid readings from GPS (in seconds) to be qualified for SxT odometer accumulation.

When you make a configuration take into a consideration the following rule:

where:

max speed in km/h – maximum speed that the vehicle get during the normal usage. Recommended 160km/h.

max time apart is a value programmed in this parameter.

base unit is "Base unit (measurement factor of GPS odometer)", address 80-83.

Data format: The parameter is an 8-bit integer.

Value span: 1 to 255

Default value: 7

6.3.11 *GPS Reset Settings*

6.3.11.1 GPS Reset Upon Ignition Off

Address: 6, bit 2 when GPS is navigating

6, bit 3 when GPS is NOT navigating

Description: As with any ARM based module, the GPS has to be reset from time to time. If one of hibernation modes is used, the GPS is reset upon entrance to hibernation.

But if the hibernation in not used the safest way to reset the GPS periodically is upon Ignition change to Off state. There is an advantage of doing such a maintenance reset when the GPS is navigating, because such a worm reset enables the shortest recovery time. It is also possible to do it only when the GPS is not navigating anyway, but in this case (for example on underground parking) the recovery might be longer.

Default values: bit 2 – 0 (disabled), bit 3 – 1 (enabled GPS reset upon ignition off when the GPS is not navigating)

6.3.11.2 GPS AHR (Auto Hardware Reset) – except in CelloTrack Nano

When the unit identifies 3 consecutive GPS communication errors, the unit will attempt to Auto Hardware Reset (AHR) its GPS up to programmable number of retries (according to Maximum Number of AHR parameter used also for Modem AHR, 5 by default).

The unit will create a dedicated event per each GPS AHR – TR 200, STR 2 (if enabled by Enable AHR Reporting parameter).

6.3.12 *Vehicle's Driver speed delta relative to GPS speed*

Address: 510

Description: This byte represents the difference, in percent's, between the vehicle's speed as measured by the GPS and the vehicle's speed as presented to the driver on the dashboard. Usually the driver display shows a speed which is about 5 % higher that the real vehicle's speed. This byte is vehicle type depended. The corrected speed will affect all the speed related calculations like over speeding, speeding related outputs activations etc. The corrected speed shall not affect the unit's distance calculation, this mechanism will continue using the real unit's speed as received by the GPS.

NOTE: This parameter applies also to CSA (Cellocator Safety Application) application, but only after ABC maneuvers calibration process end.

Default values: 5 %

6.3.13 *GPS first samples to filter out*

Address: 4097 bits 1-5

Description: This parameter defines how many first GPS samples are thrown away before starting to process them. This may slow down the TTFF but will prevent jumps and erroneous locations.

Data Range: 0-31

Default Value: 10

6.4 Inputs & Outputs

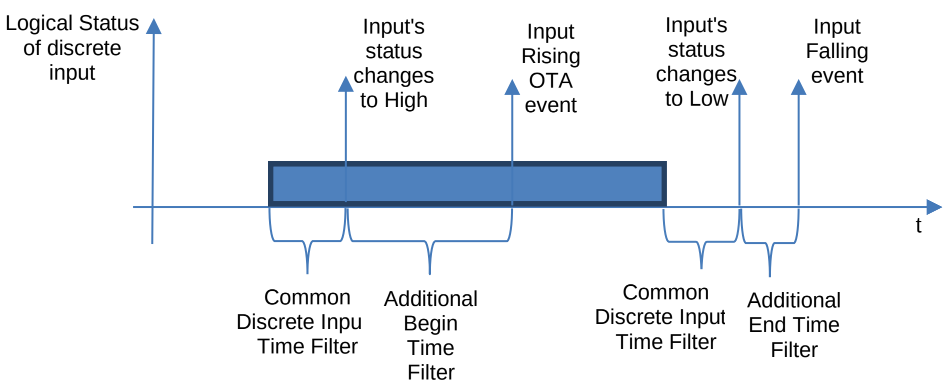
6.4.1 *Discrete Inputs Triggering Time Filters*

These two bytes defines the input's Additional Time Filters. The Additional Time Filter will extend the input's filtering capabilities separately for logical Rising and logical Falling.

The total filter is constructed from Common Discrete Inputs Time Filter (same for all inputs and all states) and dedicated filter for each state change (Rising/Falling) of each input.

It is possible to define asymmetric triggering delays for logical Rising and logical Falling for each one of system's discrete inputs.

The Additional Time Filter supports multiple resolutions from seconds to hours.



6.4.1.1 Common Discrete Inputs Time Filter

Address: 136

Description: This parameter is aimed to protect unit's discrete input from noise influence and defines time, from input's level change to change detection.

Data format: 8-bit unsigned, Resolution 10 msec.

Value span: 0x00 to 0xFF

Default value: d10

6.4.1.2 Additional Begin Time Filter Resolution

Address: bits 6 and 7

Door /

CelloTrack T, GP1 1357

Shock /

CelloTrack T, GP2	1359
Distress	1361
Unlock	1363
Lock	1365
Ignition	1367
CFE_In1	1369
CFE_In2	1371
CFE_In3	1373
CFE_In4	1375
CFE_In5	1377
CFE_In6	1379

Description: This parameter defines resolution of the additional time filter applied in addition to Common Filter before discrete input rising alert is generated.

Value	Resolution	Maximum possible value of the filter
0	1 sec	63 sec
1	30 sec	31.5 min
2	5 min	5.25 hours
3	1 hour	63 hours

Default value: 0 – resolution of 1 second

6.4.1.3 Additional Begin Time Filter value

Address: bits 0-5

Door /	
CelloTrack T, GP1	1357
Shock /	
CelloTrack T, GP2	1359
Distress	1361
Unlock	1363
Lock	1365
Ignition	1367

CFE_In1	1369
CFE_In2	1371
CFE_In3	1373
CFE_In4	1375
CFE_In5	1377
CFE_In6	1379

Description: This parameter stores a value of the additional time filter applied in addition to Common Filter before discrete input rising alert is generated. The resolution of the value is configured in previous parameter (1 second to 1 hour).

Default value: 0 – additional filter disabled

6.4.1.4 Additional End Time Filter Resolution

Address: bits 6 and 7

Door /	
CelloTrack T, GP1	1358
Shock /	
CelloTrack T, GP2	1360
Distress	1362
Unlock	1364
Lock	1366
Ignition	1368
CFE_In1	1370
CFE_In2	1372
CFE_In3	1374
CFE_In4	1376
CFE_In5	1378
CFE_In6	1380

Description: This parameter defines resolution of the additional time filter applied in addition to Common Filter after discrete input rising alert is generated.

Value	Resolution	Maximum possible value of the filter
0	1 sec	63 sec

1	30 sec	31.5 min
2	5 min	5.25 hours
3	1 hour	63 hours

Default value: 0 – resolution of 1 second

6.4.1.5 Additional End Time Filter value

Address: bits 0-5

Door /	
CelloTrack T, GP1	1358
Shock /	
CelloTrack T, GP2	1360
Distress	1362
Unlock	1364
Lock	1366
Ignition	1368
CFE_In1	1370
CFE_In2	1372
CFE_In3	1374
CFE_In4	1376
CFE_In5	1378
CFE_In6	1380

Description: This parameter stores a value of the additional time filter applied in addition to Common Filter after discrete input rising alert is generated. The resolution of the value is configured in previous parameter (1 second to 1 hour).

Default value: 0 – additional filter disabled

6.4.2 *Analog Measurement Averaging Time*

Address: 466

Name in Programmer: Power Sources Measurement Time filter

Description: This parameter is aimed to protect analog measurement from noise influence and defines averaging time. The reported value will be therefore an average voltage for the period defined in this parameter. (The sampling rate is every 10msec).

Data format: 8-bit unsigned, resolution 0.1 second

Value span: 0-25.5 seconds

Default value: 1 second

6.4.3 *Inputs in OTA Message*

Address: 0, bit 3

Presentation of inputs in wireless Cellocator protocol

0	Legacy mode, inputs are presented in their raw (unprocessed) form.
1	Inputs are presented in their processed, logical form (inverted and filtered).

***Default value**: 0*

6.4.4 *Enable Monitoring Logical Status of Ignition in OTA Packets*

Address: 1349, bit 0

Description: If this bit is enabled (1) the ignition bit in all any outbound messages (OTA and serial) will reflect logical status of Ignition (i.e. after the Ignition Filter)

Default value: 0 - Disable Logical

6.4.5 *Enable Warning Output Activation during Gradual Immobilization*

Address: 0, bit 5

Description: If enabled, a "blinkers" output (pin 18) will be activated when Gradual Stop output is gradually or immediately activated (to notify surrounding driver that the vehicle is going to blame and stop shortly).

Default value: 0 - Disable warning output activation

6.4.6 *Outputs Pulse Width Period*

Address: 140

Description: This parameter defines the activation duration time for pulse outputs (for example some system feedbacks like Driver Authorization and others).

Data format: 8-bit unsigned, resolution is 100 mSec

Default value: 0.5 second

6.4.7 *LED Management*

Address: [7, bit 4]

Description: This flag enables LED monitoring, which is different in Fleet and Security modifications of Cellocator units.

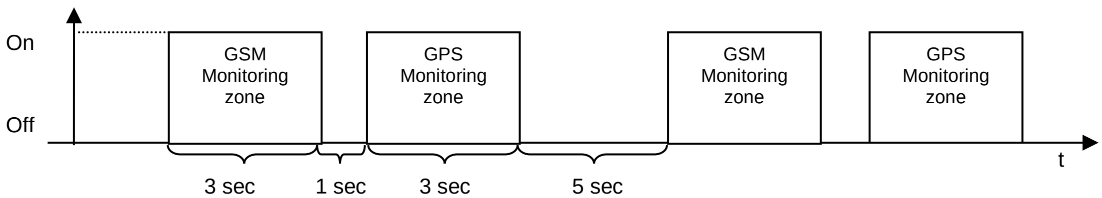
In fleet firmware modifications a sophisticated blinking pattern, monitoring GPS and GSM status is provided, in a Security modification the LED monitors a security state of the system.

In Car Sharing systems this bit also control the Proximity Reader LED

In Fleet Modification:

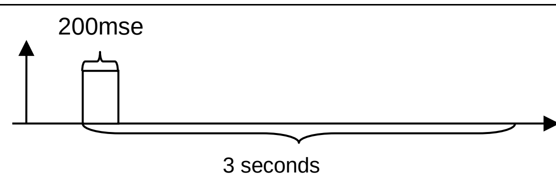
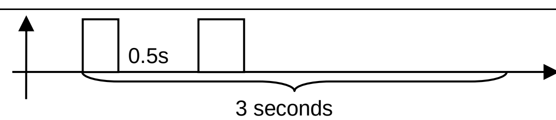
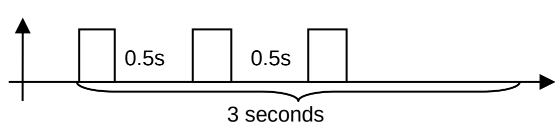
The blinking pattern is constructed from cycles of 2 blinking zones each, which will be repeated by unit continually. The first zone will represent the functionality of GSM, the second zone – GPS.

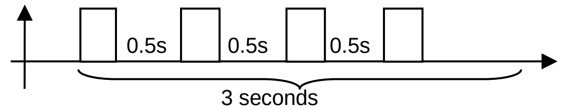
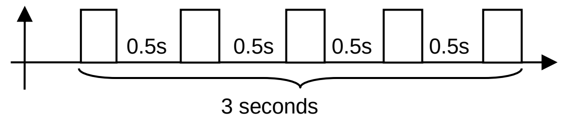
Each zone will last 3 seconds with 1 second of LED off interval between them.



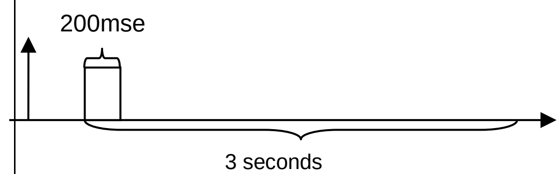
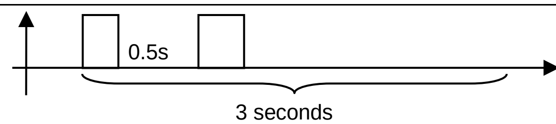
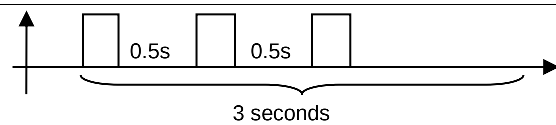
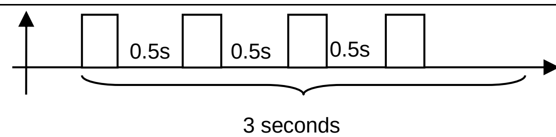
5 seconds LED Off interval will separate between each cycle.

GSM Monitoring Zone definition

Status	Blinking pattern
GSM off	off
Not registered to GSM / No SIM	
Registered in Home GSM network (not attached to GPRS)	
Registered in Roaming GSM network (not attached to GPRS)	

Attached to GPRS/home	
Attached to GPRS/roaming	

GPS Monitoring Zone definition

Status	Blinking pattern
GPS off	off
GPS is unplugged / faulty	
GPS communicating, but not navigating	
GPS is in navigation mode	
GPS is in GYRO mode (only for compatible models)	

In Security modification

1 second on/1 second off – Alarm Armed

On - Silent delay

Slow Blinking – Passive Arming

Off – Standby

Rapid blinking – Alarm Triggered

Default value (Fleet and Security): 0 - LED Management Enable;

In CarSharing - Old

LED Management Disable bit – if this bit is enabled, the monitoring LED will behave in the following manner:

- Glow during voice session
- Ignition On:
    - 0.5 second on and 2 seconds off while there is no GSM registration.
    - Off - when GSM registered.
- Ignition Off:
    - **Backwards compatible mode**
        - 1 second on and 2 seconds off when reserved (for example, when there is a Dallas ID other than zero in the low 17 slots of the Dallas ID array).
        - Off - Ready for reservation.
    - **Enhanced mode**
        - 1 second on and 2 seconds off when reserved (for example, when there is a Dallas ID other than zero in the low 30 slots of the Dallas ID array).
        - Off - Ready for reservation.

Default value: LED – disabled (1)

6.4.8 *Analog (& Frequency) Inputs in OTA Message*

Note that frequency counters are supported from FW30a.

6.4.8.1 Bytes 26-29 of OTA Message 0

Address:	1620	1621	1622	1623
Byte of OTA Message 0	26	27	28	29

Description: The OTA protocol provides 4 bytes dedicated for monitoring of analog inputs in few different message types. Those bytes can contain measurement from the different fields as per the configuration below.

Obviously if the selected source of Data is an Analog input, the corresponding input shall be programmed as an analog input in Input's Configuration.

Pin Number/Field Name	Number to be programmed	Remarks
None	0	
Pin 4 / Input-1(Door)	1	
Pin 17 / Input-2(Shock)	2	Default for byte 29 of OTA Message 0
Pin 12 / Input-3(Panic)	3	
Pin 15 / GPIO1 (Unlock)	4	
Pin 6 / GPIO2 (Lock)	5	
Battery voltage (V bat)	6	Default for byte 27 of OTA Message 0
Battery temperature (NTC), default for byte 3	7	Default for byte 28 of OTA Message 0. Note: In CelloTrack T Power, It is mandatory to select NTC in one of the OTA bytes (26-28) in order to enable the charging function
Regulated voltage	8	
Input voltage	9	Default for byte 26 of OTA Message 0
CFE In 1	10	
CFE In 2	11	

Pin Number/Field Name	Number to be programmed	Remarks
CFE In 3	12	
CFE In 4	13	
CFE In 5	14	
CFE In 6	15	
First oneWire Temperature Sensor	16	Signed value ranging from -55 to 125 *Celsius*
Second oneWire Temperature Sensor	17	
Third oneWire Temperature Sensor	18	
Forth oneWire Temperature Sensor	19	
RSSI	20	
RPM	21	Taken from analog frequency input or from CAN (depends on CAN Application Control parameter – address 4102, bit 3).

6.4.9 *Restore Output State after Reset and Shipment mode*

6.4.9.1 Restore Gradual Stop Output State after Reset and shipment mode

Address: 501, bit 0

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 - Enable

6.4.9.2 Restore Siren Output State after Reset and Shipment mode

Address: [501, bit 1]

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 - Enable

6.4.9.3 Restore St. Immobilizer Output State after Reset and shipment mode

Address: [501, bit 3]

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

This feature will function only if the of parameter of "Activate Immobilizer while there is no active Dallas" (address 1 bit 5) is **Disabled**.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 - Enable

6.4.9.4 Restore LED Output State after Reset and Shipment mode

Address: [501, bit 4]

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 - Enable

6.4.9.5 Restore Blinkers Output State after Reset and Shipment mode

Address: 501, bit 5

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 – Enable

6.4.9.6 Backup immobilizer state

Address: 501, bit 7

Description: This parameter enables the unit mechanism of backup all Immobilizer related important variables in NVM.

Data range: 0 - Disable, 1 - Enable

Default value: 1 - Enable

6.4.9.7 Restore GPIO2 Output State after Reset and Shipment mode

Address: 501, bit 2

Description: In legacy implementation all outputs states are kept by the unit before SW reset (e.g. upon PL upgrading). If enabled, all outputs states are kept by the unit before SW reset and before Shipment Mode, so an output which was active before the reset/Shipment Mode, will be activated again after the reset/Shipment Mode. If disabled, the output will not be activated after the reset/Shipment Mode, even if it was active before the reset/Shipment Mode.

Data Range: 0 – Enable

1 - Disable

Default Value: 0 - Enable

6.4.10 *Feedback Outputs*

6.4.10.1 Use Blinkers Feedback

Address: 449, bit 4

Description: This parameter enables usage of Blinkers output (pin 18) for system and security feedbacks, like Dallas ID reception confirmation beep, Silent Delay expiration notification beeps and so on. It is recommended to use buzzer connected to a feedback output. The Blinker's state will be preserved after SW/HW reset but not after Power Recycle.

Default value: 0 – Disable

6.4.10.2 Use Siren Feedback

Address: 449, bit 0

Description: This parameter enables usage of Siren output (pin 8) for system and security feedbacks, like Dallas ID reception confirmation beep, Silent Delay expiration notification beeps and so on. It is recommended to use buzzer connected to a feedback output.

Default value: 0 – Disable

6.4.11 *Outputs Inversion Mask*

6.4.11.1 Invert Blinkers Output

Address: 503, bit 3

Description: This parameter enables inversion of corresponding output's logic (pin 18). Inverted output will be normally activated and will be turned off per OTA or serial output activation command.

0 - Normal polarity (not activated - disconnected; activated – grounded)
1 - Inverted polarity (not activated - grounded; activated – disconnected)

Default value: 0 – Normal polarity

6.4.11.2 Invert Gradual Stop (PWM) Output

Address: 502, bit 2

Description: This parameter enables inversion of corresponding output's logic (pin 17). Inverted output will be normally activated and will be turned off per OTA or serial output activation command.

0 - Normal polarity (not activated - disconnected; activated – grounded)
1 - Inverted polarity (not activated - grounded; activated – disconnected)

Default value: 0 – Normal polarity

6.4.11.3 Invert Standard Immobilizer Output

Address: 503, bit 5

Description: This parameter enables inversion of corresponding output's logic (pin 7). Inverted output will be normally activated and will be turned off per OTA or serial output activation command.

0 - Normal polarity (not activated - disconnected; activated – grounded)
1 - Inverted polarity (not activated - grounded; activated – disconnected)

Default value: 0 – Normal polarity

6.4.11.4 Invert LED Output

Address: 503, bit 0

Description: This parameter enables inversion of corresponding output's logic (pin 6). Inverted output will be normally activated and will be turned off per OTA or serial output activation command.

0 - Normal polarity (not activated - disconnected; activated – grounded)
1 - Inverted polarity (not activated - grounded; activated – disconnected)

Default value: 0 – Normal polarity

6.4.11.5 Invert GPIO2 Output

Address: 503, bit 4

Description: This parameter enables inversion of corresponding output's logic (pin 6). Inverted output will be normally activated and will be turned off per OTA or serial output activation command.

0 - Normal polarity (not activated - disconnected; activated – grounded)
1 - Inverted polarity (not activated - grounded; activated – disconnected)

Default value: 0 – Normal polarity

6.4.12 *Output activation*

6.4.12.1 Crash type to output

Addresses: 606, bits 0-1

Description: This field selects which kind of crash will activate the output (for a 2 seconds pulse).

0 – Feature disabled

1 – Light crash

2 – Heavy crash

3 – Both Light and Heavy crashes

Default value: 0 - Feature disabled

6.4.12.2 Crash detection indication output selection

Address: 606, bits 2-5

Description: This field selects the output used to notify on a crash.

Output's number	Output's name
0	Feature Disabled
1	Siren
2	Gradual Stop
3	St. Immobilizer
4	LED
5	Blinkers
6	CFE Out 1
7	CFE Out 2
8-15	Reserved

Default value: 0 - Notification disabled

6.4.12.3 Input change activate output

Address: 609, bits 0-3

Description: This field selects the input that will drive the selected output state.

Output's number	Output's name
0	Feature Disabled
1	Door
2	Shock
3	CFE in 1
4	Driving Status
5	Panic
6	Unlock

7	CFE in 2
8	CFE in 3
9	Lock
10	CFE in 4
11	CFE in 5
12	CFE in 6
13	Accelerometer status
14	Ignition port
15	Reserved

Default value: 0 - Feature disabled

6.4.12.4 Input-to-output feature output selection

Address: 609, bits 4-7

Description: This field selects the output used to output the input change.

Output's number	Output's name
0	Feature Disabled
1	Siren
2	Gradual Stop
3	St. Immobilizer
4	LED
5	Blinkers
6	CFE Out 1
7	CFE Out 2
8-15	Reserved

Default value: 0 - Feature disabled

6.4.12.5 Selected output can be restored only by OTA command

Address: 533 bit 0

Description: When this bit is enabled, the unit will allow the selected output (unless it's the Std. Immobilizer) to be restored only by OTA command. If disabled, then it could be restored by both OTA command and presenting a driver-ID by a Dallas key.

0 - Disable

1 - Enable

Default value: 0 - Disable

6.4.12.6 Std. Immobilizer can be changed only when speed is low

Address: 533 bit 1

Description: When this bit is enabled, the unit will allow change in Std. Immobilizer output state only if speed is available and is lower than 7Km/h.

0 - Disable

1 - Enable

Default value: 0 - Disable

6.4.13 *Outputs by OTA monitoring*

Address: 528, Bit 0 – Blinkers

Bit 1 – PWM

Bit 2 – STD immobilizer

Bit 3 – LED output

Bit 4 - Siren

Decription: If enabled, the unit will send an event of type-0 TR-113 upon every activation/deactivation of the corresponding output by OTA command.

0 – Disable

1 - Enable

Default value: 0 – all bits disabled

6.4.14 *Usage Counter Configuration*

6.4.14.1 General Description

This feature is designed for continuous counting of the “Working time” of a device, monitored by one or two unit’s inputs. Example of possible usage is – monitoring of an engine's working hours.

The inputs who's "High State" time is counted are selectable by programming.

It is possible to assign each of two timers to a specific input, including the option to assign both timers into the same input. Every input, including ignition, supports "High State" or "usage" time calculation.

The value of the measured time from each input is located in the unit's RAM (protected, not erased on software reset). The unit makes mathematical rounding on partial minutes: (1:29 will be counted as 1 minute and 1:30 and above as 2 minutes).

Once a day the values of both Usage Counters are backed up to the especial address in non-volatile memory. The timer keeps time counting (from the value stored in RAM) each time when the logical level of the appropriate input changes from low to high.

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

Dedicated Read/Write commands over RS232 and OTA are provided for Usage Counters, including a periodical Usage Counters update OTA packet.

6.4.14.2 Enable Usage Counters

Address: 7, bit 2

Description: In order to start Usage Counters time counting this bit shall be enabled (set to 1).

Status of this parameter can be changed without reset.

Default value: 0 - Disable

6.4.14.3 Wake up from Hibernation upon Periodical Usage Counter Update Timer Expiration

Address: 1, bit 7

Description: This bit enables waking up the unit from full hibernation for periodic Usage Counter update.

Default value: 0 - Disable

6.4.14.4 1st Usage Counter Input

Address: 1330

Description: The byte contains number of the input, utilized by the first Usage Counter. The unit will use this parameter to backup the value of the 1st Usage Counter from RAM once a day.

Input's numbers definition:

Input's name	Input's number
Door	0

Input's name	Input's number
Shock/Unlock2	1
Ignition	5
Panic	6
Unlock	7
Lock	10

In order to set the use of only one Usage Counter input, select inexistent input for the second counter (for example 4).

Default value: 0

6.4.14.5 2nd Usage Counter Input

Address: 1331

Description: The byte contains number of the input, utilized by a second Usage Counter. The unit will use this parameter to backup the value of the 2nd Usage Counter from RAM once a day. In order to set use only one Usage Counter input – select inexistent input number in this parameter (for example 4).

Default value: 0

6.4.14.6 Reporting Interval of Usage Counters

Address: 1332

Description: This parameter defines Usage Counters reporting period. Setting this value by standard programming access is not recommended, as it will require reset to be implemented. Refer to OTA and serial protocol document for a dedicated update command description.

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

Default value: 0 – Reporting canceled

6.4.15 *Frequency Metering*

6.4.15.1 General Description

Pulse frequency measurement is supported on pair of Cello inputs (Door and Shock inputs, pins 14 and 15).

The frequency measurement is implemented on the same ports as the analog measurement; obviously only one of those functionalities can be active at a time).

The maximal possible frequency for measurement is 5 kHz, higher frequency causes saturation of the measurement. The high level of measured signal shall be between 3V to 30V.

It is possible to use the measured number of pulses/second as a source for one of the following system parameters:

- Speed (in cm/sec)
- General Purpose pulse frequency measurement

Each of the inputs will be defined as one of the above listed types type and assigned with an appropriate scaling factor.

6.4.15.2 Frequency Input as a Speed Information Source

If the input is defined as a "speed source", the measured frequency value, multiplied by an appropriate scaling factor is threaded by the unit as a value of speed [cm/sec]. This value is replacing a value of speed received from GPS in all the applications: distance calculations, OTA and serial packets, over/idle speeding detection etc.

In such a case the value of speed reported in OTA message type 0 and vector change report message type 9) will be valid even if the GPS is not navigating.

The unit monitors and reports the speed source in (see also the Wireless Protocol):

- The OTA msg type 0: Byte 16, bit 3.
- The OTA msg type 9, Byte 16, bit 3

0 – GPS;

1 – Pulse frequency input.

NOTE: Only one input at a time is defined as a "speed source"; otherwise (if two inputs are defined as speed source) the unit will utilize the first one (the smallest Input number out of two) as a speed source and the second one as a GP input source.

If input on pin 14 is selected as GP freq. counter it will be considered as the 1st freq. input, if input on pin 15 is selected as GP freq. counter it will be considered as the 2nd freq. input.

Upon reset

The unit will report last known value of speed (calculated before the reset) until the new value of speed will be calculated (up to 5 seconds).

Upon Power Up / Wake up after upgrade

The unit will report zero speed until new value of speed will be calculated (up to 5 seconds).

6.4.15.3 General Purpose Pulse Frequency Measurement

If the input is defined as a General Purpose pulse frequency measurement, the system is continually measuring frequency on this input (while not in full hibernation) and updating in the following cases:

- Status message type0
- Query from COM port
- Query from OTA channel
- Frequency Threshold violation

6.4.15.4 Auto Calibration of Frequency Inputs

Since the manual calibration is impossible to implement in a reality of multiple installations it is required to propose a method, enabling calibration in minimal time and with minimal installer's intervention.

There are two independent processes: calibration of speed and of GP frequency inputs.

The purpose of GP frequency input calibration is to set an optimal resolution for measurement monitoring in 1 byte of OTA protocol.

The purpose of speed pulses input (Vss) calibration is to make an accurate conversion from measured frequency in Hz to vehicle's speed in cm/sec.

1.1.1.1.44 *OTA RPM (or GP Frequency) Input Calibration*

Upon the end of the installation the installer switch on an ignition, keeps the engine running on idle (for example on 700 rpm), call the operator and informs him with the current reading of the tachometer.

The operator sends RPM calibration OTA command, containing the reading reported by operator and number of frequency input. The unit measures a frequency from the RPM input, and calculates the best Scaling Factor for the corresponding engine speed.

For example:

The idle engine speed, according to the front panel is 700rpm.

Maximum possible value of engine speed in standard vehicle might be assumed as 7000rpm (programmable in the next parameter), i.e. currently measured value is 10% of the maximum, and value of 10 is received in an incoming OTA command.

The measured frequency at the moment of OTA command reception is 400 Hz; therefore the maximum possible value is automatically set as 4000 Hz.

$$Fmax = \mathrm{Fc}\frac{100\%}{\mathrm{P}} = 400 * \frac{100\%}{10} = 4000(Hz)$$

Fc– measured frequency during calibration (Hz)

P – Percentage of a maximum value received in command (%)

Fmax – maximum possible frequency on the wire (Hz)

Using the values from the example above the Scaling Factor, adapting the resolution of the measurement will be calculated using the following equation:

$$Sfes = \frac{255}{\mathrm{Fmax}} = \frac{255}{4000[\mathrm{pps}]} = 0.06375[\mathrm{pps/bit}]$$

Sfes – scaling factor of engine speed

Fmax – maximum possible frequency on the wire

(The value, automatically programmed in EEPROM upon the end of the calibration process will be 64, refer to programming section below in this document)

Note that Cellocator Programmer automatically adapts the value and shows it as 0.064.

1.1.1.1.45 *Restoring Value of RPM from the Receiving Value*

The central control will have to apply the following conversion upon parsing of the received value, in order to convert it to the real engine speed.

$$ES[rpm] = Xes * \frac{MAXes[rpm]}{255}$$

[rpm] *ES – Momentary value of engine speed [Hz] (this value is received in an OTA response to calibration command)*

Xes – value representing Engine Speed, received in the message

$MAXes[rpm]$*– max possible value of RPM, programmable (7000 by default)*

255 – max possible value representing Engine Speed, received in the message

1.1.1.1.46 *Local RPM (or GP Frequency) Input Calibration*

Local RPM calibration requires enabling a corresponding bit in the configuration (526 bit 2), 1 input and 1 output, which must be configured as a Calibration input and output on parameters allocated on Address 516. The input is used to control the calibration process and the output to provide a feedback to the installer (normally by driving a Buzzer).

Calibration Process:

1. Entering 'RPM calibration mode' by holding the configured input for more than 5 seconds. The device will confirm this command by beeping the buzzer (at the configured output) 3 times (0.5s ON, 0.5s OFF). Device is then ready to start RPM calibration.

2. The following process should take place:

   a) Make sure the Ignition is On and the vehicle is Idling (Halt timeout is expired)

   b) Set engine to be stable on the 1st measurement point, which is configurable by "Local RPM Calibration 1st Measurement Point" parameter (address 517) (default 1000 RPM), trigger the configured input.

      The device will confirm this command by pulsing the configured output (connected to buzzer) once (0.5s beep).

   c) Set engine to be stable on x2 of the 1st measurement point, trigger the configured input, the device will confirm this command by pulsing the configured output (connected to buzzer) once (0.5s beep).

   d) Set engine to be stable on x3 of the 1st measurement point, trigger the configured input, the device will confirm this command by pulsing the configured output (connected to buzzer) once (0.5s beep).

   e) The device will confirm RPM calibration success by 2 seconds long beep.

If the time between the calibration phases is longer than 30 seconds or there is no linearity between the readings, a "bad" beep will be issued (5 beeps, 0.5s ON and 0.5s OFF each) and the RPM calibration will fail.

If a calibration phase fails the unit will preserve the previous successful calibration phase values.

Notes:

- There is no option to re-start the calibration process while currently in a calibration process (i.e. a long input trigger (more than 5 seconds) while in a current calibration process will be ignored).
- Max 10% error rate is allowed between two consecutive calibration phases. For example: after calibrating the 1000 RPM step, the allowed values for the 2000 RPM is between 1800-2200.

1.1.1.1.47 *Local RPM Calibration Enable*

Address: 526, bit 2

Description: this bit enables calibration of the RPM using local input and output.

Default value: 0 - Disable

1.1.1.1.48 *Local RPM Calibration 1st Measurement Point*

Address: 517

Description: This parameter defines the 1st RPM measurement point for local RPM calibration process. The 2nd and 3rd measurement points would be considered as x2 and x3 of the 1st point, respectively. For example, if the 1st point is defined as 500 RPM, the 2nd point would be considered as 1000 RPM, and the 3rd point would be considered as 1500 RPM. Valid range for this parameter is 300-1500 RPM (the unit will consider any programmed value lower than 300 as 300, and programmed value higher than 1500 as 1500).

Resolution: 10 RPM

Data Range: 300-1500 RPM

Default Value: 1000 RPM

1.1.1.1.49 *Local RPM Calibration input selection*

Address: 516, bits 0-3

Description: This parameter selects the input, used during local calibration of the RPM.

Number	Description
0	Disable
1	GPIO1 (Unlock)
2	GPIO2 (Lock)
3	Door
4	Shock
5	Panic
6	CFE IN 1
7	CFE IN 2
8	CFE IN 3

Number	Description
9	CFE IN 4
10	CFE IN 5
11	CFE IN 6

Default value: 0 – Disable feature

1.1.1.1.50 *Local RPM Calibration output selection*

Address: 516, bits 4-7

Description: This parameter selects the output, used during local calibration of the RPM.

Number	Description
0	Disable
1	GPIO1 (Siren)
2	Gradual Stop
3	St. Immobilizer
4	LED
5	Blinkers
6	CFE OUT 1
7	CFE OUT 2
8	GPIO2 Output

Default value: 0 – Disable feature

1.1.1.1.51 *Report engine hours based on RPM*

Address: 526, bit 3

Description: This parameter is only applicable for a units containing CSA (iQ40, iQ50 or CANiQ).

If this bit is enabled, and Engine RPM is used and it's value is higher then zero the unit will count engine on minutes.

Upon end of the trip the unit will generate an OTA type 9 event to Fleet server, containing sub-data 4 (GPS and Time) and sub-data 0x16 (number of minutes the engine was on during this trip).

The same information will be sent also to CSA server, in Module 32 (End of Trip), under the same conditions.

Default value: 0 – Disable feature

1.1.1.1.52 *Speed (Vss) Input Calibration*

Upon reception of OTA calibration command (refer to Wireless protocol, Command type 0x14) the unit shall enter the pulse counting mode until next ignition off. During this mode the unit does not measure frequency on the specific input, but accumulates number of pulses received during the entire driving period.

The driver will be asked by the operator to drive certain distance; the same value of distance will be sent to the unit inside the calibration command sent to the unit at the same time.

The driver will drive for the required distance according to the front panel reading, stop and switch off the ignition.

The unit will use accumulated number of pulses to calculate the scaling factor as per the description below.

Example:

60.000 pulses accumulated during 5km.

$$Sfs = \frac{\text{D[cm]}}{\text{Acc}} = \frac{500000\text{[cm]}}{60000\ \text{[pulses]}} = 8.333$$

D– Driven distance [cm]

Acc – Accumulated number of pulses

Sfs – scaling factor of speed

(The value to be written to an EEPROM is 8333)

The accuracy of the reported speed and distance depends on the accuracy of distance driven during calibration.

Below provided reference results of distance calculation accuracy, achieved after 2km calibration distance:

Odometer value (trip of 479 km)	Error [Km]	Error [%]
GPS source	+10	1.87%
VSS source	-5	1.04%

1.1.1.1.53 *Maximum Possible Scaled Frequency*

Address 2368-2369

Description: This parameter contains the maximum possible value of scaled frequency, measured on GP Frequency input.

In case of engine speed it will be a maximum possible engine speed in units of rpm (in standard vehicle might be assumed as 7000rpm)

This value is used by the unit during the process of auto-calibration.

Default value: 7000

1.1.1.1.54 *Enable Frequency Violation Start Event*

Address: 1677 (for Door input), and (1690 for Shock input) bit 2

Description: If enabled ('1'), the unit will generate a dedicated event upon freq. violation start.

Default value: 0 - Disable

1.1.1.1.55 *Enable Frequency Violation Start Distress*

Address: 1677 (for Door input), and (1690 for Shock input), bit 3

Description: If enabled ('1'), the unit will generate distress session upon freq. violation start.

Default value: 0 - Disable

1.1.1.1.56 *Enable Frequency Violation End Event*

Address: 1677 (for Door input), and (1690 for Shock input), bit 4

Description: If enabled ('1'), the unit will geneare a dedicated event upon freq. violation end.

Default value: 0 - Disable

1.1.1.1.57 *Enable Frequency Violation End Distress*

Address: 1677 (for Door input), and (1690 for Shock input), bit 5

Description: If enabled ('1'), the unit will generate distress session upon freq. violation end.

Default value: 0 - Disable

1.1.1.1.58 *Don't Use Time Filter for Frequency Violation End*

Address: 1677 (for Door input), and (1690 for Shock input), bit 6

Description: If enabled ('1'), the unit will not wait for the violation filter time and generate violation end alert immediately after violation end.

Default value: 0 – Use filter

1.1.1.1.59 *Ignore Violation on Ignition On*

Address: 1677 (for Door input), and (1690 for Shock input), bit 7

Description: If enabled ('1'), the unit will not generate alert:

a) If upon ignition on a measured value is violating the threshold.

b) If after any type of reset a measured value is violating the threshold.

Default value: 0 – report violation on Ignition On.

6.4.15.5 Pulse Counter

Fuel consumption is very basic feature in Fleet Management. Older vehicles without embedded fuel consumption mechanisms usually install 3rd party Fuel Flow Meters translating the fuel flow into electrical pulses. The Cello Pulse Counter feature will integrate pulse counting into Cello's legacy frequency measurement mechanism. The solution will programmatically support any relation between Litters and resulted electrical pulses to support multi vendor Flow Meters devices.

The Cello unit supports pulse counter frequency of up to 30Hz.

The user can send dedicated OTA request and get the measured fuel consumption in Litters. The Litter measure will be calculated by multiplying the number of pulses accumulated by programmable scaling factor.

The user can read and set the accumulated pulse count via PL upload and download. The value in the PL is the raw pulse count.

1.1.1.1.60 *Pulse Counter Scaling Factor*

Address: 2442-2443 (For Door Input), and 2444-2445 (For Shock Input)

Description: When the Pulse Counter feature is enabled (Door/Shock "Input type" field option 5) the pulse count will be translated to fuel volume units by multiplying the "Pulse Counter" value by the "Pulse Counter Scaling Factor" value.

The consumed fuel will be reported periodically to the server using modular message (Msg Type 9, Sub-data type 14).

The value is represented by 16 bits Little Endian.

Default value: 1 – One pulse per Litter

1.1.1.1.61 *Pulse Counter Current Pulse Count*

Address: 2438-2441 (For Door Input), and 2434-2437 (For Shock Input)

Description: When the Pulse Counter feature is enabled (Door/Shock "Input type" field option 5) this value represents the current pulse count.

The user can program this value to 0 in order to clear the current pulse count.

Note: for preventing NVM wear, the FW will update this value in the NVM upon:

1. Receiving the 1st pulse after power on
2. Every 24 hours after power on

However, the FW will read this value from the PL immediately upon PL change.

The value is represented by unsigned, 32 bits, Little Endian.

Default value: 0

1.1.1.1.62 *Pulse Counter Periodic Transmission Period*

Address: 2446-2447 (Common for Door and Shock Inputs)

Description: When the Pulse Counter feature is enabled (Door/Shock "Input type" field option 5) the unit starts sending periodic messages (Msg Type 9, Sub-data type 14) containing values representing the amount of fuel volume consumed by the vehicle as from the last Pulse Count reset.

This configuration value represents the time between message transmission in resolution of 15 Minutes or 15 Seconds (configurable, address 2461).

The value is represented by unsigned, 16 bits, Little Endian.

Default value: 0

1.1.1.1.63 *Pulse Counter Periodic Transmission Resolution*

Address: 2461, bit 0 (Common for Door and Shock Inputs)

Description: This parameter enables selection of pulse counter periodic time transmission resolution, between 15 minutes and 15 seconds. The transmission resolution will be multiplied with the value of Pulse counter periodic time transmission parameter.

Default value: 0 (15 minutes)

6.4.15.6 Excessive RPM events Config

Address: 2448

Description: The unit will trigger event towards the communication center upon detection of an appropriate driver behavior violation if this violation is enabled (1) in this bitmask.

The feedback will be triggered upon violation of the logical conditions, irrespectively to the generation (or not generation) of event/distress for the corresponding violation.

Reserved				Excessive RPM threshold 2 crossed Distress Event	Excessive RPM threshold 2 crossed Logged Event	Excessive RPM threshold 1 crossed Distress Event	Excessive RPM threshold 1 crossed Logged Event
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

The value is represented by unsigned, 16 bits, Little Endian.

Default value: 0

6.4.15.7 Feedback for Excessive RPM Events 1/2

Address: 2449-2451 for Excessive RPM Event 1
2452-2454 for Excessive RPM Event 2

Description: The unit will trigger event towards the communication center upon detection of an appropriate driver behavior violation if this violation is enabled (1) in this

Driver behavior continuous violation - Feedback bitmask

Address: 2449 for first event output

2452 for second event output

Reserved		Output Activation Pattern (Upon Driver behavior violation)			Output, auto-activated upon Driver behavior violation detection		
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Driver behavior continuous violation - Output activation template

Address: 2450 for first event output

2453 for second event output

Number of activations in a session				Activation length			
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Address: 2451 for first event output

2454 for second event output

Time between the activation sessions				Number of activation sessions			
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Default value: 0

6.4.15.8 Excessive RPM (Engine Speed) Threshold ½

Address: *2455-2456: Threshold 1*
2457-2458: *Threshold 2*

Description: This parameter contains threshold for Excessive RPM (Engine Speed) event.

NOTES:

- The value of Engine Speed is scaled value of frequency measurement, taken from the input defined as General Purpose Frequency Meter.
- If both multipurpose inputs are defined as General Purpose Frequency Meters, the scaled value from Shock input (pin 15/20) will be used as a value of Engine Speed for Coasting detection.

Default value: 900

6.4.16 *GPIO1/2 Configuration*

Address: 8199

These configuration bits controls the direction of the GPIOs. Each bit can be configured to function as Input or output.

When GPIO1 is configured as output (or input and output), it will get all functions of legacy Siren signal.

<table>
<tr><td colspan="4"></td><td colspan="2">GPIO2 Pin<table><tr><th></th><th>Description</th></tr><tr><td>0</td><td>GPIO disabled</td></tr><tr><td>1</td><td>Input</td></tr><tr><td>2</td><td>Output</td></tr><tr><td>3</td><td>Input and Output</td></tr></table></td><td colspan="2">GPIO1 Pin:<table><tr><th></th><th>Description</th></tr><tr><td>0</td><td>GPIO disabled</td></tr><tr><td>1</td><td>Input</td></tr><tr><td>2</td><td>Output</td></tr><tr><td>3</td><td>Input and Output</td></tr></table></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>

Default values:

Bits 0-1: GPIO1 = 1 - Input

Bits 2-3: GPIO2 = 1 - Input

6.5 Modem & SIM

6.5.1.1 Shorten Cellular Registration Timeout

Address: 1 bit 1

Description: This programmable bit enables/disables a longer GSM registration to (5 minutes). In case of lack of GSM registration after an expiration of this timeout the modem will be reset.

0 –5 minutes GSM registration timeout

1 - 30 seconds timeout

Default value: 0 - 5 minutes GSM registration timeout

6.5.1.2 Enable Modem Power Control by Door, Shock Input

Address: by "Door" input: Address 1, bit 4

By "Shock" input: Address 465, bit 1

Description: If enabled ('1'), the modem will be switched off by "Door" or "Shock" input active state detection; it will be turned back on by input inactive state detection; i.e. it is required two states switch to use this feature (and not just a push button).

Default value: 0 - Disable

6.5.1.3 AHR (Auto Hardware Reset for Modem)

AHR (Auto Hardware Reset) is a process in which the unit performs power recycle to the Modem (i.e. power down to the Modem for at least 500ms) and to the Micro-processor.

The unit will perform AHR upon occurrence of one of the following scenarios:

- Responsive Modem: The Modem responds to AT commands, but No GSM registration in Ignition On mode for programmable time (configurable by "Registration Lack Timeout (for AHR)" parameter, address 515). In that case, the unit will perform AHR. If there is still no GSM registration according to the above conditions, additional AHRs will be performed, up to a programmable number of retries (configurable by "Maximum Number of AHR" parameter, address 504, bits 0-3).
- Non-Responsive Modem: The modem does not respond to AT commands for 5 consecutive queries. In that case, the unit will reset the Modem (SW reset). If there is still no response for the Modem after 4 resets, a power recycle to the Modem only (Pre-AHR) will be performed, after which the unit will wait for 1 second, and open a 30 seconds window in which the queries and resets process will be done again. If there is still no response from the Modem (i.e. the Pre-AHR mechanism didn't work), AHR will be performed. The process will repeat up to a programmable number of retries (configurable by "Maximum Number of AHR" parameter, address 504, bits 0-3).

The unit will create a dedicated event per each AHR (if enabled in Second Configuration Byte).

1.1.1.1.64 *Registration Lack Timeout (for AHR)*

Address: 515

Description: stores the timeout value (in minutes), before AHR trigger if the following conditions are true:

- No GSM coverage
- Ignition On mode

Data format: 1 byte, unsigned integer, resolution of minute. Zero value cancels the AHR upon lack of GSM registration.

Default value: 30 minutes

1.1.1.1.65 *Maximum Number of AHR*

Address: 504, bits 0-3

Description: The low nibble of this parameter stores the maximal allowed number of AHR retires in one session and the high nibble is currently reserved.

After the last AHR attempt, no more attempts will be made, even if the modem continues to be non-responsive or not registered.

If the AHR mechanism is disabled due to sustained non-responsiveness / non-registration (as explained above), it will only be re-enabled when achieving a full data connection, or reaching the idle modem management loop, if data connection is prohibited.

Zero retry number will cancel AHR process. Please note that setting this parameter to 0 is not recommended.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Reserved				Maximum number of AHR retries that will be made			

Data format: 1 byte = 2 nibbles.

Default value: bits 4-7 = 0, bits 0-3 = 5.

1.1.1.1.66 *Enable AHR Reporting*

Address: 1, bit 3

Description: If this bit is enabled the unit will store a plain event with dedicated transmission reason (address 200) upon each performed AHR.

Default value: 0 - Disable

6.5.1.4 Modem Reset Settings

1.1.1.1.67 *Modem Reset Period*

Hardcoded to every 24 hours.

6.5.1.5 GSM Band & GPRS Auth Type

Setting proper values of network selection and PPP GPRS Connection Authentication type enables accelerating the GSM and GPRS registration process.

On each modem's initialization the unit will check network setting and modify it if the actual setting of the modem differs from the one, programmed in this section.

Same way on each modem's initialization the unit will check the PPP GPRS Connection Authentication type and modify it if the actual Authentication type of the modem differs from programmed in this section.

Default value: Cellular Network Selection

Address: 1444, bits 0-2

Description: This parameter enables to allow the modem free switching between networks, or to fix it to a certain network (for example in cases which fallback from 3G to 2G is not allowed).

Where the fallback is not applicable by the modem, the value is considered as "Reserved".

Range:

Enum	Description
0	Automatic
1	Reserved
2	2G Only
3	3G Only
4	4G Only

Default value: 0 – Automatic

1.1.1.1.68 *Region of operation (for units with CAT-M modem only)*

Address: 1444 bits 4-7

Description: This parameter selects the modem region of operation to switch its FW to the corresponding mode.

Value span: 0 - AT&T USA

1 - Verizon USA

2 - Global non-USA

3 - Australia

4-15 - Reserved

Default value: 2 - Global non-USA

1.1.1.1.69 *IoT Technology*

Address: 1445 bits 0-3

Description: This parameter selects which IoT technology to use and prioritize.

Data range:

0 – CAT-M1

1 – NB1-IoT

2 - CAT-M1 (preferred) and NB1-IoT

3-15 - Reserved

Default value: 0 – CAT-M1

1.1.1.1.70 *PPP GPRS Connection Authentication Selection Mode*

Address: 1354, bit 6

0	Factory setting, in case of Telit PAP
1	Manual Mode, see next parameter

Default value: 0

1.1.1.1.71 *PPP GPRS Connection Authentication type*

(Only for Manual Authentication type)

Address: 1354, bits 0-1

0	PAP
1	CHAP
2	AUTO
3	Reserved

Default value: 0

6.5.1.6 SIM PIN

1.1.1.1.72 *Enable Auto SIM PIN Locking*

Address: 1348, bit 1

Description: If this bit is enabled (‘1’) the unit will auto-lock the SIM card with the PIN code programmed on addresses 1326 – 1329.

NOTES:

- Once enabled, the SIM PIN locking is irreversible; there is no way to cancel SIM PIN locking by command.
- The user has to upload the content of the programming after activation of this flag and programming in order to re-synchronize between the configuration file and the actual content of the programming.

IMPORTANT: Incorrect usage of this feature might cause SIM card blocking!

Refer to the description in the New SIM PIN section below for further details.

Default value: 0 (Disable)

1.1.1.1.73 *Active SIM PIN*

Addresses: 197-200

Name in Programmer: SIM PIN

Description: This parameter stores the PIN code that will be entered to unlock the GSM SIM card when required.

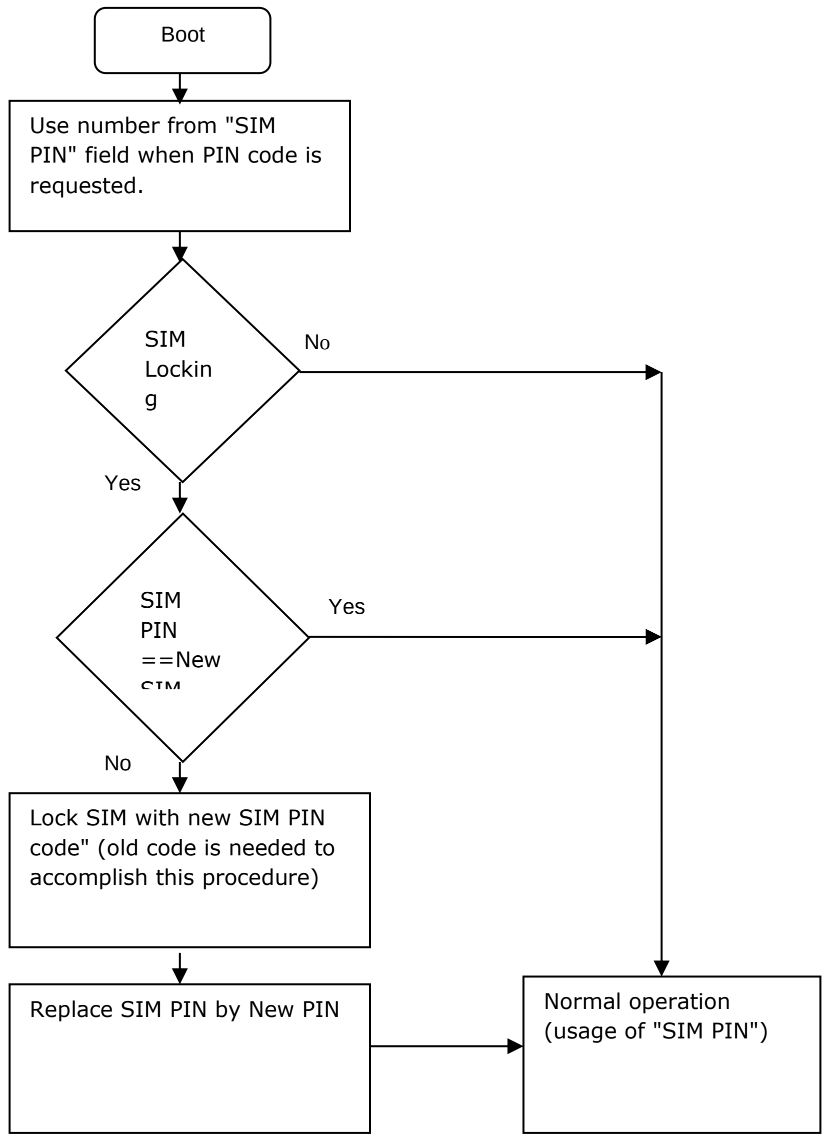
Data format (GSM): The bytes contain the digits of the PIN, encoded in BCD. The order of the transmission is bytes with lower address first, lower nibbles first. If only the lower nibble of a byte is used (this is legal only in the last byte – in case this is the last digit of the PIN), the higher nibble should have all of its bits set (the nibble should contain 15 dec). The rest of the bytes that are not used should contain 0xFF.

Default value: 1234

1.1.1.1.74 *New SIM PIN*

Addresses: 1326-1329

This parameter stores the new PIN code that should be used for locking the SIM Card during the SIM Lock procedure. This code will replace the Active SIM PIN on address 197-200 upon successful completion of the SIM Lock procedure:



NOTE: Since the unit is actively modifying content of its programming cells (replacing the old Pin code by the new one) the configuration file and the actual content of programming will lose synchronization. It is very important to synchronize them by uploading the actual content of the configuration memory from the unit before next configuration cycle.

WARNING: Programming the same configuration file twice, without uploading an actual content of programmable cells after the first programming, will cause immediate blocking of the SIM card.

Data format (GSM): The bytes contain the digits of the PIN, encoded in BCD. The order of the transmission is bytes with lower address first, lower nibbles first. If only the lower nibble of a byte is used (this is legal only in the last byte – in case this is the last digit of the PIN), the higher nibble should have all of its bits set (the nibble should contain 15 dec). The rest of the bytes that are not used should contain FFh.

Default value: 1234

1.1.1.1.75 *Lock to Certain IMSI*

Address: 1914

Description: If this parameter contains a value of 5 or 6 BCD numbers, the unit will validate an international mobile subscriber identity (MCC + MNC) of its SIM card ~15 seconds after any wake up. If the value of the SIM is different from the value predefined in this parameter – the unit will switch off the modem. If this parameter contains a value smaller than 5 digits the feature is disabled.

6.6 Power Management

6.6.1 *Power Management Mode*

Address: 266

Description: This parameter defines power consumption of the unit during Ignition Off mode.

Power consumption reduction is achieved as a trade off with availability: as the availability is lower, the power consumption is lower. The main power consumers of the unit are GPS and GSM modules; the unit switches them off periodically during parking.

Programmed Value	Mode Description	Description	Current Consumption [1]
0	No hibernation	Both GSM and GPS modules are fully active during parking, GPRS session active. (Not valid in CT-10Y and CT-Solar products)	Average: 37.35mA Peak: 181.2mA
1	Average Hibernation / GPS Peeking	The GSM modem active, GPRS session active. The GPS is peeking as per programming (see below)	(while GPS is off) Average: 23.69mA Peak: 104.5mA
2	Full Hibernation	Both GSM and GPS modules are in asynchronous peeking as per programming below. The unit does not respond to RS232 queries as well	(while both GPS & GSM off) Average: 782uA

[1] In lab conditions, no battery, Vin=13.7V, very good GPRS coverage over 900MHz GSM network. The results might vary under different test conditions.

Programmed Value	Mode Description	Description	Current Consumption [1]
		Note: In this mode Security Modification will not be able to detect Signal Correlation	
3	Full Hibernation + UART (CFE)	Relevant for CFE installations only. Same as Full Hibernation but the External Serial port is left turned on. This power mode will wake the Cello unit when one of the CFE inputs detects distress events.	Average: 6mA

Default value: 2

6.6.2 *Hibernation Mode Delay*

Address: 271-272

Description: This parameter defines time interval between Stop Event and entering any programmed Hibernation Mode.

Note: a reception of message from server side (except ACK responses) in the delay period will reset the delay (i.e. the unit will count again the configured delay from last message reception before going to hibernation).

Data format: 16-bit unsigned integer, 16 seconds resolution

Value span: 0x01 (16 seconds) through 0xFFFF (291 hours)

Default value: 60 (=16 minutes)

6.6.3 *Enable Pre-Hibernation Update*

Address: 4, bit 6 for event

4, bit 7 for distress

Description: This parameter enables and disables an update, before entering the full hibernation mode.

The update is not generated during GSM or GPS communication peeks, only between the Stop Event and entering the full hibernation; 15 seconds before an expiration of Hibernation Mode Delay timeout (Address 271).

In case of Hibernation Mode Delay timeout = 0, the event will be generated just after the Stop event.

Default value: Both disable (zeroes)

6.6.4 *Enable Data Forwarding from Serial Port by SMS (in Hibernation)*

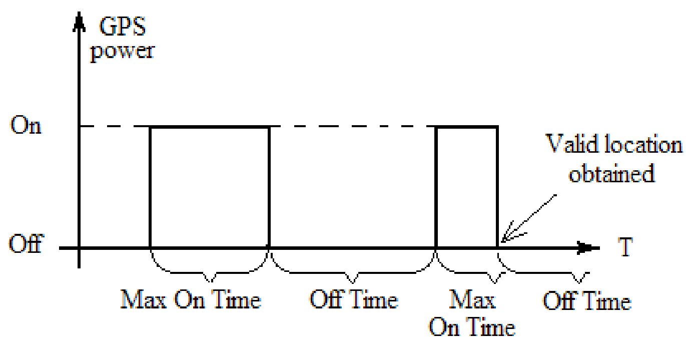
Address: 4 bit 5

Description: If this parameter is disabled, the unit will not try forwarding data from 3rd party device connected to unit's COM port (over CSP or Transparent Data protocols) through SMS in hibernation. (in case GPRS is not available or disabled, the forwarded data will be accumulated in unit's buffer).

Default value: Disabled (1)

6.6.5 *GPS Peeking*

6.6.5.1 GPS Peeking – Max On Time



Address: 263

Description: GPS peeking is a power management of GPS receiver, which enables to reduce its power consumption.

GPS peeking is activated in Ignition Off mode only, when Power Management mode is defined as 1or 2. Except for CelloTrack family, which is explained in section _d2h_bmk__Ref441484482_22.

This parameter defines the maximum amount of time the GPS is kept turned on while peeking. The GPS will be turned off once a fix is achieved, or if the Max On Time expires.

Data format: 8-bit unsigned integer, 16 seconds resolution.

Value span: 1 (16 seconds) through 255 (68 minutes); zero value is illegal and shouldn't be used

Default value: 5 (1 minute 20 seconds)

6.6.5.2 GPS Peeking – Off Time

Address: 264-265

Description: This parameter defines the amount of time between GPS peeks. (Refer to the chart in GPS Peeking – Max On Time). During this time the GPS is turned off, to conserve energy.

Data format: 16-bit unsigned integer, 16 seconds resolution.

Value span: 1 (16 seconds between two consecutive peeks) through 65535 (~12 days between two consecutive peeks)

Default value: 675 (3 hours from the end of one peek to the start of the next one)

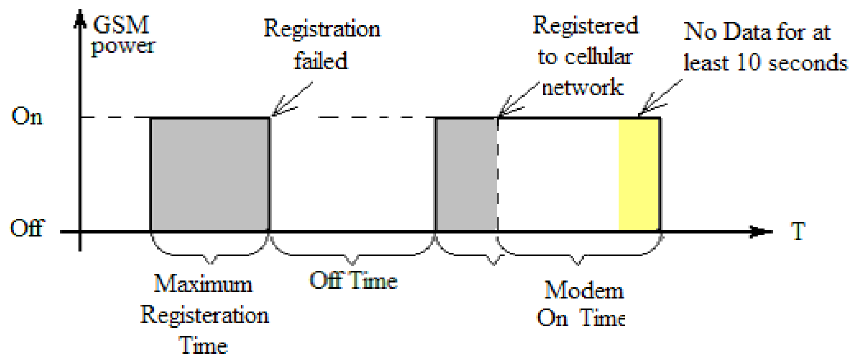
6.6.6 *GSM Peeking*

6.6.6.1 GSM Peeking – Maximum Network Registration Time

Address: 270

Description: GSM Peeking is a power management of GSM Modem, which allow to reduce its power consumption.

GSM peeking is activated in Ignition Off mode only, when Power management mode is defined as 2.



Maximum Network Registration Time: This parameter defines time interval, given to GSM modem for registration into cellular network. If registration wasn't accomplished during that time – the modem is being turned off for Off Time.

Maximum Network Registration Time overlaps with the "stronger" Maximum Modem On Time (defined in address 267). The modem is switched back off when Maximum Modem On Time expires and there is no data transfer for at least 10 seconds (even if Maximum Network Registration Time was configured to a higher value which hasn't expired yet).

Data format: 8-bit unsigned integer, 16 seconds resolution

Value span: 1 (16 seconds) through 255 (68 minutes)

Default value: 4 (1 minute and 4 seconds)

6.6.6.2 GSM Peeking – Modem Off time

Address: 268-269

Description: This parameter defines the amount of time between GSM peeks. (Refer to the chart in GSM Peeking – Maximum Network Registration Time). During this time the GSM Modem is turned off, to conserve energy).

Data format: 16-bit unsigned integer, 16 seconds resolution.

Value span: 02h (32 seconds between two consecutive peeks) through FFFFh (~12 days between two consecutive peeks). Values below 32 seconds (<02h) are illegal and shouldn't be used.

Default value: 225 (1 hour from the end of one peek to the start of the next one)

6.6.6.3 GSM Peeking – Maximum Modem On time

Address: 267

Description: This parameter defines time the modem is kept turned on after waking up. Note that Maximum Modem On Time overlaps with the "weaker" Maximum Network Registration Time (defined in address 270), i.e. the Modem will be turned Off after Maximum Modem On Time, even if Maximum Network Registration Time was configured to a higher value which hasn't expired yet. If GPRS is enabled, the unit will dial GPRS and connect to the communication server during this time.

Data format: 8-bit unsigned integer, 16 seconds resolution

Value span: 1-255 (16 Sec – 68 min); value of 0 is illegal and shouldn't be used

Default value: 4 (1 minute and 4 seconds)

6.6.7 *Battery Charging*

The unit is equipped by a built in Li-Ion/Polymer CCCV charger, applying 0.5C (constant current), charge the battery up to 4.1V, then CV (constant voltage) charge till 4.15V.

The charger will be activated in Ignition On mode (with an exception described below) in temperature range between 0°C and 45C.

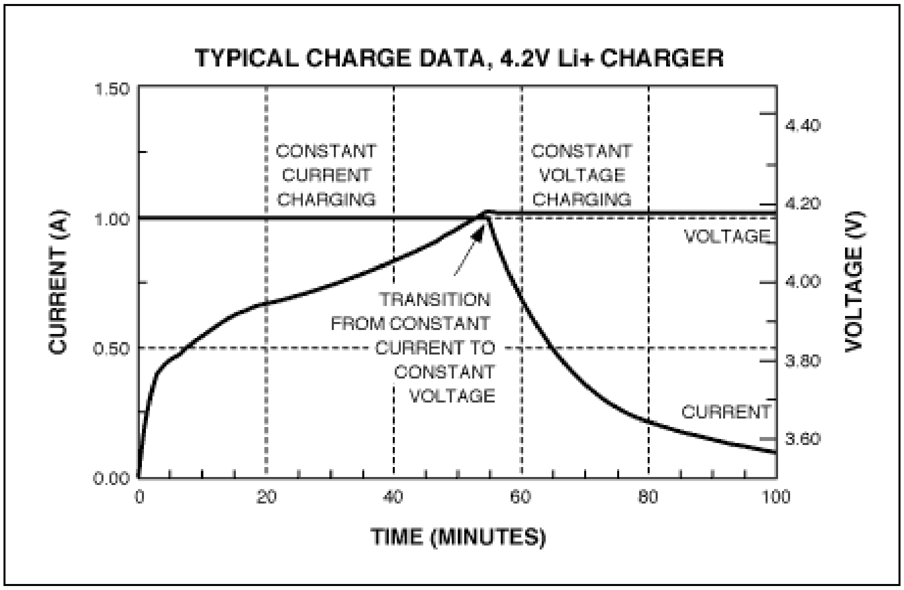


Figure 2. Typical results are shown for a Li+ battery charged using a CCCV charger.

The full charge time of the standard 700mAh battery is ~2hours.

6.6.7.1 Maximum Backup Battery Extra Charge Time

Address: 138

Name in Programmer: Maximum extra charge time

Description: This parameter defines the maximum time for extra backup battery charge in Ignition Off mode. The charge process begins upon Stop in case of detection of low level of backup battery (see corresponding programming parameter), and continues for the time defined in this parameter (if the unit does not enter hibernation).

Data format: 8-bit unsigned integer, resolution of 10.24 sec

Value span: 00h to FFh

Default value: 117 (~20 minutes)

6.6.7.2 Charge Irrespective of Operational Mode

Address: 1350 bit 0

Description: While this bit is set (1) the unit will activate the built in charger if the main power source presents. In this case neither operational mode, not the ignition or movement detection affect start or stop charging; only the logic of the built in charger affects the charge process.

When this bit is disabled (0, legacy mode) the unit activates the charger only during standby engine on mode and for limited time upon switching the ignition off.

Default value: 0 - Disabled

6.7 Informative Parameters

6.7.1 *Last Distance Event*

Address: 85-88

Description: This parameter stores odometer value (in base units) recorded upon last Distance event generation. This parameter is not recommended for user modification, it is managed by the unit for recovery situations.

If upon programming the value programmed in this parameter will be higher than the value of odometer, the unit will overwrite it with the value of odometer.

Data format: The parameter is a 32-bit integer

Value span: 32bits range

Default value: 0

6.7.2 *Field for Customer Use*

Address: 1314 – 1317

Description: This field is designed to store customer's proprietary data (like specific EEPROM content identifier).

Data format: Customer defined

Default value: zeros

7 Distance and Speed Events

7.1 Distance Events

7.1.1 *Enable Distance Updates*

Address: 99 bit 1 for Plain Events

102 bit 1 for Distress Events

Description: This parameter enables generation of the Events and/or Distresses upon the passage of a certain distance.

The distance updates are generated with respect to Home or Roam GSM network and the speed of the vehicle. Normally the customer would expect reported distance to be longer in Roam networks (to save on a communication in roaming GSM) and on high speeds, where the rear events can still provide a good picture of the root.

Default value: Both zeros (disabled)

7.1.2 *Trip for a Distance Event*

Address: 89 – 91 for Home Network

32 – 34 for Roam Network

Description: This parameter defines a distance between two consequences Distance updates (events or distresses). The distance is in basic distance units.

Data format: The parameter is an unsigned a 24-bit integer

Default value: 5

7.1.3 *Distance Event Multiplier for HIGH SPEED Mode*

Address: 92, bits 0-3 for Home Network

35, bits 0-3 for Roam Network

Description: This parameter defines a multiplying factor of distance update for normal and high speeds. The speed is considered "high" when higher then programmed in Velocity threshold for HIGH SPEED mode on address 455.

For example: if Trip for a Distance event is set to 100 meters, and Distance Event Multiplier for roaming is set to 4, the unit will set distance updates in roaming mode to every 400 meters.

Default value: Both 1

7.2 Over and Idle Speed

7.2.1 *Velocity Threshold for Over Speed Start Event*

Address: 93

Description: This parameter stores velocity threshold used for Over Speeding session start. If velocity of the vehicle is higher than this threshold, for longer than programmed in the Over Speed Duration filter parameter, the unit will consider over-speeding. If corresponding updates are enabled, the unit will generate event or/and distress.

Note that the Overspeed start will be registered on a velocity of ~2km/h higher than programmed. In addition, this threshold is only used when not in "Trailer mode" and not in "Input dependent Over Speed" mode

Value resolution: Units in 32 cm/sec

Default value: 91 (105km/h)

7.2.2 *Velocity Threshold for Over Speed End Event*

Address: 94

Description: This parameter stores velocity threshold used for Over Speeding session end (only if the Over Speeding session is already open). If velocity of the vehicle gets lower than this threshold, for longer than programmed in Over Speed Duration filter parameter (or immediately as per the configuration flag described below), the unit will consider end of over-speeding.

If corresponding updates are enabled, the unit will generate event or/and distress.

Note that this threshold is only used when not in "Trailer mode" and not in "Input dependent Over Speed" mode

Value resolution: Units in 32 cm/sec

Default value: 87 (100km/h)

7.2.3 *Filter of Over Speed Duration*

Address: 95

Description: This parameter stores timeout value, used to consider the speed violation start/stop. It actually defines the over speed duration which will cause a corresponding update (if enabled).

Value resolution & span: Duration resolution is 2.5 Seconds. Duration Span from: 0 seconds (0x00h), to 10min 30 sec (0xFEh).

Default value: 4 (10 seconds)

7.2.4 *Do not use Time Filter to Close Over Speed Session*

Address: 492, bit 4

Description: If this bit is set, any open over speed sessions will be closed when the speed of the vehicle will get lower then "Velocity threshold for GPS over Speed End" threshold.

Default value: 0 (disabled)

7.2.5 *Alternative Over Speed Threshold for Input Dependent Mode*

Address: 2391

Description: The unit supports automatic change of over-speed thresholds while certain input is triggered.

This is useful to change over-speed threshold while raining (in this case the input will be connected to the wipers wire) or at night (in this case the input will be connected to the vehicle lights).

Function 12 is available in a list of options available for "Function assigned" byte in input's configuration. When it is selected for any input (except ignition), and this input is triggered, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds.

NOTES:

- Over-speed threshold may change only while over-speed session is NOT active.
- If the input changes its state while the over-speed session is active – the unit will keep using over-speed thresholds selected upon over-speed session start.
- If both the "Trailer mode" and "Input dependent Over Speed" modes are active concurrently the unit will select the lowest speed threshold out of two.

Specific Transmission Reason byte of Over-Speed alert

Upon detection of over-speed violation the unit is sensing event or/and distress with transmission reason 34(start)/42 (stop). The "Specific Transmission Reason" byte of those messages will contain value "1" if the unit is utilizing alternative Over-speed thresholds while generating them.

This parameter contains an alternative value of Over-speed threshold, used when an input, programmed as "Over-speed threshold control" is triggered.

The same value is used for both Over-speed start and Over-speed end thresholds.

The over-speed time filter (programmed on address 95) shall expire prior to alert generation irrespectively to the selected speed thresholds.

Resolution: 32 cm/sec

Default value: 70km/h

7.2.6 *Velocity Threshold for Idle Speed Start Event*

Address: 97

Description: This parameter stores velocity threshold used for Idle Speeding session start (Idle Speeding refers to when the vehicle is parking with a working engine). If velocity of the vehicle gets lower than this threshold, for longer than programmed in Idle Speed Duration filter parameter (from ignition on or from higher speed), and the RPM is higher than 450 for 5 seconds, the unit will consider Idle Speeding start.

If corresponding updates are enabled, the unit will generate event or/and distress.

Value resolution: Units in 32 cm/sec

Default value: 14 (16 km/h)

7.2.7 *Velocity Threshold for Idle End Event*

Address: 96

Description: This parameter stores velocity threshold used for Idle Speeding end (only if the Idle Speeding session is already open). If velocity of the vehicle gets higher than this threshold, for longer than programmed in Over Speed Duration filter parameter (or immediately as per the configuration flag described below), or the RPM gets lower than 450 for 5 seconds, the unit will consider end of idle-speeding.

If corresponding updates are enabled, the unit will generate event or/and distress.

Value resolution: Units in 32 cm/sec

Default value: 16 (19 km/h)

7.2.8 *Filter of Idle Speed Duration*

Address: 5240-5241

Description: Defines duration of moving slower then idle speed threshold that will cause idle start event. (3 seconds minimum). Unit will limit it to 3600.

Resolution: 1 second

Data Range: 3-3600 seconds

Default Value: 10 seconds

7.2.9 *Do not use Time Filter to Close Idle Speed Session*

Address: 492, bit 5

Description: If this bit is set, any open idle speed sessions will be closed when the speed of the vehicle will get higher than "Velocity threshold for GPS Idle Speed End" for longer than 10 seconds.

Default value: 0 (disabled)

7.2.10 *Start Idle Speed Timer with Ignition On*

Address: 492, bit 6

Description: When this bit is set, the unit will start counting time to Idle Speed Start from the Ignition On detection. Otherwise (if this bit is zero) the timer activated from the first time the speed is getting lower than *Velocity threshold for GPS Idle Speed Start*

Default value: 0 (disabled)

7.2.11 *Create Idle/Over Speed End Update for an Open Session per Ignition Off*

Address: 492, bit 7

Description: When this bit is set, the unit will close opened Idle/Over Speed sessions upon ignition off and generate an appropriate updates.

Otherwise (this bit is zero) the unit will not generate an appropriate updates and simply close any open speed session upon Ignition off.

Default value: 0 (disabled)

7.2.12 *Events and Distress Control*

7.2.12.1 Enable Distress for Idle Speed Start/End

Address: 102, bit 3

Description: If this bit is set the unit will generate distress session upon every Idle Speed start /end.

Default value: 0 (disabled)

7.2.12.2 Enable Events for Idle Speed Start/End

Address: 99, bit 3

Description: If this bit is set the unit will generate an event upon every Idle Speed start /end.

Default value: 0 (disabled)

7.2.12.3 Enable Events for Over Speed Start/End

Address: 99, bit 2

Description: If this bit is set the unit will generate an event upon every Over Speed start /end.

Default value: 0 (disabled)

7.2.12.4 Enter Distress for Over Speed Start/End

Address: 102, bit 2

Description: If this bit is set the unit will generate distress session upon every Over Speed start /end.

Default value: 0 (disabled)

7.3 Sudden Course Changed and Sudden Speed Change Sensors

Sudden Course Change and **Sudden Speed Change** sensors are derived from the GPS output; they analyze the delta speed and course between GPS fixes.

The speed and course thresholds are provided separately for each of 4 ranges of speed.

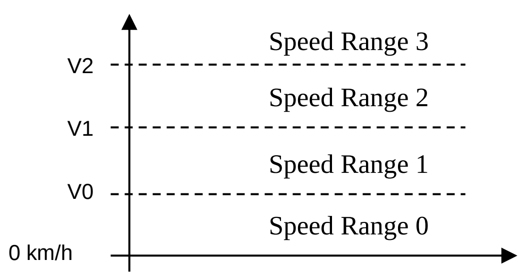
7.3.1 *Speed Thresholds V0, V1 and V2*

Address: V0-473

V1-474

V2-475

Description: The 4 speed ranges are defined by 3 speed thresholds: V0, V1 and V2



The speed ranges threshold (V0, V1, V2) must meet the condition: V0<V1<V2

Data format: 8 bits parameters with resolution of 16 cm/sec

7.3.2 *Delta Speed and Delta Course for Speed Range X*

Description: The sensors will trigger if the delta speed or/and course between two adjacent valid fixes (the unit is getting an updated GPS data fix every 1 second) exceeds a predefined speed or/and course thresholds for the specific speed range (if the current or last fix is invalid, the sensors won't trigger).

The following table contains address of speed and course thresholds for each speed range:

Speed Range	Harsh Braking Threshold 8 bits parameters with resolution of 16 cm/sec	Acceleration Threshold 8 bits parameters with resolution of 16 cm/sec	Course Delta Threshold 8 bits parameters with resolution of 0.016 rad
Speed Range 0	476	511	480
Speed Range 1	477	512	481
Speed Range 2	478	513	482
Speed Range 3	479	514	483

Zero value in any of the parameters above will cancel the corresponding sensor for the specific speed range.

Default Values:

Address (Dec)	Value (Dec)	Value
473	34	19.6 km/h
474	104	60 km/h
475	173	99.6 km/h
476	17	9.8 km/h
477	17	9.8 km/h
478	17	9.8 km/h
479	17	9.8 km/h
480	49	45°
481	49	45°
482	49	45°
483	49	45°
511	17	9.8 km/h
512	17	9.8 km/h
513	17	9.8 km/h
514	17	9.8 km/h

Note: Sudden Course Change events will be masked when the speed is under 5 km/h.

7.3.3 *Events, Distress Updates Control*

7.3.3.1 Sudden Speed Change (Acceleration and Harsh Braking)

Address: 99, bit 4 for Events

102, bit 4 for Distress

Description: If this bit is set, the unit will generate a corresponding update for any detected harsh acceleration and harsh braking.

Default Values: zeros (disabled)

7.3.3.2 Sudden Course Change

Address: 99, bit 5 for Events

102, bit 5 for Distress

Description: If this bit is set, the unit will generate a corresponding update for any detected harsh course change. Note: sudden course change events which occurred when the speed is under 5 km/h will be filtered.

Default Values: zeros (disabled)

7.3.4 *Speed Limiting Geo-Fence*

Speed limiting Geo-Fence enables the fleet manager to define speed limits within geo-Fence boundaries. Each Geo-Fence entry in the configuration memory can define 1 of 4 possible speed thresholds. The Speed limiting Geo-Fence feature is enabled by setting the field TOE (Type of Entry) in the Geo-Fence entry to 6. The unit can handle up to 4 over lapping speed zones sessions concurrently.

Speed violations are reported via a dedicated type 0 message whenever the speed within the Geo-Fence exceeds the configured speed threshold. End of speed violation session will be reported when one of the following events occurs:

1. After violation start the speed fails lower then zone's specific threshold according to programmed over speed rules (after expiration of over-speed end time filter).
2. The unit leaves Geo-Zone boundaries.
3. Specific zone timeout expired (while inside zone boundaries).

Speed limiting decisions will be taken (both for start and for end of over speed) based on legacy time filter of over speed (at address 95).

7.3.5 *Speed Limiting Geo-Fence Enable*

Speed Limiting Geo-Fence is enabled by setting the value of TOE (Type Of Entry) filed to 6. Please see TOE - Type Of Entry

7.3.6 *Speed Limiting Geo-Fence Threshold Select*

Each Geo-Fence entry has 2 bits filed called "Speed Limiting Threshold Select". The filed can select one of 1 of 4 possible threshold values. The 4 Geo-Fence Speed Limiting thresholds are defined in

MSB for 100 geo-fences (CRx00 only)	**Speed Limiting Threshold Select (Bits 31,30)**		**Address of Speed Limit parameter in Configuration memory**
Addresses 2023-2035 (2035 bits 4-7 are unused)	**Bit 31**	**Bit 30**	
0	0	0	1917
0	0	1	1918
0	1	0	1919
0	1	1	1920

7.3.7 *Speed Limiting Geo-Fence Threshold*

Address: 1917, 1918, 1919, 1920

Description: These 4 parameters define the Geo-Fence speed limiting thresholds. The speed limiting threshold is defined in units of Km/h.
Default value: 20, 30, 40, 50

7.3.8 *Speed Limiting Geo-Fence Alerts Enable*

Generation of Speed limiting zone shall be enabled as follows:

Address: 1004, bit 5 Event

1005, bit 5 Distress

Description: If this bit is enabled the unit will generate an alerts upon violation of selected speed limit of the active Speed limiting zone. Speed session started within the premises of a geozone will be terminated when the speed goes below the speed threshold (inside the premises of the GeoFence) or when the vehicle goes out of the GeoFence.

Speed Limiting violation Start event: Type 0, TR212, STR=geo fence index.

Speed Limiting violation End event: Type 0. TR213, STR=geo fence index.

Default value: 0 – both disable

7.3.9 *Speed Limiting Geo-Fence Output Activations*

The same output activations properties used for "Driver Behavior over speeding" will be used for Speed Limiting Geo-Fence. The "OverSpeed" feedback bit must be set in Feedback for driver behavior violations bitmask to enable Speed Limiting Geo-Fence outputs.

Please refer to:

Output, auto-activated upon continuous driver behavior violation detection

Output activation pattern (upon Continuous driver behavior violation)

NOTE: When "Speed Limiting Zone" is selected in the GeoFence configuration the Fence generic output activation will be automatically disabled.

7.4 Go (Start Movement) and Halt (Stop Movement) Events

This feature is intended to detect slow movement in traffic jams. The session is very similar to Idle Speed feature described above, although serves for a different purpose simultaneously with Idle Speed detection.

The session proposes set of programmable parameters, identical to those of Idle Speed Algorithm:

- "Go/Halt" speed detection Threshold
- "Go/Halt" Threshold Time Filter
- "Go/Halt" session configuration flags
- "Go/Halt" events/distress control

The Go/Halt session is also used for Curve Smoothing feature to prevent generation of unnecessary events of "course change" during parking.

7.4.1 *Go/Halt Speed Detection Threshold*

Address: 1387-1388

Description: This parameter stores velocity threshold for detection of movement start (GO event) and movement end (Halt event).

If measured velocity is higher than this threshold for longer than the Time Threshold, "Go" event will be triggered.

If measured velocity is lower than this threshold for longer than the Time Threshold, "Halt" event will be triggered.

Value resolution: Units in cm/sec

Default value: 5 km/h

7.4.2 *Go/Halt Time Threshold Filter*

Address: 1389

Description: This cell stores a time filter for "Go/Halt events" generation, while the speed of the vehicle complies with the logical condition described in the parameter above.

Value resolution & span: Duration resolution is 1 second. Duration Span from: 0 seconds (0x00), to 255 seconds (0xFF).

Default value: 3 (3 seconds)

7.4.3 *Go/Halt Session Control*

These parameters allow setting especial aspects of the Go/Halt session.

7.4.3.1 Multiplier for Go/Halt Time Threshold Filter for "Halt" Detection

Address: 1390, bits 0-3

Description: Allows enlarging the "Halt Detection filter", in order to prevent Halt detections on traffic lights. The value of the Time Threshold filter will be multiplied by the value in this parameter.

Value of zero will cancel the Time Threshold filter for "Halt" event detection.

Default value: 0 – Cancel Time Threshold for "Halt"

7.4.3.2 Do not use Time Threshold Filter for "Go" Detection

Address: 1390, bit 4

Allows immediate "Go" detection, ignoring Time Threshold filter.

Default value: 0 **–** use time threshold for "Go"

7.4.3.3 Enable Go/Halt Updates

Address: 496, bit 2 for Events

497, bit 2 for Distress

Description: If this bit is set, the unit will generate a corresponding (Go or Halt) update upon detection.

Default Values: zeros (disabled)

8 Time and Trip Events

8.1 Start and Stop Alerts

8.1.1 *Start Alert Generation Time Filter*

Address: 104

Name in Programmer: Start Event Time Filter

Description: This parameter stores time filter, defining a required duration of stable Ignition On state (after ignition state change) for triggering Start (driving session) alert.

The control of alert type (plain event / distress event) is made from Ignition Input Settings folder.

Value resolution & span: Duration resolution is 2.56 seconds.

Default value: 7.74 sec.

8.1.2 *Stop Alert Generation Time Filter*

Address: 105

Name in Programmer: Stop Event Time Filter

Description: This parameter stores time filter, defining a required duration of stable Ignition Off state (after ignition state change) for triggering Stop (driving session) alert.

The control of alert type (plain event / distress event) is made from Ignition Input Settings folder.

Value resolution & span: Duration resolution is 2.56 seconds

Default value: 7.74 sec.

8.2 Time-based Alert

This group of parameter controls time period of the updates, generated by the unit periodically between "Start" and "Stop" (when ignition switch is on). “Time alerts” or periodical updates are not generated after "Stop" (when ignition switch is off).

This period is controlled also by the OTA Tracking Command and applied on the fly with no reset.

Time-based alert period might be automatically modified by the unit in real time as a function of the following conditions:

- GSM condition: Home, Roam GSM network or No GSM coverage mode
- Speed: High Speed mode or Normal Speed mode.

There is also a possibility of dynamic Time-based alert period modification as a function of speed, refer to V-Trek feature below.

8.2.1 *Time Report Period*

Address: 5234-5235 for Home cellular network

5236-5237 for Roam cellular network

Data format: 16-bit unsigned.

Resolution: 1 second.

Description: Timed Event Period. Value 0 disables the time events.

Value span: 0-65535 Seconds (0=Disable)

Default value: 300 Seconds

8.2.2 *Time Report Period Multiplier for NOIP Mode*

Address: 485

Description: This parameter enables automatic change of time events period during NO IP mode (while GPRS is unavailable):

The basic time event period is multiplied by the factor programmed in this parameter.

Note: value of Zero is legal and considered by the unit as "1".

Default value: 1

8.2.3 *Table of Time-based Alert Period Calculation*

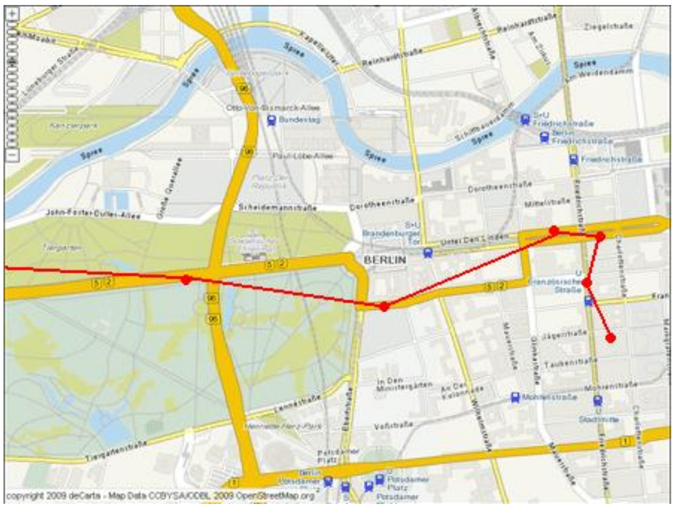
	Home Network		**Roam Network**	
	Time-based alerts Resolution Definer= 0	Time-based alerts Resolution Definer= 1	Time-based alerts Resolution Definer= 0	Time-based alerts Resolution Definer= 1
Low Speed	**TEPH** * 4 seconds	(**TEPH**) * 90 seconds	**TEPR** * 4 seconds	(**TEPR**) * 90 seconds
High Speed	HSpeedHm * (**TEPH** * 4 seconds)	HSpeedHm * (**TEPH**)* 90 seconds	HSpeedRm * (**BPVR** * 4 seconds)	HSpeedRm * (**BPVR**)* 90 seconds

- **TEPH** – Time-based alert Period in home network, bits 0:6 of address 106'
- **TEPR** – Basic period value in roam network, bits 0:6 of address 499 (value of zero will cause the unit to use Home settings during roaming)
- **HSpeedHm** – Time-based alert period multiplier for high speed mode in Home network, (bits 4:7 of address 92)
- **HSpeedRm** – Time-based alert period multiplier for high speed mode in Roam network, (bits 4:7 of address 35)

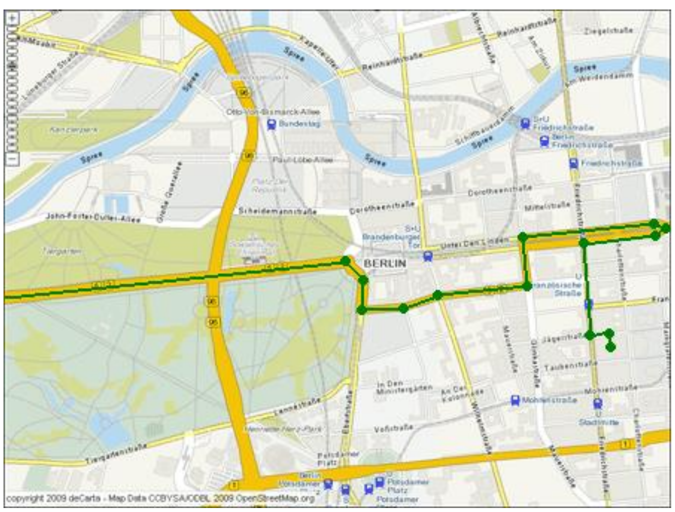
8.3 Curve Smoothing

The idea behind this feature is to provide a good correlation between the reported locations to the roads on a map without significant increase of communication cost.

Neither time nor distance events enable tracking as a function of road curves (note that it is possible to utilize sudden course change detection for "curve smoothing" with significant traffic increase), and the path on the map doesn't appear accurate enough, as shown below.



Detecting movement vector change dramatically improves the stickiness to the road and readability of the reports, but will also dramatically increase the traffic:



The vector change detection has to be supported by data compression in order to ensure good stickiness to a road curve for a reasonable price.

The vector change detection occurrence may be reported as a plain/distress events with TR204 (**vector change Report)**, or as a bulk of up to 6 **vector change detection** occurrences, compressed into a single message type 9 , sub-data D (refer to a wireless protocol for more details).

8.3.1 *Enable Vector Change Detection Events /Distress*

Address: 1433, bit 0 for Events

1433, bit 1 for Distress

Description: If this bit is enabled, upon generation of Start (or the first GPS Nav. Start after Start if there is no valid GPS upon Start) the unit stores reference vector of course.

The unit stores reference GPS stamp value (time, date, latitude, longitude, speed and course) every time it is detecting change of course's vector.

The stored reference course value is compared with the value of course received with every new valid GPS frame. If the received value of course differs from stored one more then the value of **vector change programmable parameter** (5° by default), the unit will log **vector change detection** occurrence (not event in the logged memory yet but in a volatile memory) and replaces reference course value by the new one.

Note that if compressed vector change report is enabled, the value of this parameter will be ignored.

If **compressed vector change report** (next parameter) is disabled the unit will generate a dedicated event/distress type 0 with TR204 (**Vector Change Report**).

Default value: Both disable

8.3.2 *Prevent Curve Smoothing Message Generation during "Halt" Mode*

Address: 1433, bit 3

Description: If this bit is enabled (1):

- The unit will stop Curve Smoothing message generation upon "Halt" session start (irrespectively to GO/HALT event generation enable/disable programming flag).
- The Curve Smoothing message generation will restart upon "Go" session start (irrespectively to GO/HALT event generation enable/disable programming flag).

Default value: Disable (0)

8.3.3 *Enable Compressed Vector Change Report*

Address: 1433, bit 2

Description: If this bit is enabled, settings of bit's 0 and 1 of this byte (previous parameter) will be ignored. In this case the compressed vector change data will be sent by the unit in the following cases:

- Upon detection of 6th **vector change detection** occurrence. In this case the system will generate an Msg 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 Msg type 9 containing all previous **vector change detection** occurrences.

- Upon Stop. Msg type 9 containing all previous **vector change detection** occurrences (if any) will be generated immediately upon stop report.
- Upon reset command the Msg type 9 containing all previous **vector change detection** occurrences (if any) will be generated.

The Compressed **Vector change Report** Msg type 9 will be logged in the same message stack as plain event type 0, will utilize the same sequence of numerator and acknowledge rules.

The Compressed Vector change Report Msg type 9 will NEVER be generated as real-time or distress event, only as logged event.

Upon power up/reset the unit will record reference course/coordinates upon reception of the first valid GPS packet.

Note: When no significant course changes are detected by the unit (for example when driving long straight roads), the unit will send periodic "Compressed Vector Change Reports" to avoid compressed data overflow.

8.3.4 *Compressed Vector Change Report Timeout*

Address: 1434

Description: This parameter contains a timeout to generate Msg type 9 containing all logged **vector change detection** occurrences before six occurrences were accumulated.

This parameter will take affect when:

- Compress Vector change Detection is enabled,
- At least one vector change detection logged
- No vector change detection occurrence is logged by the unit during the period defined in this parameter

Range and resolution: Unsigned integer 8 bits, resolution of minutes

Default value: 10 minutes

8.3.5 *Vector Change Detection Angle*

Address: 1435

This parameter defines the minimum course change from last logged event, considered as Vector change Detection occurrence. Possible values are 0 to 180°.

Range and resolution: 8 bits, unsigned integer, resolution of degrees

Default value: 5°

8.4 Communication Idle Alerts

8.4.1 *Time between Communication Idle Alerts*

Address: 70-71

Name in Programmer: Time between Comm.Idle Transmissions

Description: This parameter defines the maximum time without any communication. If a message is not received within this timeout, an idle communication alert is registered.

It is possible (configuration bit described below) to wake up the unit from the full hibernation in order to try delivering this type of alert in real time.

This algorithm is frequently used as a "Heart Bit" of the unit, the "Keep Alive" messaging.

Data format: 16-bit unsigned integer, 1 minute resolution.

Default value: 30 (minutes)

8.4.2 *Event and Distress Controls for Communication Idle Alert*

Address: 493, bit 0 for plain event

494, bit 0 for distress

Description: This bit enables alerting Idling of Communication with period programmed in Time.

Default value: Event enabled (1), distress disabled (0)

8.4.3 *Do not Wake Up from Hibernation upon Comm. Idle Distress*

Address: 494, bit 7

Description: If this bit is set (1), the unit will not generate a distress Communication Idle alert in full hibernation, and therefore will not wake up from full hibernation upon expiration of Time between Communication Idle Alerts timeout.

Default value: 0 - wake up from full hibernation to alert Comm. Idle

8.4.4 *Enable Comm.Idle Log Event/Distress during modem off*

Address: 493, bit 6 for plain event

Description: If that bit is set (1), the unit will store an event of Communication Idle according to timer "Time Between Idle Transmissions" even in Modem Off mode. Affects only if the Event of Idle Transmission is enabled.

0 - Do not generate during modem off

1 - Generate during modem off

Default value: 0 - Do not generate during modem off .

Address: 494, bit 6 for Distress

Description: If that bit is set (1), the unit will create an emergency idle transmissions during Modem OFF.

0 - Do not generate during modem off

1 - Generate during modem off

Default value: 0 - Do not generate during modem off

8.5 Driver Authentication

There are a few possible usages for the Dallas (iButton™) key in the Cellocator unit:

- As driver ID for fleet management application: In this case the driver can use any Dallas key to identify himself; the Driver to Dallas association is performed on the server side.
- As driver ID for fleet management application with pre-programmed list of "known drivers" (30 drivers maximum): In this case only the Dallas code from the list will release an immobilization of the vehicle and will cause successful driver identification alert to the server.
- As vehicle owner identification for car-alarm application (security units only): In this case the driver might identify himself with pre-programmed Dallas in order to release the security unit from Alarm Armed state, while only 30 codes can be pre-programmed.
- As a Trailer ID (can work together with Driver ID over the same 1-Wire bus).

The driver authentication in fleet management application enables monitoring working hours of each driver and tracking driver's activity.

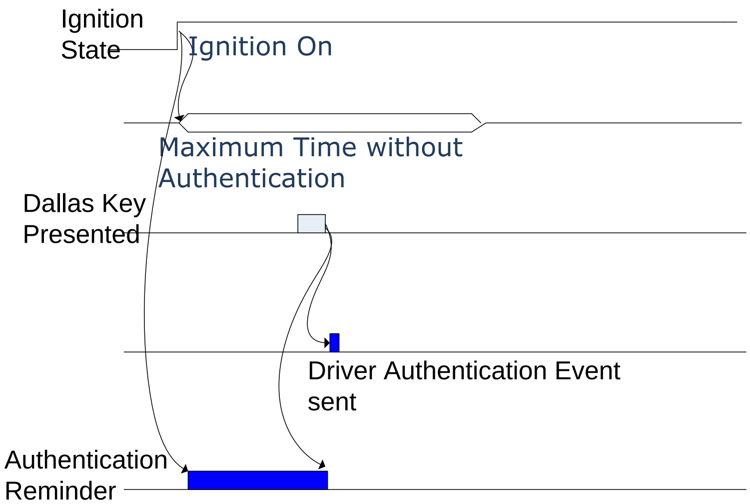
The driver supposes to identify himself with his unique Dallas key before (or immediately with) switching ignition on. From this moment to the end of the journey all the location messages generated by Cellocator unit will include code of this Dallas.

The unit will erase this code from its memory shortly after switching Ignition to off.

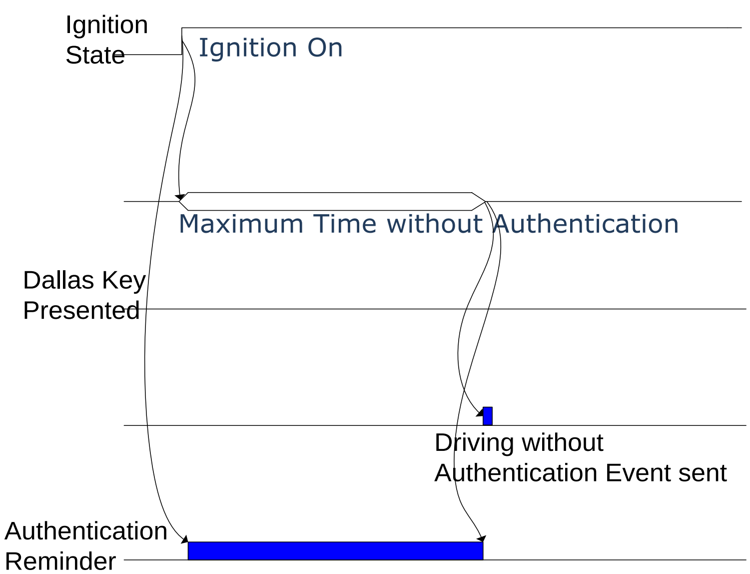
There are two alerts dedicated to the Driver Authentication features: New Dallas Code Received and Driving without authentication. There is also a dedicated alert for Trailer connection status change.

Note: The ignition event initiating the authentication processes could be selected to start from physical ignition signal or from the filtered ignition signal based on configurable parameter: "Ignition filter source for starting Driver Authentication time calculations" (address 0, bit 4).

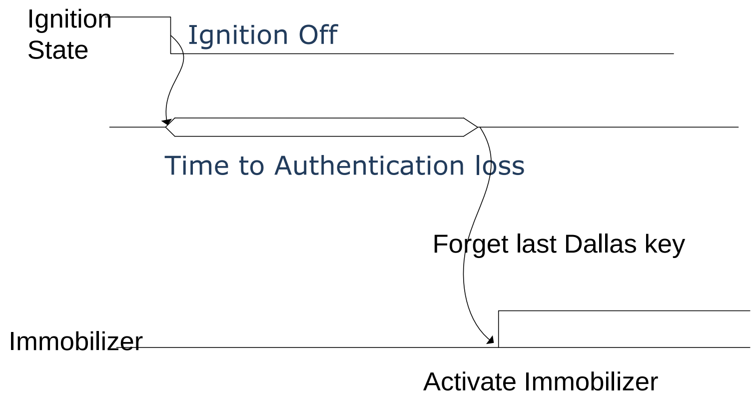
The following diagrams describe typical authentication scenarios:



Scenario 1: Driver authenticated



Scenario 2: Driver not Authenticated



Scenario 3: Erase Dallas key after Ignition Off

8.5.1 *Enable Driving Without Authentication Alert*

Address: 123, bit 0 for event

484, bit 0 for distress

Description: If this bit is enabled, the unit will generate an alert of "Driving without Authentication" in case a Dallas key was not detected before an expiration of Maximum Time without Authentication timeout.

Default value: Event enabled (1), Distress disabled (0)

8.5.2 *Enable Authentication Updated Alert*

Address: 123, bit 1 for event

484, bit 1 for distress

Description: If this bit is enabled, the unit will generate an "Authentication updated" alert upon new Dallas key detection (this update can be limited to pre-programmed Dallas keys only, see the parameter below).

Default value: Event enabled (1), Distress disabled (0)

8.5.3 *Maximum Time without Authentication*

Address: 111

Description: This parameter stores the value of maximum allowed time between Start Event and transmission of message with transmission reason "Driving without authentication", in case the Dallas key was not detected.

If any Dallas key detected during the time period defined in this parameter, the unit will send a message with new Dallas code and transmission reason "Driver Authenticated" (it is also possible to deliver Driver ID Updated report only in case the iButton code fit one of the programmed values).

Value resolution: 30 seconds

Span: 0 -255 (=0-127.5 minutes)

Default value: 2 (=1 minute)

8.5.4 *Enable Authentication Reminder Feedback Output Activation*

Address: 123, bit 4

Description: If "Enable Authentication Reminder Output Activation" bit is enabled (see below) – the unit will activate feedback output/s from Ignition On detection (after filter defined by the "Ignition Filter Source for Starting Driver Authentication Time Calculations" parameter) until one of the tree conditions below will come true:

- Timeout defined by "Maximum Time without Authentication" parameter will expire
- Any (or pre-programmed as per configuration bit below) Dallas code will be received
- Ignition will be switched off

Default value: 1 - enable

8.5.5 *Ignition Filter Source for Starting Driver Authentication Time Calculations*

Address: 0, bit 4

Description: This parameter defines a start point for timeouts for:

- Reminder Feedback Output Activation (Ignition On)
- Time to Authentication loss (Ignition Off, next parameter)
- Timeout to Driving Without Authentication Event (Ignition On)

The 2 options are:

- 0 - Ignition ON/OFF filter + Inputs filter)
- 1 - Inputs filter only

Default value: 0

8.5.6 *Time to Authentication Loss*

Address: 112

Description: This parameter stores a time period, during which the unit will keep a last detected Dallas Code after the Stop Event.

After this period of time the Dallas Code will be erased from unit's memory and in every outgoing transmission from the unit Authentication code will be sent as 0.

If during the time period, defined in this parameter, will be detected Start event – the unit will keep sending last detected Dallas key (until Stop event) in every outgoing message.

If Immobilizer Activation enabled (see next parameter) this timer defines how long after Stop event the Standard Immobilizer output (pin 7) will be activated.

Resolution: 0.5 minutes/bit

Data span: 0-255 (max value 127.5 minutes)

Default value: 1 (30 seconds)

8.5.7 *Activate Immobilizer while no active Dallas*

Address: 1, bit 5

Description: If this bit is enabled the unit will activate its Standard Immobilizer output (pin 7) from Authentication loss after Stop event (see previous parameter) until the driver authorizes itself using Dallas Key (any Dallas key or known Dallas key, as per the Enable Pre-defined driver ID’s list configuration bit).

NOTES:

- This flag is only applicable to fleet edition of Cello and will not work in a security variant.
- If this flag is set (enabled), the Standard Immobilizer output (pin 7) will be automatically activated immediately after SW reset or Power Recycle.
- In CRx00 devices, the immobilizer output can be switched to one of the available device output pins ("Blinkers", "LEDs") using the configurable option located in address 506. The selected output will maintain the same reset behavior a described in note 2 above.

Default value: 0 - disabled

8.5.8 *Enable Conditional Activation of Immobilizer*

Address: 0, bit 2

Description: If this bit is enabled (1), the unit will only perform self activation of Immobilizer output while both conditions listed below are fulfilled:

- An appropriate legacy logical condition is detected (No Driver ID in the memory, Towing detection, reminder etc)
- High signal detected on the ignition input.

Immobilizer output will be switched off immediately after one of the above conditions is not present.

If this bit is disabled (0), immobilizer output is activated independently from the status of an Ignition input.

NOTE: This bit is only affecting self activation of the output. Activation by command (OTA or Serial) is still unconditional and independent from the status of an Ignition input.

Only the additional OTA/serial command or detection of Authorized Dallas switches off an output activated by command.

Default value: Disable (0)

8.5.9 *Enable Pre-defined Driver ID's List*

Address: 123, bit 2

Description: If this bit is set the unit will compare received Dallas with the pre-programmed list and will act accordingly. In case of reception of unknown code the unit **WILL NOT** do the following:

- Unblock Immobilizer (If Immobilizer Activation enabled)
- Indicate Dallas reception by Feedback beep
- Deactivate "Driver ID reminder feedback" outputs (if Enable Authentication Reminder Output Activation enabled)
- Send "New Driver ID" message
- Record the unknown Dallas code as latest Driver ID

If valid Dallas is not received during the timeout, programmed in "Maximum time without authentication" – the unit will send "Driving without ID" message, as it would do if no Dallas is received at all.

Default value: 0 - disabled

8.5.10 *Enable "Dallas ID Updated" Event even if it is not in the List*

Address: 123, bit 3

Description: If this bit is set the unit will generate a Driver Authentication Update event (TR 46) upon Dallas key detection even if it is not in the pre-programmed list. The foreign (code not in the list) Dallas code is reported in every message type 0, but the unit:

- Will not Unblock Immobilizer
- Will not Indicate Dallas reception by Feedback beep
- Will not Deactivate "Driver ID reminder feedback" outputs

Default Value: 0 - disabled

8.5.11 *iButton Codes (100 Buttons)*

Address: 429 to 446 (Dallas keys 1-3),

1448 to 1609 (Dallas keys 4-30)

661 to 990 (Dallas keys 31-85)

6500 to 6541 (Dallas keys 86-92)

6575 to 6622 (Dallas keys 93-100)

Description: This section of the memory contains the identification data for 100 Dallas iButtons.

Data format: Each button is assigned with 6 ID bytes. The data of these 6 bytes is printed on the surface of the button, where every pair of hexadecimal digits is equivalent to one byte.

Valid values: The data must exactly match the buttons data, or they would not work.

Default Value: All zeroes

8.5.12 *Enable Feedback upon Authentication*

Address: 123, bit 5

Description: If enabled, the unit will activate pulse on the output/s programmed as the System Feedbacks when new Dallas code is detected. The pulse will be activated for a time, defined in an Outputs Pulse Width parameter (address 140).

Default Value: Zero (disabled)

8.5.13 *Enable Resending "Driver Authentication" Alert upon each Detection*

Address: 123, bit 6

Description: If this bit is set the "Driver Authentication Update" event (TR 46) will be generated every time when a Dallas key is attached to the reader (even if it has the same code as last attached Dallas). Removing Dallas key for 1 second at least from the holder will cause the unit to threat the Dallas as removed and the next attachment of the same Dallas will cause new event generation.

Default Value: 0- disabled

8.5.14 *Enable Dallas Bus Mode (1-Wire) Bus*

Address: 123, bit 7

Description: If this bit is cleared the Cello unit will start acting as 1-Wire Bus master managing multiple 1-Wire slaves. If this bit is set the Cello unit will retain its legacy behavior communicating with single slave 1-Wire device.

Default Value: 1 - Dallas in Point to point mode (Bus mode disabled)

8.5.15 *Enable Infinite Driver Notifications when Driver is not Identified*

Address: 0, bit 1

Description: If this bit is set, Driver Authentication Reminder will be generated indefinitely overriding the timeout defined in: "Timeout of Driver Authentication Reminder".

Default Value: 0 - Legacy Driver Authentication Alert period

8.6 Extended Driver Authentication

8.6.1 *Enable Differentiation between Driver and Passenger*

Address: 1349, bit 4

Description: If this is enabled (0), the unit will change the standard Driver ID management logic (every new code automatically replacing a previous one) by an extended logic of Driver/Passenger management as described below.

Default value: 1 - Disable

8.6.1.1 Driver Identification

The User ID is considered "Driver ID" if received when there is no Dallas code in the RAM (both in Ignition on and Ignition off mode).

Driver ID is treated by the unit similarly to the legacy Dallas ID (unique 48 bit iButton identifier), except for the following:

- Different code received (new iButton attached) while there is a Driver ID in the RAM:
  - In ignition on: will be treated as "Passenger ID" (see below) and will not erase the existing Driver ID from RAM
  - In ignition off : will be ignored
- If received code is identical to the active Driver ID in RAM – it will be ignored
- The last bit of STR (in OTA alert, message type 0) contains status of Group ID recognition ("1" – authenticated, "0" – not authenticated)
- The first bit of STR (in OTA alert, message type 0) contains "0" (indicating "Driver ID")

Note: When "differentiation between the driver and the passenger" is enabled (0), the "Enable "Dallas ID updated" event even if it is not in the list" parameter (address 123, bit 3) will be ignored.

If “differentiation between the driver and the passenger” is not enabled (1), the unit is using the Legacy Driver ID algorithms.

8.6.1.2 Passenger Identification

The passenger identification only works when ”differentiation between the driver and the passenger” is enabled in the programming.

The User ID is considered "Passenger ID" if:

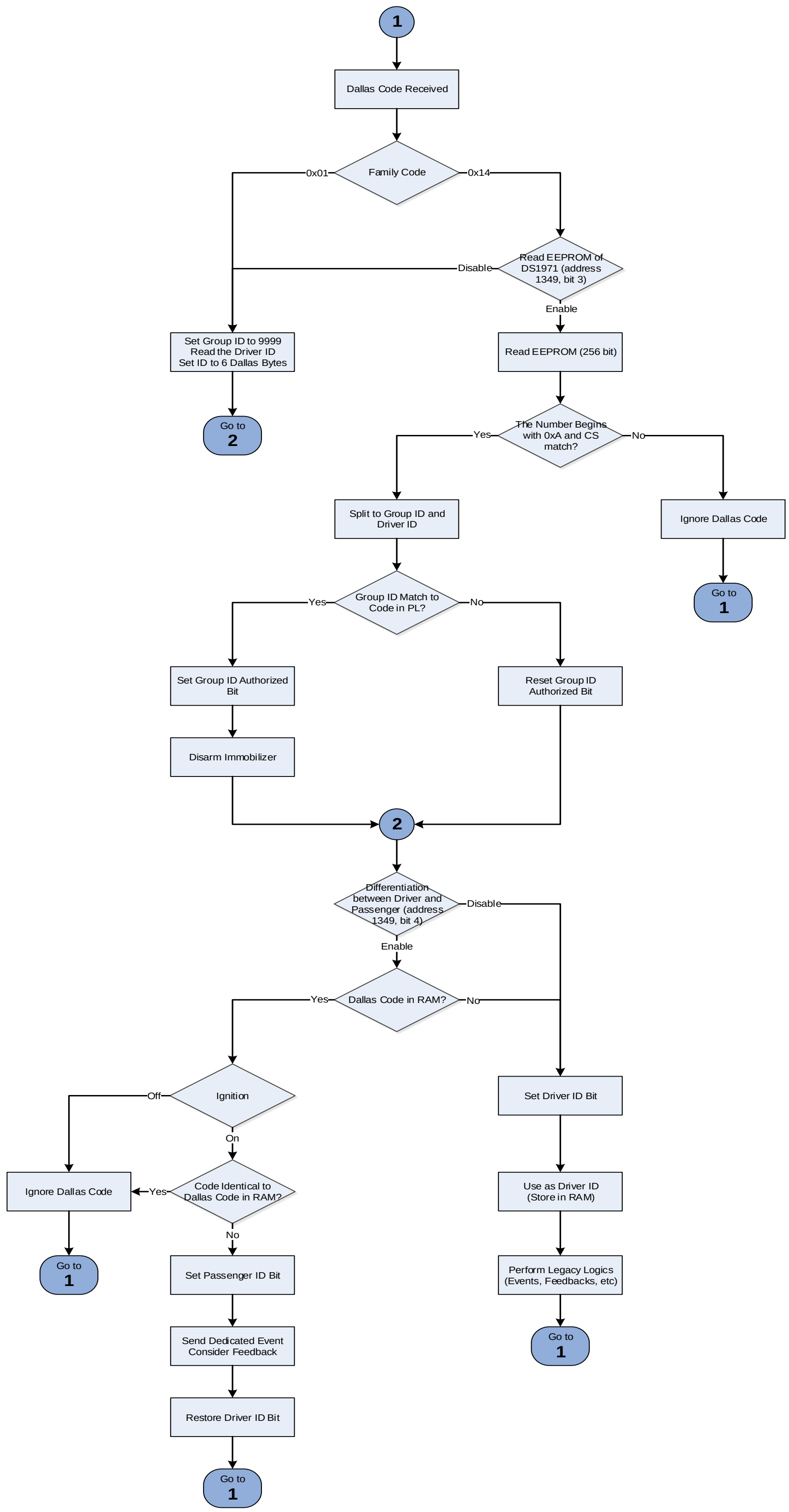
- Received in Ignition On mode
- Received while there is an active Driver ID code in the RAM

Reception of "Passenger ID" causes the unit to generate a "Driver Authentication Update" event (TR46), containing received code in Dallas bytes of Msg type 0, while the STR Specific byte contains:

- The last bit of TR Specific byte shall contains status of Group ID recognition ("1" – recognized, "0" – not recognized), see below.
- The first bit of TR Specific byte contains "1" (indicating "Passenger ID")

Received "Passenger ID" is NOT replacing active Driver ID in the RAM. Once "Driver Authentication Update" event/distress is generated, the Passenger ID code is "forgotten".

8.6.1.3 Driver/Passenger/Group Management Flow Chart


1
Dallas Code Received
Family Code
0x01
0x14
Read EEPROM of DS1971 (address 1349, bit 3)
Disable
Enable
Set Group ID to 9999
Read the Driver ID
Set ID to 6 Dallas Bytes
Read EEPROM (256 bit)
Go to
2
The Number Begins with 0xA and CS match?
Yes
No
Split to Group ID and Driver ID
Ignore Dallas Code
Go to
1
Group ID Match to Code in PL?
Yes
No
Set Group ID Authorized Bit
Reset Group ID Authorized Bit
Disarm Immobilizer
2
Differentiation between Driver and Passenger (address 1349, bit 4)
Disable
Enable
Dallas Code in RAM?
Yes
No
Ignition
Off
On
Set Driver ID Bit
Ignore Dallas Code
Yes
Code Identical to Dallas Code in RAM?
No
Use as Driver ID (Store in RAM)
Go to
1
Set Passenger ID Bit
Perform Legacy Logics (Events, Feedbacks, etc)
Send Dedicated Event Consider Feedback
Go to
1
Restore Driver ID Bit
Go to
1

8.7 Trailer Connection Monitoring

The purpose of this feature is to enable detection and reporting of connection and disconnection of a trailer to the track.

The trailer is equipped by identification device, connected to a 1-Wire bus port of Cellocator unit. Once the trailer is connected, its identification device is continually transmitting its Dallas ID.

The family of Dallas device used by the trailer is programmed in configuration. If such a device is attached longer than the configurable timeout, the unit is assuming connection of the trailer and vice versa (if disconnected longer than the configurable timeout, the unit is assuming disconnection).

Limitations:

- Only one trailer can be used at a time.
- If two or more devices from the trailer's Dallas family are concurrently and continually attached to the bus, reliable trailer detection is not guaranteed.
- If second device from the trailer's Dallas family is attached while trailer is already detected, this second device will be immediately considered as Driver/Passenger.

Upon trailer connection (expiration of a "Timeout for Trailer Connection status change") the unit will raise Bit 1 of Byte 41 in every outbound OTA msg type 0 to indicate that the Trailer is connected.

Upon trailer disconnection the unit shall reset Bit 1 of Byte 41 in every outbound OTA msg type 0 to indicate that the Trailer is disconnected.

It is possible to query trailer ID by OTA command (Command Code 0x16).

NOTES:

- Trailer ID is never reported in other message types except message with TR199 and 31 (Reply to command, if Trailer ID was requested).
- This feature requires the Dallas bus to be enabled Enable Dallas Bus (singleWire)

8.7.1 *Dallas Family of Trailer Identifier*

Address: 2393

Description: The following parameter contains Dallas family ID of the Trailer identifier. If the device with selected family ID will be attached to the bus longer than programmed in the "Timeout for Trailer Connection status change" parameter - it will be considered as Trailer.

If the device with selected family ID will be attached to the bus for less than programmed in "Timeout for Trailer Connection status change" parameter - it will be considered as Driver/Passenger, while the corresponding reaction (event/feedback) will be issued upon disconnection from the iButton.

Zero value in this parameter disables Trailer connection detection.

NOTE: This feature requires the Dallas bus to be enabled Enable Dallas Bus Mode (singleWire)

Default value: 01h (iButton DS1990A)

8.7.2 *Enable Trailer Connection Event*

Address: 1349, bit 5

Description: If this bit is set (1) the unit will issue a dedicated event when the Dallas ID of the Trailer's family is continually connected (or disconnected) for longer that programmed in the "Timeout for Trailer Connection status event" parameter.

The event will contain transmission reason 199 (Trailer connection status change), and specific transmission reason (STR) 0 for trailer disconnected, 1 for trailer connected.

In both cases:

- Bits 4-5 of byte 10 (OTA Msg type 0) contain value of 0b11 (Trailer ID)
- Bytes 33-38 of OTA Msg type 0 with TR199 contain the ID of Trailer Identification device.

Default value: 0 - disabled

8.7.3 *Trailer Connection Distress*

Address: 1349, bit 6

Description: If this bit is set (1) the unit will issue a dedicated distress when the Dallas ID of the Trailer's family is continually connected (or disconnected) for longer that programmed in the "Timeout for Trailer Connection status event" parameter.

The distress will contain transmission reason 199 (Trailer connection status change), and specific transmission reason (STR) 0 for trailer disconnected, 1 for trailer connected.

In both cases:

- Bits 4-5 of byte 10 (OTA Msg type 0) contain value of 0b11 (Trailer ID)
- Bytes 33-38 of OTA Msg type 0 with TR199 contain the ID of Trailer Identification device.

Default value: 0 - disabled

8.7.4 *Timeout for Trailer Connection Status Change*

Address: 2392

Description: This parameter stores time period (in seconds) of continuous connection (or disconnection) of the Dallas button (of family programmed in "Dallas Family of Trailer Identifier" parameter), used for triggering corresponding event or distress.

Default value: 15

8.7.5 *Trailer Connected: Over Speed Start Velocity threshold*

Address: 261

Description: The unit can apply different velocity thresholds for Over Speed session start and end when trailer is connected.

This parameter stores velocity threshold (in 32 cm/sec/bit) used for Over Speeding session start when trailer is connected.

If over speed session started by violating "Trailer connected" over speeding start threshold, it will be ended by reaching "Trailer connected" over speeding end velocity threshold, even if the trailer disconnected between those two events.

NOTE: If both the "Trailer mode" and "Input dependent Over Speed" modes are active concurrently the unit will select the lowest speed threshold out of two.

Resolution: 32 cm/sec/bit

Default value: 0 cm/sec

8.7.6 *Trailer Connected: Over Speed End Velocity Threshold*

Address: 262

Description: The unit can apply different velocity thresholds for Over Speed session start and end when trailer is connected.

This parameter stores velocity threshold (in 32 cm/sec/bit) used for Over Speeding session end when trailer is disconnected.

If over speed session started by violating "Trailer connected" over speeding start threshold, it will be ended by reaching "Trailer connected" over speeding end velocity threshold, even if the trailer disconnected between those two events.

NOTE: If both the "Trailer mode" and "Input dependent Over Speed" modes are active concurrently the unit will select the lowest speed threshold out of two.

Resolution: 32 cm/sec/bit

Default value: 0 cm/sec

8.8 Controlling of Work Time on Static Objects

Address: 1349, bit 7

Description: The purpose of this feature is to enable usage of existing equipment and software for controlling of employees work time on static objects.

If this bit is set (1):

The unit will ignore all Driver ID logic (except feedback), irrespective of other configuration bits and programmed Dallas codes.

Upon reception of any Dallas code of any group the unit will:

Activate feedback if enabled

Irrespectively to the operational mode and Ignition status of the unit, generate pair of events containing received Dallas code: Start event and Stop event (one after another, with no delay between them).

Bit's 4-5 of byte 10 will contain value of 0b00 (Driver ID)

Bytes 33-38 of message will contain a received code.

Immediately after generation of pair of events the received Dallas will be erased from unit's memory.

Default value: 0 - Disable

8.9 Driver Behavior

8.9.1 *Coasting*

8.9.1.1 Coasting Detection (Speed and RPM)

The unit detects start and stop of coasting: vehicle driving down a hill with not engaged gear.

Every combination of speed and RPM may be configured as a trigger for coasting alert (Transmission Reason – 21, Specific Transmission - 1 for Coasting start / 0 – for Coasting stop).

The unit will generate an alert ("speed & RPM" start and stop") when:

- the RPM is below programmed threshold (or above programmed threshold);

  AND
- the speed is above programmed threshold (or below programmed threshold);

  AND
- The state lasts more than programmed time period.

8.9.1.2 Enable Coasting Event /Distress

Address: 1350, bit 3 for event, bit 4 for distress

Description: If this bit is set, and at least one of two multipurpose inputs (door/shock) is defined as General Purpose Frequency Meter (Assigned function 1), upon detection of Coasting the unit will generate an alert (event or/and distress, depends on the selected bits) with Transmission Reason – 21, Specific Transmission - 1 for Coasting start / 0 – for Coasting stop).

The unit will detect Coasting only if both Speed and Engine speed simultaneously violate appropriate thresholds for longer than programmed in violation time filter.

NOTES:

- The value of Engine Speed is scaled value of frequency measurement, taken from the input defined as General Purpose Frequency Meter.
- If both multipurpose inputs are defined as General Purpose Frequency Meters, the scaled value from Shock input (pin 15/20) will be used as a value of Engine Speed for Coasting detection.
- Measurement of frequency by dedicated input consumes at least 1 second.
- Except OTA alert Coasting detection can trigger output activation as a notification to the driver. Refer to the description of the programming parameters below.

Default Values: 0 - disabled

8.9.1.3 Speed Threshold Type

Address: 1350, bit 1

Description: If this bit is set, the speed threshold programmed on address 2387 will be treated as a maximum threshold (values of speed higher then this threshold will be considered violating).

If this bit is zero, the speed threshold programmed on address 2387 will be treated as a minimum threshold (values of speed lower then this threshold will be considered violating).

Default Values: 0 - minimum threshold

8.9.1.4 Engine Speed Threshold Type

Address: 1350, bit 2

Description: If this bit is set, the engine speed threshold programmed on addresses 2388-2389 will be treated as a maximum threshold (values of engine speed higher then this threshold will be considered violating).

If this bit is zero, the engine speed threshold programmed on address 2388-2389 will be treated as a minimum threshold (values of engine speed lower then this threshold will be considered violating).

Default Values: 0 - minimum threshold

8.9.1.5 Speed Threshold for Coasting

Address: 2387

Description: This parameter contains value of speed, used by Coasting detection feature as a maximum or minimum speed threshold (as per a configuration bit on address 1350, bit 1).

Resolution: km/h

Default value: 20

8.9.1.6 Engine Speed Threshold for Coasting

Address: 2388-2389

Description: This parameter contains value of engine speed, used by Coasting detection feature as a maximum or minimum engine speed threshold (as per a configuration bit on address 1350, bit 2).

NOTES:

- The value of Engine Speed is scaled value of frequency measurement, taken from the input defined as General Purpose Frequency Meter.
- If both multipurpose inputs are defined as General Purpose Frequency Meters, the scaled value from Shock input (pin 15/20) will be used as a value of Engine Speed for Coasting detection.

Resolution: RPM

Default value: 900

8.9.1.7 Coasting Violation Period

Address: 2386

Description: This parameter contains an initial value of timer, used as a violation filter of Coasting detection feature.

The unit will detect Coasting only if both Speed and Engine speed simultaneously violate appropriate thresholds for longer than programmed in this parameter.

Resolution: seconds

Default value: 10

8.9.2 *Behavior Violation Indications to Driver*

The unit is supporting up to two feedback signals (visual and audible) for the following driver behavior violations:

- Over Speed
- Coasting
- Harsh Breaking
- Harsh Acceleration
- Sudden course change.

- Idle speed
- Excessive RPM

All above listed violations are spitted into 2 groups of continuous violations and momentary violations.

Each group of violations can be escorted by template of indication to driver on two assigned outputs as per configuration.

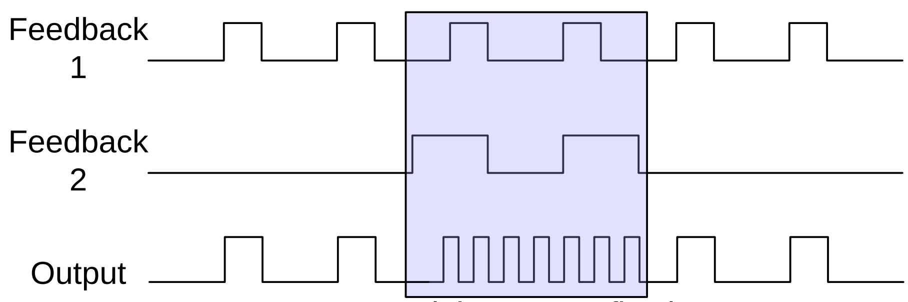
For continuous violations (over-speed, coasting and idle-speed) the activation only occurs upon session start.

Violation to Idle-speed is an exception: in spite of being continuous violation, Idle-speed is assigned by indication of momentary violation template.

Any combination of up to 2 outputs assigned for driver behavior is legal.

When single output is used as a feedback for two events, and those 2 events are simultaneously pending, a predefined hard coded pattern will be activated till simultaneous condition ends.

In case more than one feedback is activated simultaneously on the same output a special hard coded pattern will dominate the output till there are no more simultaneous events.



Special pattern reflecting Simultaneous feedbacks

The special hardcoded feedback will be 250mSec On and 250mSec Off.

Interaction with other Output Activation mechanisms

The priority of the output activation upon over-speeding violation is the same as a priority of feedback, i.e. – the lowest.

Any other output activation (manual activation, jamming, etc) has stronger priority and will take control over the selected output when needed.

8.9.2.1 Feedback for Driver Behavior Violations Bitmask

Address: 2376

Bit 6 – Excessive RPM (According to Continuous violation template)

Bit 5 – Idle Speed (According to Momentary violation template)

Bit 4 - Sudden course change (According to Momentary violation template)

Bit 3 - Harsh Acceleration (According to Momentary violation template)

Bit 2 - Harsh Breaking (According to Momentary violation template)

Bit 1 – Coasting (According to Continuous violation template)

Bit 0 - Over Speed (irrespectively to the source of threshold, according to Continuous violation template). This bit must be also enabled for "Speed Limiting GeoFence" feature.

The unit will trigger feedback upon detection of an appropriate driver behavior violation if this violation is enabled (1) in this bitmask.

The feedback will be triggered upon violation of the logical conditions, irrespectively to the generation (or not generation) of event/distress for the corresponding violation.

Default value: 0xFF

8.9.2.2 Output, Auto-activated upon Momentary Driver Behavior Violation Detection

Addresses: 523, bits 0-2

524, bits 0-2

Description: This field contains the number of the output used by this notification routine.

Output's name	Output's number
Feature Disabled	0
Siren	1
Gradual Stop	2
St. Immobilizer	3
LED	4
Blinkers	5
CFE Out 1	6
CFE Out 2	7

Default value: (0) Notification disabled

8.9.2.3 Duration of Output Activation, upon Momentary Driver Behavior Violation Detection

Addresses: 523, bits 3-5

524, bits 3-5

Description: This field contains the duration of the output activation upon momentary driver behavior violation detection.

Zero - forbidden.

Resolution: 0.5 seconds/bit

Default value: (1) 0.5 seconds

8.9.2.4 Number of Output Activation Repetitions upon Momentary Driver Behavior Violation Detection

Addresses: 523, bits 6-7

524, bits 6-7

Description: This field contains the number of the output activation repetitions (Duty cycle 50%) upon momentary driver behavior violation detection.

Zero - forbidden.

Default value: (1) Continuous repetition

8.9.2.5 Output, Auto-activated upon Continuous Driver Behavior Violation Detection

Address: 2377 for first output and 2380 for second output, bits 0-2

Description: This pair of parameters defines a numbers of outputs that will be activated upon driver behavior violation.

Output's name	Output's number
Feature Disabled	0
Siren	1
Gradual Stop	2
St. Immobilizer	3
LED	4
Blinkers	5
CFE Out 1	6
CFE Out 2	7

Value span: 1to 5

Default value: zero

8.9.2.6 Output Activation Pattern (upon Continuous Driver Behavior Violation)

Address: 2377 for first output and 2380 for second output, bits 3-5

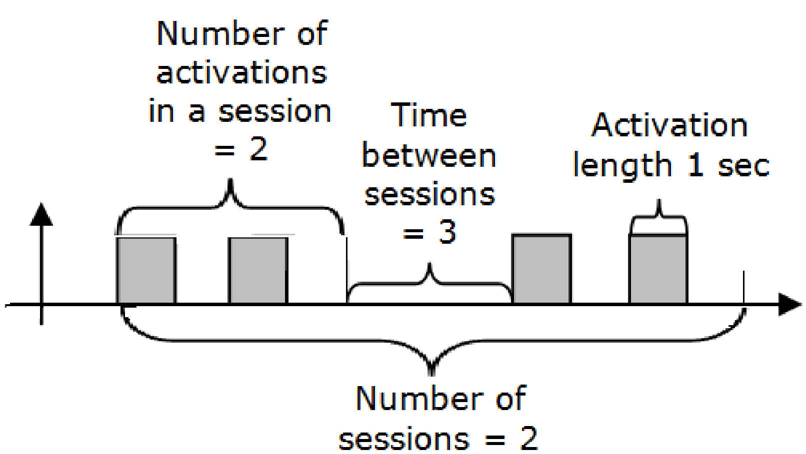
Description: This pair of parameters defines a activation pattern of outputs upon detection of Driver behavior violation.

Setting	Action
0	Pulse Activation (The output shall be activated for the time, defined in "Pulse Outputs Width Period", addr. 140 dec
1-3	Reserved
4	Template Activation (according to the settings described below)
5	Warning of delayed violation registration (template activation - according to the settings described below) **NOTE**: If user configures at first feedback according to "Warning of delayed violation registration" pattern and at second feedback according to "Template Activation" pattern the unit will function according to "Warning of delayed violation registration" pattern.
7	Reserved

Default value: (0) Pulse Activation

Template of continuous Output Activation upon detection of driver behavior violation

Example of template: Two activations in a session, 1 second for each activation, 2 sessions, 3 seconds between sessions:



Warning of delayed violation registration

This option is only applicable for continuous driver behavior violations: coasting, Over-speed and Excessive RPM.

If this option is selected, upon driver behavior violation detections the unit does the following:

- It does NOT generate an event immediately.

- It activates selected output (after expiration of OverSpeed or Coasting filter) according to a template definition on addresses 2377-2379 (for the first output) and 2380-2382 (for the second output).

The output shall be deactivated when one (of two) conditions come true:

- The end of violation

  OR

- The violation lasts longer than the time defined in Driver behavior- continuous violation feedback Logic: Feedback Violation Deactivation time threshold .

NOTE: The event shall only be generated if the violation lasts longer than 10 seconds.

The warnings will be triggered only after the programmable filters of coasting and over-speeding

Outputs will be deactivated immediately when the condition will become not true or after 10 seconds (without the programmable filter).

8.9.2.7 Continuous Driver Behavior Violation - Output Activation Template Activation Length

Address: 2378 for first output and 2381 for second output, bits 0-3

Description: This pair of parameters defines a length of activation of the selected output upon Driver behavior violation detection.

0 for the time, defined in "Pulse Outputs Width Period", addr. 140 dec.

Note that the duty cycle of activation is 50%, i.e. activation time is the same as off time.

Value resolution: 0.5 second

Default value: 1(0.5 seconds)

8.9.2.8 Continuous Driver Behavior Violation - Output Activation Template: Number of Activations in a Session

Address: 2378 for first output and 2381 for second output, bits 4-7

Description: This pair of parameters defines a number of activations of the selected output upon Driver behavior violation detection.

0 – cancels outputs activation upon driver behavior violation detection.

Default value: 3

8.9.2.9 Continuous Driver Behavior Violation - Output Activation Template: Number of Activation Sessions

Address: 2379 for first output and 2382 for second output, bits 0-3

Description: This pair of parameters defines a number of sessions of output activations upon Driver behavior violation detection.

0 – cancels outputs activation upon driver behavior violation detection**.**

Default value: 1

8.9.2.10 Continuous Driver Behavior Violation - Output Activation Template: Time between the Activation Sessions

Address: 2379 for first output and 2382 for second output, bits 4-7

Description: This pair of parameters defines a time between activation sessions of output activations upon Driver behavior violation detection.

Zero value. If zero is programmed the unit will only perform one session of activation irrespectively to the programmed number of sessions.

Value resolution: 0.5 second

Default value: 2 (1 second)

8.9.3 *Additional Thresholds for GP Frequency Meter*

One is used as an activity start/stop detector (for example engine start/stop), the second is used for a kick down detection.

Each threshold is equipped by independent time filter and transmission reason; the unit generates a trigger upon violation of the thresholds in both directions: up and down.

8.9.3.1 Additional GP Frequency thresholds

Address: 1st threshold - 2372-2373

2nd threshold - 2374-2375

Default value: 5000

Description: These parameters contain value of threshold for frequency measurement on GP Frequency meter input.

The threshold is applied after scaling measurement result (in case of Engine speed measurement the threshold will be programmed in RPM and not in Hz)

NOTE: If both multi-purpose inputs (Door and Shock) programmed as GP Frequency meters, the thresholds are applied to shock input.

Resolution: scaled frequency.

Default value: 1st threshold - 100

2nd threshold - 5000

8.9.3.2 Violation Timers of Additional GP Frequency Thresholds

Address: Timer of 1st threshold - 2370

Timer of 2nd threshold - 2371

Description: These parameters contain time, during which the measured frequency upon change shall stay higher (or lower) than the corresponding threshold in order to generate an appropriate alert (TR 210 for 1st threshold, 211 for 2nd threshold. STR 1 for "Rising", 0 for "falling").

Resolution: – seconds.

Default value: 1st threshold – 10 seconds

2nd threshold – 5 seconds

8.9.3.3 Alert Bitmask: Violation of Additional GP Frequency Thresholds

Address: 1351

	Type of alert	1st additional GP frequency threshold	2nd additional GP frequency threshold
Rising	Event	Bit 0	Bit 4
	Distress	Bit 1	Bit 5
Falling	Event	Bit 2	Bit 6
	Distress	Bit 3	Bit 7

Description: This parameter contains a bitmask, allowing to mask an alerts generated as a response to violation of additional GP Frequency threshold. '1' enables a corresponding alert and '0' disables it (TR 210 for 1st threshold, 211 for 2nd threshold. STR byte will contain 1 for "Rising", 0 for "falling").

Default value: all zeroes (Disable)

8.10 Electrical Vehicles

8.10.1 *Enable Unit Ignition-ON and activate CAN#1 upon Connecting Electrical Vehicle to Charging Source*

Address: 3, bit 0

Description: This parameters enables the unit to wake up from hibernation upon sensing battery voltage above "Voltage Level Threshold for Ignition On Detection" (address 468), even during Ignition Off (this happens in electrical vehicles upon connection to charging source). The unit will go back to hibernation upon sensing battery voltage below "Voltage Level Threshold for Ignition On Detection" (address 468) (this happens in electrical vehicles upon disconnection from charging source).

Range: 0 – Disable, 1 - Enable

Default Value: 0 – Disable

8.10.2 *Enable Unit Ignition-ON and activate CAN#2 upon Connecting Electrical Vehicle to Charging Source*

Address: 3, bit 1

Description: This parameters enables the unit to wake up from hibernation upon sensing battery voltage above "Voltage Level Threshold for Ignition On Detection" (address 468), even during Ignition Off (this happens in electrical vehicles upon connection to charging source). The unit will go back to hibernation upon sensing battery voltage below "Voltage Level Threshold for Ignition On Detection" (address 468) (this happens in electrical vehicles upon disconnection from charging source).

Range: 0 – Disable, 1 - Enable

Default Value: 0 – Disable

9 Inputs Events

The Cellocator unit provides 6 inputs; the hardware of all those inputs varies from pulled up, pulled down, wet (not equipped by pull up/down resistor) or adapted for frequency measurement. Each input is equipped by a packet of legacy functions:

- Trigger on the input cause generation of an event with an appropriate transmission reason
- Two inputs allow analog signal measurement
- Same two inputs allow frequency measurement
- Some affect unit's logic (like Ignition and door)

Each input (except ignition) is equipped by a configuration field, enabling to set up its type and other attributes, like threshold, differentiating between logical 0 and logical 1.

Input	Entry Type
Door	Analog / discrete "wet" and "dry" contact, Frequency Counter
Shock	Analog / discrete"wet" and "dry" contact, Frequency counter
Panic	Discrete only, "dry" contact
Unlock	Discrete only, "dry" contact
Lock	Discrete only, "dry" contact
Tamper	In CANiQ-M only

When configured as discrete input ("dry" or "wet") the table below defines the range of voltage threshold for logical zero detection.

	Wet (no internal pulling resistor)			Dry (Internally pulled up)		
	Min allowed	Defaults	Max allowed	Min allowed	Defaults	Max allowed
	Value in Volts (Programmed Value)					
Shock	0V (0)	14.7V (125)	30V (255)	0.2v (57)	1V (125)	1.45v (160)
Door	0V (0)	14.7V (125)	30V (255)	0.2v (57)	1V (125)	1.45v (160)

	Wet (no internal pulling resistor)	Dry (Internally pulled up)		
Lock[2]	N/A	0.2v (57)	1.85V (200)	2.36v (240)
Unlock		0.2v (57)	1.85V (200)	2.36v (240)
Panic		0.2v (57)	1.85V (200)	2.36v (240)

The table below provides threshold translation from the programmed value into voltage on interface pin (Measurement error ±20mv).

Threshold Value at PL file	Corresponding voltage on Door and Shock inputs
0-56	1.00v (in range value protection)
57	0.20v
80	0.47v
100	0.71v
125	1.00v
140	1.19v
160	1.45v
161-255	1.00v (in range value protection)

Threshold Value at PL file	Corresponding voltage on Lock/Unlock/Distress
0-56	1.85v (in range value protection)
57	0.20v
80	0.47v
100	0.69v
125	1.00v
140	1.15v
160	1.39v
200	1.87v
204	1.91v
232	2.26v
240	2.37v

[2] The provided values are valid for Cello hardware A04 and above. If you own older hardware please contact our technical support for further information concerning the highest possible zero detection value.

244-255	1.85v (in range value protection)

9.1 4 – Ignition

Ignition input can be used for detection of journey Start and Stop, which are key events in unit logic and require an especial treatment, or as a general purpose input (when journey Start/Stop is detected using an accelerometer).

Journey Start and Stop:

The system will enter hibernation mode between Journey Stop and Journey Start, and will start generating periodical events between Journey Start and Journey Stop

In case it is used for detection of journey Start and Stop, except "Common Discrete Inputs Time Filter" applied to every input, the Start/Stop Alert Generation Time Filters are applied as well.

A general purpose input:

If ignition input is used as a general purpose it is internally pulled down and can recognize the following signals:

- Low (logical zero) 0V<Vin<3.5V
- High: Vin>9V

Voltages between 3.5V to 9V are undefined.

9.1.1 *Reporting Journey Start*

Address: 126, bit 5 for event

130, bit 5 for distress

Description: if this bit is set the unit will generate a corresponding alert upon Journey Start detection (by ignition or by accelerometer).

Default Value: Event enabled (1), Distress and HRLS – disabled (0)

9.1.2 *Reporting Journey Stop*

Address: 124, bit 5 for event

128, bit 5 for distress

Description: if this bit is set the unit will generate a corresponding alert upon Journey Stop detection (by ignition or by accelerometer).

Default Value: Event enabled (1), Distress – disabled (0)

9.1.3 *Inverting Journey Start/Stop*

Address: 100, bit 5

Description:

Once inverted:

The system will report "Journey Start" when low level (by ignition or by accelerometer) is recognized and vice versa.

Default Value: (0) not inverted

9.1.4 *Reporting Signal Falling on Ignition*

Address: 125, bit 7 for event

129, bit 7 for distress

Description: if this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Note: This feature will not work when CFE configuration is used.

Default Value: zeros – disabled (0)

9.1.5 *Reporting Signal Rising on Ignition*

Address: 127, bit 7 for event

131, bit 7 for distress

Description: if this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Note: This feature will not work when CFE configuration is used.

Default Value: zero – disabled (0)

9.1.6 *Inverting Ignition Input*

Address: 101, bit 6

Description: Ignition input is internally pulled down and therefore does not require an inversion in most of the cases.

In case it is serving as a GP and logical levels are opposite to physical levels – the input shall be inverted.

Default Value: (0) not inverted

9.2 5 – Lock

This input is equipped by an internal pull up resistor and therefore can only serve as discrete dry contact.

9.2.1 *Function Assigned to Lock Input*

Address 1706, bits 0-4

Description: This field enables assignation of certain functionality to a Lock input.

Function number	Description
0	Use as a GP input (default)
1-8	Reserved
11	Reserved
12	Over-speed threshold control If this function is selected, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds while this input is triggered.
13-31	Reserved

Default Value: zero – GP input

9.2.2 *Inverting Lock Input*

Address: 101, bit 2

Description: Lock input is pulled up (internally); therefore it does require an inversion when it is required to detect activation by low level (-).

Once inverted: the "low" level of signal (below threshold programmed in parameter below) on this input will be treated as logical "1" (active). The "high" level of signal, as well as floating state, on this input will be treated as logical "0" (not active).

Default Value: (1) inverted

9.2.3 *Threshold for Lock Input*

Address: 1707

Description: This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact) will be considered as logical "one".

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span: 57 (0.2V) to 240 (2.36V). Any measured value below 57 or above 240 causes the unit to convert this value to default (200).

Default Value: 200 (1.85V)

9.2.4 *Averaging Factor for Lock Input*

Address: 1708

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In the operational modes listed below the unit is ignoring averaging factor and processing each measurement sample separately:

- In Full Hibernation mode, including the Modem / GPS On Time
- In Signal Correlation Mode (applicable in security builds only)

Default Value: 10 samples

9.2.5 *Reporting Signal Falling on Lock*

Address: 125, bit 2 for event

129, bit 2 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

9.2.6 *Reporting Signal Rising on Lock*

Address: 127, bit 2 for event

131, bit 2 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zero – disabled (0)

9.3 11- Unlock

This input is equipped by an internal pull up resistor and therefore can only serve as discrete dry contact.

9.3.1 *Function Assigned to Unlock Input*

Address 1703, bits 0-4

Name in Programmer: Assigned Function

Description: This field enables assignation of certain functionality to an Unlock input.

Function number	Description	Comment
0	Use as a GP input (default)	
1-8	Reserved	
11	Reserved	
12	Over-speed threshold control If this function is selected, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds while this input is triggered.	
13-31	Reserved	

Default Value: zero – GP input

9.3.2 *Inverting Unlock Input*

Address: 100, bit 7

Description: Unlock input is pulled up (internally); therefore it does require an inversion when it is required to detect activation by low level (-).

Once inverted: the "low" level of signal (below threshold programmed in parameter above) on this input will be treated as logical "1" (active). The "high" level of signal, as well as "not connected" state, on this input will be treated as logical "0" (not active).

Default Value: (1) inverted

9.3.3 *Threshold for Unlock Input*

Address: 1704

Description: This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact) will be considered as logical "one".

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span: 57 (0.2V) to 240 (2.36V). Any measured value below 57 or above 240 causes the unit to convert this value to default (200).

Default Value: 200 (1.85V)

9.3.4 *Averaging Factor for Unlock Input*

Address: 1705

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In the operational modes listed below the unit is ignoring averaging factor and processing each measurement sample separately:

- In Full Hibernation mode, including the Modem/GPS On Time
- In Signal Correlation Mode (applicable in security builds only)

Default Value: 10 samples

9.3.5 *Reporting Signal Falling on Unlock*

Address: 124, bit 7 for event

128, bit 7 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

9.3.6 *Reporting Signal Rising on Unlock*

Address: 126, bit 7 for event

130, bit 7 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zero – disabled (0)

9.4 14 – Door

9.4.1 *Door Input Type*

Address 1674, bits 5-7

Description: This input is equipped by pair of internal resistors, which can be programmatically turned into pull up, pull down or canceled at all. Therefore the input can serve as digital or analog input of the types described below as well as a frequency counter

Input Type number	Description
0	Discrete Dry Contact (on board pull-up)
1	Discrete Normal (Wet Input)
2	Analog Backward Compatible (0-2.5V)
3	Analog New Range (0-30V)
4	Frequency meter
5	Pulse Counter: Enables Pulse Counting mechanism

6-7	Reserved

Default Value: 0 - Discrete Dry Contact
For **LV300P** only: 1 - Discrete Normal (Wet Input)

9.4.2 *Function Assigned to Door Input*

Address 1674, bits 0-4

Description: This field enables assignation of certain functionality to a Door input.

Function number	Description	Comment
0	Use as a GP input (default)	
1	Use as a GP frequency meter (refer to frequency metering section in this document)	Only compatible to Type 4 (Frequency meter)
2	Use as a Speed source (refer to frequency metering section in this document)	
3	Use as a Fuel Level source (refer to the note below this table)	
4-8	Reserved	
11	Reserved	
12	Over-speed threshold control If this function is selected, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds while this input is triggered.	
13	Offline Tracking Upload Events Trigger	
14-31	Reserved	

Note: For utilizing this input as fuel level source (or fuel consumption estimation based on the fuel level), a fuel probe need to be connected to the input, this parameter need to be set to "Use as a Fuel Level source" (3), and any CAN configuration for fuel level (or fuel consumption estimation) need to be disabled.

Default Value: zero – GP input

9.4.3 *Scaling Factor for Frequency Report on Door Input*

Address: 1675-1676

Name in Programmer: Scaling Factor Frequency

Description: Applicable only if door is selected as input type 4. The scaling factor is intended to be used for conversion of the measured frequency into common unit of speed (cm/sec) in case the measurement is utilized as a speed source or into any other common format, if the input is used as a GP pulse frequency counter.

NOTE: This value may be calculated and programmed by the unit automatically during the Auto-Calibration Process. (Refer to the Frequency Metering Section in this document)

Stored value of Scaling Factor (Sf * 1000)	
First Configuration Byte (MSB)	Second configuration byte (LSB)

In case of Speed Source (Input's type 4, Assigned function 2):

The value utilized as a speed [cm/sec] will be calculated as follows:

$\mathbf{S = Fs * Sf[{}^{cm}/_{sec}]}$

S – Momentary value of speed [cm/sec]

Fs – Measured frequency

Sf – scaling factor

(The scaling factor is stored as follows: Sf=stored value/1000).

NOTE: In this case the scaling factor is given by the specific vehicle and actually translating number of pulses into a speed (in cm/sec).

Example:

When calibrating a vehicle at 40 Km/h (1111cm/sec), the index obtained is 54 (that is, 54 pulses per second). When the measured value is 108 pulses, it means that the vehicle is running at 80 Km/h (2222cm/sec).

In this case the scaling factor will be **Sf=1111 /54=20.576**.

Maximum value of a scaling factor of speed is Sf=65.535.

The stored value of Sf will be 65535.

In case of GP pulse frequency counter (Input's type 4, Assigned function 1):

The scaled value of the measurement will be reported in every position update from the unit in one of the Analog Inputs monitoring bytes, as per the configuration described above in this document.

The scaling factor, similarly to the previous case, is stored as follows:

Sf=stored value/1000

NOTE: Unlike the previous case the scaling factor here is a variable, adapted by the user to report the measured frequency value with best possible resolution in one byte.

Example:

Assuming the GP Pulse Frequency input is used to measure the engine speed (in RPM);

When calibrating a vehicle at 2000 RPM, the measured value is 116 (that is, 116 pulses per second). When the system receives 232 pulses it means that the vehicle is running at 4000 RPM.

If maximum available engine speed is 8kRPM, let's set a resolution of 32RPM/Bit (8000/255) in order to be able to report the measured value in single byte.

In our example we measure 2000/116=17.24 RPM/bit. Using simple proportion lets calculate the scaling factor:

Sf=17.24/32=0.53875

(stored value will be 0539)

The value reported in OTA message type 0 will be therefore:

$\mathbf{Es} = \mathbf{Fs} * \mathbf{Sf}[\mathbf{32RPM/Bit}]$

Es – reported value of engine speed [32RPM/Bit]

Fs – Measured frequency

Sf– scaling factor

9.4.4 *Thresholds on Door as a General Purpose Frequency Counter*

Address: 1678-1681

Description: This parameter defines minimum, maximum or range (as per the configuration byte) thresholds for frequency measurement on Door GP Frequency measurement input. Upon violation of this threshold for longer than the pre-programmed period, the unit will generate an appropriate OTA msg type 0, with dedicated transmission reason (192 dec).

NOTE: The threshold is applied on the result after scaling and not on the measured value (As [RPM] in case of Engine Speed measurement).

Each of the thresholds consumes 2 bytes: 1678-1679 for low threshold, 1680-1681 for high threshold. The threshold is applied on General Purpose Pulse measurement input only.

9.4.5 *Time Filter for Frequency/Analog Door Input*

Address: 1682

Description: (not applicable for discrete or wet types of input)

This parameter defines the violation time before generating a corresponding alert in 100mseconds resolution

Default value: Default value 50 (5 seconds)

9.4.6 *Door Freq. Input Violation Type*

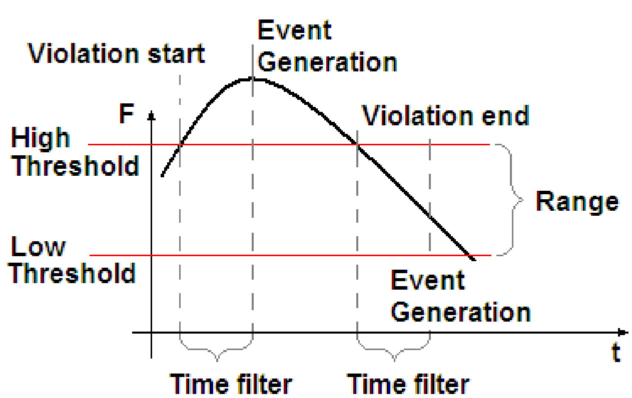
Address: 1677, bits 0-1

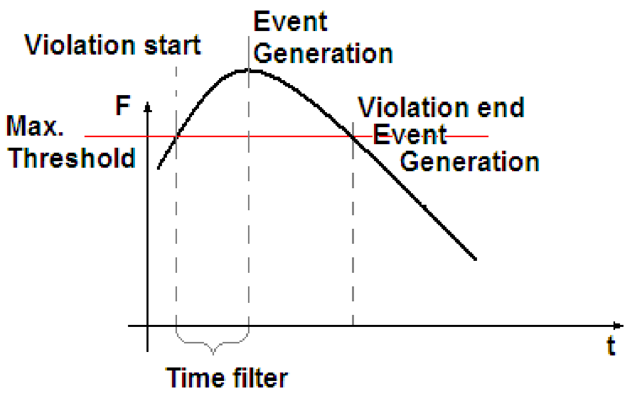
Description: This parameter defines violation type as follows:

0 – Threshold	0 – Low Threshold 1 – High Threshold
1 – Range	0 – Keep In Range 1 - Keep Out range
Bit 1	Bit 0

Bit 1 defines type of the violation: threshold or range. If threshold type is selected, bits 0 define if the low or high thresholds are processed.

If range type is selected - bit 0 defines if the violating value is inside or outside the range.





9.4.7 *Threshold for Door Input*

Address: 1678

Description: Applicable only for discreet types (wet and dry)

This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact in case of dry) will be considered as logical "one".

NOTE: The type of input affects the voltage value; the same value will mean different voltage for wet and discrete types.

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span for wet type: 0 (0V) to 255 (30V)

Default Value: 125 (14.7V)

Value span for discrete type: 57 (0.2V) to 160 (1.45V). Any measured value below 57 or above 160 causes the unit to convert this value to default (125).

Default Value: 125 (1V)

9.4.8 *Averaging Factor for Door Input*

Address: 1686

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is reported to the application and/or compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In Full Hibernation mode the unit is ignoring averaging factor and processing each measurement sample separately

Default Value: 10 samples

9.4.9 *Inverting Door Input*

Address: 100, bit 0

Description: Inversion is only applicable when the input type is configured as one of the discrete types.

When set as dry signal, the input is pulled up (internally); therefore it does require an inversion when it is required to detect activation by low level (-).

Once inverted: the "low" level of signal (below threshold programmed in parameter above) on this input will be treated as logical "1" (active). The "high" level of signal, as well as floating state, on this input will be treated as logical "0" (not active).

When set as wet signal type - no inversion is required.

Default Value: (1) inverted

9.4.10 *Reporting Signal Falling On Door*

Address: 124, bit 0 for event

128, bit 0 for distress

Description: Only applicable when the input type is configured as one of the discrete types.

If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

9.4.11 *Reporting Signal Rising on Door*

Address: 126, bit 0 for event

130, bit 0 for distress

Description: Only applicable when the input type is configured as one of the discrete types.

If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zeroes – disabled (0)

9.4.12 *Function buttons events – Door input*

Address: 1685

Description: Enable/Disable logged event and/or Distress event for each one of the 4 buttons sourced from the Door input.

Distress for button 4	Event for button 4	Distress for button 3	Event for button 3	Distress for button 2	Event for button 2	Distress for button 1	Event for button 1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Default Value: zeroes – disabled (0)

9.5 15 – Shock

9.5.1 *Shock Input Type*

Address 1687, bits 5-7

Description: This input is equipped by pair of internal resistors, which can be programmatically turned into pull up, pull down or canceled at all. Therefore the input can serve as digital or analog input of the types described below as well as a frequency counter.

Input Type number	Description
0	Discrete Dry Contact (on board pull-up)
1	Discrete Normal (Wet Input)
3	Analog New Range (0 – 30V)
4	Frequency Meter
5	Pulse Counter : Enables Pulse Counting mechanism
6-7	Reserved

Default Value: 0 = Discrete Dry Contact

9.5.2 *Function Assigned to Shock Input*

Address 1687, bits 0-4

Description: This field enables assignation of certain functionality to a Door input.

Function number	Description	Comment
0	Use as a GP input (default)	
1	Use as a GP frequency meter (refer to frequency metering section in this document)	Only compatible to Type 4 (Frequency meter)
2	Use as a Speed source (refer to frequency metering section in this document)	
3	Use as a Fuel Level source (refer to frequency metering section in this document)	
4-8	Reserved	
11	Reserved	
12	Over-speed threshold control If this function is selected, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds while this input is triggered.	
13	Offline Tracking Upload Events Trigger	
14-31	Reserved	

Note: For utilizing this input as fuel level source (or fuel consumption estimation based on the fuel level), a fuel probe need to be connected to the input, this parameter need to be set to "Use as a Fuel Level source" (3), and any CAN configuration for fuel level (or fuel consumption estimation) need to be disabled.

Default Value: zero – GP input

9.5.3 *Scaling Factor for Frequency Report on Shock Input*

Address: 1688-1689

Name in Programmer: Scaling Factor Frequency

Description: Applicable only if shock input is selected as input type 4. The scaling factor is intended to be used for conversion of the measured frequency into common unit of speed (cm/sec) in case the measurement is utilized as a speed source or into any other common format, if the input is used as a GP pulse frequency counter.

Stored value of Scaling Factor (Sf * 1000)	
First Configuration Byte (MSB)	Second configuration byte (LSB)

NOTE: This value may be calculated and programmed by the unit automatically during the Auto-Calibration Process. (Refer to frequency metering section in this document)

In case of Speed Source (Input's type 4, Assigned function 2):

The value utilized as a speed [cm/sec] will be calculated as follows:

$\mathbf{S} = \mathbf{Fs} * \mathbf{Sf}[\mathbf{cm}/\mathbf{sec}]$

S – Momentary value of speed [cm/sec]

Fs – Measured frequency

Sf – scaling factor

(The scaling factor is stored as follows: Sf=stored value/1000).

NOTE: In this case the scaling factor is given by the specific vehicle and actually translating number of pulses into a speed (in cm/sec).

Example:

When calibrating a vehicle at 40 Km/h (1111cm/sec), the index obtained is 54 (that is, 54 pulses per second). When the measured value is 108 pulses, it means that the vehicle is running at 80 Km/h (2222cm/sec).

In this case the scaling factor will be Sf=1111 /54=20.576

Maximum value of an scaling factor of speed is Sf=65.535

The stored value of Sf will be 65535

In case of GP pulse frequency counter (Input's type 4, Assigned function 1):

- The scaled value of the measurement will be reported in every position update from the unit in one of the Analog Inputs monitoring bytes, as per the configuration described above in this document.
- The scaling factor, similarly to the previous case, is stored as follows:

  Sf=stored value/1000

NOTE: Unlike the previous case the scaling factor here is a variable, adapted by the user to report the measured frequency value with best possible resolution in one byte.

Example:

Assuming the GP Pulse Frequency input is used to measure the engine speed (in RPM);

When calibrating a vehicle at 2000 RPM, the measured value is 116 (that is, 116 pulses per second). When the system receives 232 pulses it means that the vehicle is running at 4000 RPM.

If maximum available engine speed is 8kRPM, let's set a resolution of 32RPM/Bit (8000/255) in order to be able to report the measured value in single byte.

In our example we measure 2000/116=17.24 RPM/bit. Using simple proportion lets calculate the scaling factor:

Sf=17.24/32=0.53875

(stored value will be 0539)

The value reported in OTA message type 0 will be therefore:

$$\mathbf{Es} = \mathbf{Fs} * \mathbf{Sf}[\mathbf{32RPM/Bit}]$$

Es – reported value of engine speed [32RPM/Bit]

Fs – Measured frequency

Sf– scaling factor

9.5.4 *Threshold on Shock as a General Purpose Frequency Counter*

Address: 1691-1694

Description: This parameter defines minimum, maximum or range (as per the configuration byte) thresholds for frequency measurement on Shock GP Frequency measurement input. Upon violation of this threshold for longer than the pre-programmed period, the unit will generate an appropriate OTA msg type 0, with dedicated transmission reason (192 dec).

NOTE: The threshold is applied on the result after scaling and not on the measured value (Es [RPM] in case of Engine Speed measurement).

Each of the thresholds consumes 2 bytes: 1691-1692 for low threshold, 1693-1694 for high threshold.

The threshold is applied on General Purpose Pulse measurement input only.

9.5.5 *Time Filter for Violation of Frequency / Analog Shock Input*

Address: 1695

Description: Applicable only for GP Frequency input or analog input types.

This parameter defines the violation time before generating a corresponding alert in 100mseconds resolution

Default value: Default value 50 (5 seconds)

9.5.6 *Shock Freq. Input Violation Type*

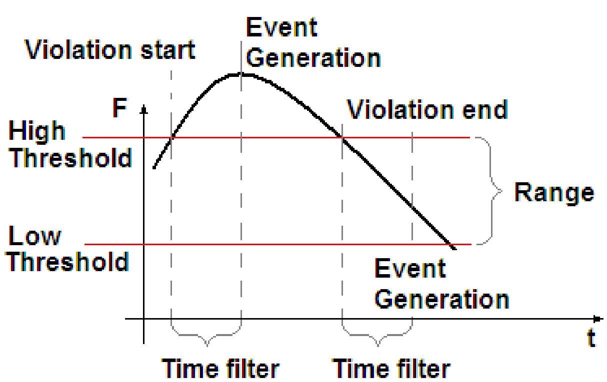
Address: 1690, bits 1-0

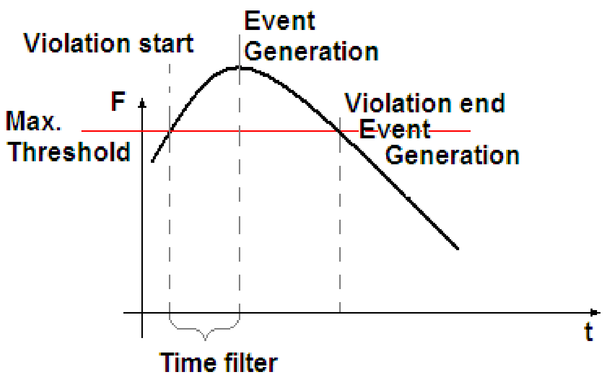
Description: This parameter defines violation type as follows:

0 – Threshold	0 – Low Threshold 1 – High Threshold
1 – Range	0 – Keep In Range 1 - Keep Out range
Bit 3	Bit 2

Bit 3 defines type of the violation: threshold or range. If threshold type is selected, bits 2 define if the low or high thresholds are processed.

If range type is selected - bit 2 define if the violating value is inside or outside the range.





9.5.7 *Threshold for Shock Input*

Address: 1691

Description: Applicable only for discreet types (wet and dry)

This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact in case of dry) will be considered as logical "one".

NOTE: The type of input affects the voltage value; the same value will mean different voltage for wet and discrete types.

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span for wet type: 0 (0V) to 255 (30V).

Default Value: 125 (14.7V)

Value span for discrete type: 57 (0.2V) to 160 (1.45V). Any measured value below 57 or above 160 causes the unit to convert this value to default (125).

Default Value: 125 (1V)

9.5.8 *Averaging Factor for Shock Input*

Address: 1699

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is reported to the application and/or compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In Full Hibernation mode the unit is ignoring averaging factor and processing each measurement sample separately.

Default Value: 10 samples

9.5.9 *Inverting Shock Input*

Address: 100, bit 1

Description: Inversion is only applicable when the input type is configured as one of the discrete types.

When set as dry signal, the input is pulled up (internally); therefore it does require an inversion when it is required to detect activation by low level (-).

Once inverted: the "low" level of signal (below threshold programmed in parameter above) on this input will be treated as logical "1" (active). The "high" level of signal, as well as floating state, on this input will be treated as logical "0" (not active).

When set as wet signal type - no inversion is required.

Default Value: (1) inverted

9.5.10 *Reporting Signal Falling on Shock Input*

Address: 124, bit 1 for event

128, bit 1 for distress

Description: only applicable when the input type is configured as one of the discrete types.

If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

9.5.11 *Reporting Signal Rising on Shock Input*

Address: 126, bit 1 for event

130, bit 1 for distress

Description: Only applicable when the input type is configured as one of the discrete types.

If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zeroes – disabled (0)

9.5.12 *Function buttons events - Shock Input*

Address: 1698

Description: Enable/Disable logged event and/or Distress event for each one of the 4 buttons sourced from the Shock input.

Distress for button 4	Event for button 4	Distress for button 3	Event for button 3	Distress for button 2	Event for button 2	Distress for button 1	Event for button 1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Default Value: zeroes – disabled (0)

9.6 16 – Panic

This input is equipped by an internal pull up resistor and therefore can only serve as discrete dry contact.

9.6.1 *Function Assigned to Panic Input*

Address 1700, bits 0-6

Name in Programmer: Assigned Function

Description: This field enables assignation of certain functionality to a Panic input.

Function number	Description	Comment
0	Use as a GP input (default)	
1-8	Reserved	
11	Reserved	
12	Over-speed threshold control If this function is selected, the unit will automatically use speed threshold programmed on address 2391 as both Over-speed start and Over-speed end thresholds while this input is triggered.	
13-31	Reserved	

Default Value: zero – GP input

9.6.2 *Inverting Panic Input*

Address: 100, bit 6

Description: Panic input is pulled up (internally); therefore it does require an inversion when it is required to detect activation by low level (-).

Once inverted: the "low" level of signal (below threshold programmed in parameter above) on this input will be treated as logical "1" (active). The "high" level of signal, as well as floating state, on this input will be treated as logical "0" (not active).

Default Value: (1) inverted

9.6.3 *Threshold for Panic Input*

Address: 1701

Description: This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact) will be considered as logical "one".

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span: 57 (0.3V) to 240 (3V). Any measured value below 57 or above 240 causes the unit to convert this value to default (200=2.5V).

Default Value: 200

9.6.4 *Averaging Factor for Panic Input*

Address: 1702

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In the operational modes listed below the unit is ignoring averaging factor and processing each measurement sample separately:

- In Full Hibernation mode, including the Modem / GPS On Time
- In Signal Correlation Mode (applicable in security builds only)

Default Value: 10 samples

9.6.5 *Reporting Signal Falling on Panic*

Address: 124, bit 6 for event

128, bit 6 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. In case this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

9.6.6 *Reporting Signal Rising On Panic*

Address: 126, bit 6 for event

130, bit 6 for distress

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. In case this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zero – disabled (0)

9.7 Accelerometer

The accelerometer can be used as an input generating a variety of specific logics and events.

9.7.1 *Tilt Tamper*

In order to detect detachment of the unit from the installation surface (along with its cradle or when installed without a cradle), a tilt-tamper mechanism can be used.

When orientation (by earth gravity) on each axis changes more than the configured angle threshold when compared to the steady state for a longer time than the configured timer threshold, the unit will report it.

This feature utilizes 2 IIR filters: slow (factor is hardcoded = 2) and very slow (factor is hardcoded = 30). Each IIR filter is implemented as following:

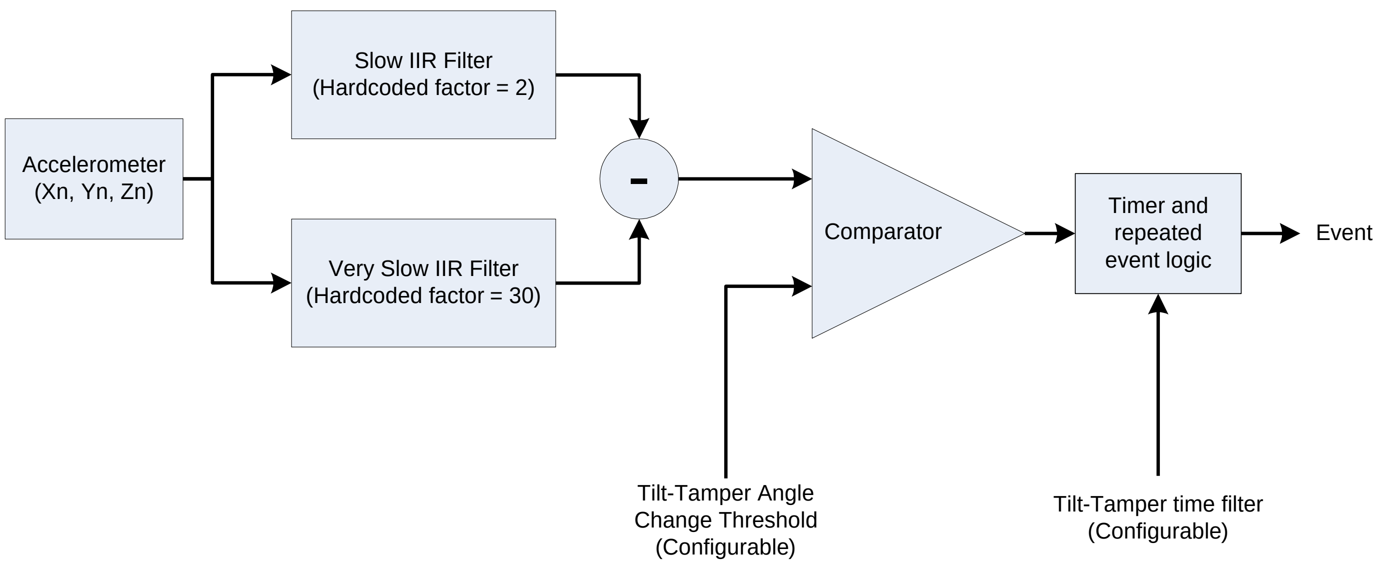
$$Sum_0 = Sample_0 * Factor$$

$$Avg = \frac{Sum}{Factor}$$

$$Sum_n = Sum_{n-1} - Avg_{n-1} + Sample_n$$

When Avg is the filtered value (filter output).

The subtraction of these 2 filters outputs is compared with the configurable threshold.



When a tilt tamper event is created, there is no other such event until the system has stabilized.

9.7.1.1 Tilt Tamper Messaging

Address: 2044 bits 4-5

Description: This parameter allows to configure the type 0 messaging for the tilt tamper feature (TR 158, STR 2).

Data range:

Value	Description
0	Disable
1	Distress
2	Logged
3	Logged & Distress

Default value: 0 – Disable

9.7.1.2 Tilt-Tamper Angle Change Threshold

Address: 2045

Description: This parameter allows to configure the angle threshold that will be considered as a tilt tamper scenario. 0 – Disables the feature**.**

Resolution: 0.588º

Data range: 0.588º÷150º

Default value: 45.276º

9.7.1.3 Tilt-Tamper Time Filter

Address: 2046**,** bits 0-3

Description: This parameter allows to configure the time in which an angle higher than the one configured in "Tilt Tamper Angle Change Threshold" parameter needs to be detected in order to generate a Tilt Tamper event. The time configured in this parameter is added to the inherent time it takes the IIR filters mechanism to identify the tilt tamper (usually 2 seconds for 45 degrees threshold).

Resolution: 1 second

Data range: 0-15 seconds

Default value: 0 seconds

9.8 Tamper events (CANiQ-M Only)

Note: Nano and CelloTrack are using different Configuration bits for Tamper control.

Address: 124, bit 2 for falling event

126, bit 2 for rising event

128, bit 2 for falling distress

130, bit 2 for rising distress

Description: If the enclosure is getting open or closed the unit will send event with **TR-159 (Inactive)** = **Close**, and **TR-158 (Active)** = **Open**.

Default Value: zeros – Disable (0)

10 Power Events

10.1 Power Threshold Settings

The thresholds listed below are used to determine if the main and backup power sources are low.

Each of these conditions for each of the power sources (main and backup) is equipped by pair of thresholds enabling to alerts in sessions.

10.1.1 *Main Power Low Threshold – High/Low levels*

Address: **115** – High level (Doesn't exist on CelloTrack-Solar)

116 – Low level (for CelloTrack-Solar see section _d2h_bmk__Ref535335408_22)

Description: The unit will trigger "Main Battery low" alert if the measured level of the main power will be lower than the value programmed in Main Power Low Threshold Low Level parameter.

The unit will trigger "Main Battery OK" alert if the measured level of the main power will be higher than the value programmed in Main Power Low Threshold High Level.

Data format: 8-bit unsigned,

0.1176470588235V/bit

Default values:

Address 115: 10.584V

Address 116: 10.1136V

10.1.2 *Backup Battery Low Threshold – High/Low Levels*

Address: **119** – High level

120 – Low level

Description: The unit will trigger "Battery low" alert if the measured level of the backup battery will be lower than the value programmed in Backup Battery Low Threshold Low Level parameter.

Note that the unit is not charging the battery in Ignition Off mode except in the following cases:

- When the Battery Low alert was issued upon Stop Event. In this case the unit might activate the charger for limited time (as specified in "Maximum extra charge time" parameter)
- "Charge irrespectively to an operational mode" parameter is enabled.

The unit will trigger "Battery OK" alert when the measured level of the Backup Battery will become higher than the value, programmed in Backup Battery Power Low Threshold High Level.

Note that since the measured voltage of the backup battery during charging is ~0.2V higher then measurement without a charging it is possible that the unit will report status change (battery low or battery high) too early.

In order to prevent this situation it is recommended not to set the battery thresholds to tide.

Data format: 8-bit unsigned, 0.01647058823V/bit.

Default values: Address 119: 3.48V

Address 120: 3.52V

10.2 Power Events/Distress Control

10.2.1 *Enabled Main Power Disconnected in Ignition Off Mode alert*

Address: 121, bit 0 for events

122, bit 0 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Main Power disconnected session start and end.

Default value: 0 – disabled

10.2.2 *Enabled Main Power Low in Ignition Off Mode Alert*

Address: 121, bit 1 for events

122, bit 1 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Main Power Low session start and end.

Default value: 0 – disabled

10.2.3 *Enabled Backup Battery Disconnected in Ignition Off Mode Alert*

Address: 121, bit 2 for events

122, bit 2 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Backup Battery Disconnect session start and end.

NOTE: The backup battery disconnection is sensed by voltage on NTC channel.

Default value: 0 – disabled

10.2.4 *Enabled Backup Battery Low in Ignition Off Mode Alert*

Address: 121, bit 3 for events

122, bit 3 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Backup Battery Low session start and end.

Default value: 0 - disabled

10.2.5 *Enabled Main Power Disconnected in Ignition On Mode Alert*

Address: 121, bit 4 for events

122, bit 4 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Main Power disconnected session start and end.

Default value: 0 – disabled

10.2.6 *Enabled Main Power Low in Ignition On Mode Alert*

Address: 121, bit 5 for events

122, bit 5 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Main Power Low session start and end.

Default value: 0 – disabled

10.2.7 *Enabled Backup Battery Disconnected in Ignition On Mode Alert*

Address: 121, bit 6 for events

122, bit 6 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Backup Battery Disconnect session start and end.

NOTES:

- If backup battery is not installed the unit will not generate the "backup battery disconnected" alert.

- The backup battery disconnection is sensed by voltage on NTC channel.

Default value: 0 – disabled

10.2.8 *Enabled Backup Battery Low in Ignition On Mode Alert*

Address: 121, bit 7 for events

122, bit 7 for distress

Description: If this bit is set the unit will generate appropriate alerts upon detection Backup Battery Low session start and end.

Default value: 0 - disabled

10.3 Radio-Off Mode (Hardcoded - Always Enabled)

Previously in Address: 1349, bit 1 (Now it does not have any configuration bit)

Note that the bit was added in Codebase 30j and removed in 31p; in all other versions this feature is always enabled.

The feature described below is not applicable for CelloTrack variants. For CelloTrack Radio-Off please refer to: Radio-Off (CelloTrack and CelloTrack Power)

Description: When the main power of Cello is disconnected and the unit is solely working from internal backup battery the unit will switch its modem upon discharge of the battery lower than 3.5V.

This way the remaining charge of the battery will allow maintenance of GPS, processor and memory for generation (without OTA sending) of high number of events before entering "Shipment Mode" (battery disconnect).

The unit will do the following:

1. Log an especial event "modem off" (TR207, specific data field 2) upon:
    - Solely working from internal backup battery.
    - Detection of internal backup battery voltage lower than 3.5V (on any temperature) for longer than 1 second (100 samples).
2. Switch the modem off 2 seconds after the event generation, but keep generating and logging events.
    - The modem is switched off even if there is a data transfer upon timer expiration.
    - Once switched off, the modem will be switched back on only upon main power reconnection.
3. Log an especial event "Auto-Shipment due to a low power" (TR207, specific data field 0) upon discharging to 3.25V for longer than 1 second (100 samples).
4. Enter "Shipment Mode".

Default (Hardcoded) value: 1 - Enabled

11 Geo-Fences

11.1 Geo-Fence

The group of parameters below contains configuration structures of 100 internal Geo-Fences of Cellocator unit. Each geo-fence is a rectangular perimeter, activated in a selected time of the day. It is equipped by violation condition, capable to trigger an alert or output activity upon occurrence.

During Ignition On mode the unit is continually examining its location and checking if it is violating a condition of one of the fields.

Each of a 100 geo-fences is a structure of 16 bytes in the following order:

	Byte 15	Byte 14	Byte 13	Byte 12	Byte 11	Byte 10	Byte 9	Byte 8	Byte 7	Byte 6	Byte 5	Byte 4	Byte 3	Byte 2	Byte 1	Byte 0
Field description / Address	Config. byte 4	Maximal Latitude Displace-ment		Latitude of Fence's Centrum				Maximal Longitude Displace-ment		Longitude of Fence's Centrum				Configuration bytes 1,2 and 3		
Fence 0 2496-2512	2512															2496
Fence 1 2513-2528	2528															2512
Fence 99 4080-4095	4095															4080

11.1.1 *Format of Geographical Perimeter*

Address: 2496-4095

Name in Programmer: EdgePoint 0001 – 0100

Description: The perimeter is defined by center coordinates and maximal displacement for each coordinate (the same structure for longitude and latitude). The coordinates are the usual 10^{-8} radians format. The displacement is $10^{-8}/256$ radians (the same format like the coordinates but without the least significant byte and the most significant byte, keeping only the middle bytes).

Maximal Longitude Displacement		Longitude of Fence's Centrum			
Segment Byte 8	Segment Byte 7	Segment Byte 6	Segment Byte 5	Segment Byte 4	Segment Byte 3

Maximal Latitude Displacement		Latitude of Fence's Centrum			
Segment Byte 14	Segment Byte 13	Segment Byte 12	Segment Byte 11	Segment Byte 10	Segment Byte 9

Default value: all bytes are zeroes (all waypoints disabled).

11.1.2 *Four Configuration Bytes of the Fence*

Address: Bytes 0, 1, 2 and 15 of each fence:

Speed Limiting	Geo-Fence Thresholds Select	Output Control					TOE MSB	End time hours[3]					End time minutes						Start time hours					Start time minutes						TOE (LSB)	
		Activation pattern		Output Number																											
31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Config. Byte 3								Config. Byte 2								Config. Byte 1								Config. Byte 0							
Segment Byte 15								Segment Byte 2								Segment Byte 1								Segment Byte 0							

[3] In order to set certain fence to be permanently active the start time shall be set to 0:00 and the end time to 24:00

11.1.3 *TOE - Type of Entry*

This field defines the usage of an appropriate Fence entry.

Bit 24	Bit 1	Bit 0	Entry type	Geo Fence Heading Angle Support (Not supported in CelloTrack family)
0	0	0	Entry is inactive (the whole 16 bytes are ignored by the unit)	No
0	0	1	Entry is active and treated as waypoint data	Yes
0	1	0	Entry is "keep out" fence data (unit must be outside location window)	Yes
0	1	1	Entry is "keep in" fence data (unit must be inside location window)	Yes
1	0	0	Entry is treated as Geo-hotspot (both entering and leaving cause a trigger)	Yes
1	0	1	Entry is treated as Modem Off zone. The unit generates an event and switches off the Cellular modem 10 seconds after entering the zone. The modem is turned on immediately upon exiting from the "no modem zone".	Yes
1	1	0	Speed limiting zone	Yes
1	1	1	PointerCept	No

11.1.4 *Waypoint*

Waypoints are perimeters, which the unit has to be found at defined time intervals. The unit must be found in the perimeter for at least one sample in the whole time window. Once it happens, the waypoint is "checked" (i.e. no additional checks will be done for this waypoint). If this does not happen, the unit will trigger a dedicated alert.

11.1.5 *Geo Hot Spot*

Generates trigger on entry and exit to a fenced zone. Transmission reason 191, Trigger's transmission-reason-specific data: Bits 0-6 is the index of the slot. Most significant bit (bit 7) indicates direction: entry to hot spot ("1") or exit from hot spot ("0"). Behavior is not affected by fence logic bit. Please note, Hot-Spot does not trigger outputs.

11.1.6 *No Modem Zone*

Generates trigger when shutting down modem as a result of entry to "no modem zone".

Trigger is generated only for the first fence that causes the modem's shutdown. Upon entry to another overlapping (or common boundary) "no modem" zones, while modem is already turned off, no more triggers are generated. Modem is shut down 10 seconds after entering "no modem zone", regardless of trigger settings.

The modem is turned on immediately upon exiting from the "no modem zone".

11.1.7 *Output Control*

Geo-fence violation can trigger output activation. This feature is designed to let the unit automatically notify the driver that he is violating pre-programmed geo-fence rule and, in critical cases, even auto- immobilize a vehicle.

5 bits in each entry are defined for output activation as follows:

Activation pattern		Output Number		
Bit 29	Bit 28	Bit 27	Bit 26	Bit 25

The violation of the "Keep In", "Keep out" Geo-Fence will trigger output activation upon violation (after Geo-Fence violation filter);

The Modem Off zone will trigger an output while inside the Geo-Fence (note that it is possible to invert the logic of some outputs programmatically and this way to trigger output activation outside the fence).

The output will be automatically deactivated upon Geo-Fence violation end.

The output activated by Geo-Fence logic is persistent, e.g. not disturbed by reset or AHR.

Upon violation the activated output might be switched off by Output Control Command from Central Control. The unit will "remember" the status of the output and will restore it upon initialization in case of reset.

Once deactivated by command, the output will be re-activated upon next violation.

The logic of the zone violation is set by zone type in TOE of the zone (for example Keep Out zone will cause an assigned output to be activated when the unit will enter this zone).

Outputs Number description:

Output's name	Output's number
Feature Disabled	0
Siren (GPIO1)	1
Gradual Stop	2
St. Immobilizer	3
LED	4
Blinkers	5
CFE Out 3	6
CFE Out 4 or PSP indication beep (if PSP was enabled, Relevant **only for session start i.e. Entering the Zone)**	7

11.1.8 *Output Activation Pattern*

Setting	Action
0	Pulse Activation (The output shall be activated for the time, defined in "Pulse Outputs Width Period", addr. 140 dec.
1	Change state to "active" upon trigger
2	Activate Gradually (only compatible with Gradual Stop output)
3	Activate Nested (executed only after vehicle stops, e.g. Ignition off or 10 valid GPS packets showing speed lower than 1 km/h)

11.2 Fences Configuration

11.2.1 *Geo-Fence Logic*

Address: 6, bit 5

Description: This parameter defines the reference of the unit to the geo-fences (Applicable only for Keep In and Keep Out types).

Global context mode (fence logic = 0)

Keep in fences logic:

When position changes, trigger is generated if both terms below are true:

- In the new position *ALL* keep-in fences are in violation state (meaning - position is outside all keep-in fences).
- Previously at least one of the fences wasn't in violation state (position was in the area of at least one of the fences).

Trigger's transmission-reason-specific data is the index of latest slot that changed its status to violation state.

Keep out fences logic:

When position changes, trigger is generated if both the terms below are true:

- In the new position at least one of the fences is in violation state (meaning - position is inside one of the keep-out fences).
- Previously *ALL* keep-out fences weren't in violation state (position was outside the area of all keep-out fences).

Trigger's transmission-reason-specific data is the index of latest slot that changed its status to violation state.

Discrete context mode (fence logic = 1):

Triggers are generated discretely for violation of each keep-in/out fence, regardless of other fences status. Trigger's transmission-reason-specific data is the index of the slot that changed its status to violation state.

Default value: 0 - Global context mode

11.2.2 *Geo-Fence Violation Filter*

Address: 1006

Description: This parameter designed to reduce number of fault Geo-Fence violation events. It defines required amount of sequential valid GPS packets (GPS packets are received every second) introducing Geo-Fence violation in order to generate an alert.

Default value: 1

Note: the violation filter is not applicable with waypoint type Geo-Fences (since by definition, in a waypoint type Geo-Fence one GPS sample in which the unit is inside the Geo-Fence perimeter is enough to "check" positively this Geo-Fence).

11.2.3 *Ignore Geo-Fence Violation on Boot (after Reset)*

Address: 1, bit 2

Description: If this bit is set, the "first geo-violation changes ignore" mode is activated.

This mode allows avoiding generation violation repetitions upon any kind of reset. In this mode, the unit will use the first stable violation state as the baseline for subsequent processing of geo-fences.

This means that any geo-fences in violation state on the first stable status are not reported, and only subsequent changes are reported.

Once started, "first geo-violation changes ignore" mode terminates when:

- A valid, stable GPS fix and geo-fence state is achieved. Any geo-violations at this point are not reported, and used as baseline.
- 120 seconds timeout expires. The rationale for this is not ignore important changes occurring at a later time, if this state started when there is no GPS coverage.
- After "first geo-violation changes ignore mode" ends, subsequent geo-violation changes are reported as usual.

Note that due to this mode's timeout, if GPS takes longer than 120 seconds to achieve a fix after boot, any active geo-violation will be reported as usual when GPS fix is finally achieved

Default value: 0 – Do not ignore violations on boot

11.2.4 *Control of Geo-Fence Alters (Events and Distress)*

11.2.4.1 Keep In Geo-Fence Zone Violation

Address: 1004, bit 0

1005, bit 0

Description: If this bit is enabled the unit will generate an alerts upon violation of Keep In Type of Geo-Zones.

Default value: 0 – both Disable

11.2.4.2 Keep Out Geo-Fence Zone Violation

Address: 1004, bit 1

1005, bit 1

Description: If this bit is enabled the unit will generate an alerts upon violation of Keep Out Type of Geo-Zones.

Default value: 0 – both Disable

11.2.4.3 Way Point Violation

Address: 1004, bit 2

1005, bit 2

Description: If this bit is enabled the unit will generate an alerts upon violation of Way Point Type of Geo-Zones.

Default value: 0 – both Disable

11.2.4.4 Geo Hot Spot Violation

Address: 1004, bit 3

1005, bit 3

Description: If this bit is enabled the unit will generate an alerts upon violation of Geo Hot Spot Type of Geo-Zones.

Default value: 0 – both Disable

11.2.4.5 No Modem Zone Entry

Address: 1004, bit 4

1005, bit 4

Description: If this bit is enabled the unit will generate an alerts upon violation of No Modem Type of Geo-Zones.

Default value: 0 – both Disable

11.2.5 *Geo-Fence Heading Angle*

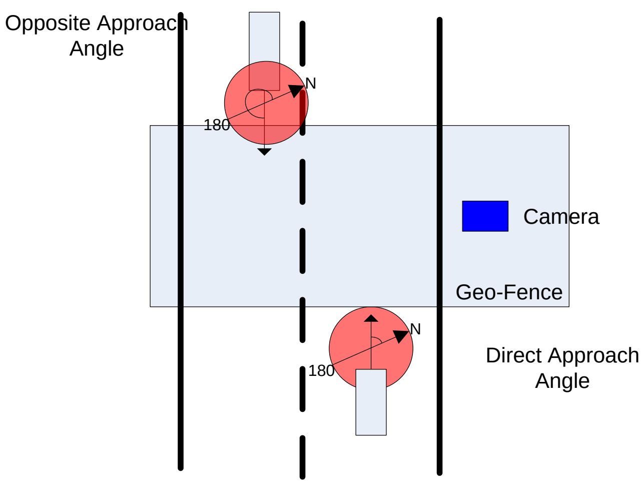
Address: 1921-2020

Description: This feature enables each Geo-Fence to be conditioned by the vehicle's approach angle. An array of 100 bytes was allocated in the unit's configuration memory to hold the Geo-Fence approach angle entries. Each entry holds a number between 0 to 11 representing 12 possible angle ranges of 30 degrees with resolution of +- 30 Degrees. Each entry also holds control bits to enable the Geo-Fence Angle for direct and opposite headings.

<table>
<tr><td></td><td>Enable direct approach Angle</td><td>Enable Opposite approach angle</td><td>Spare</td><td>Geo-Fence Approach Angle
<table>
<tr><th>Code</th><th>Engle [Degrease]</th></tr>
<tr><td>0</td><td>0</td></tr>
<tr><td>1</td><td>30</td></tr>
<tr><td>2</td><td>60</td></tr>
<tr><td>3</td><td>90</td></tr>
<tr><td>4</td><td>120</td></tr>
<tr><td>5</td><td>150</td></tr>
<tr><td>6</td><td>180</td></tr>
<tr><td>7</td><td>210</td></tr>
<tr><td>8</td><td>240</td></tr>
<tr><td>9</td><td>270</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><td></td><td></td><td></td><td></td><td><table><tr><td>10</td><td>300</td></tr><tr><td>11</td><td>330</td></tr></table></td></tr>
<tr><td>7</td><td>6</td><td>5</td><td>4</td><td>0-3</td></tr>
</table>

The following diagram shows possible scenario of a vehicle approaching geo-Fence with predefined heading relative to earth's north and the same vehicle approaching the same geo-fence from the opposite direction. In this case both enable bits must be set to detect the event. The feature can trigger outputs just like any Geo-Fence. It is possible to generate audible alert via CE8 device if PSP is enabled and Geo-Fence output code number 7 is selected. See Geo-Fence output control. For more information about the relations between GEO-Fence heading and the TOE (Type of Entry field setting the Goe-Fence functional settings please refer to: GeoEnceHeadingAngleSupport. Please note Hot-Spot does not support output activation.



Default value: 0 – Disable

11.2.6 *Geo-Fence Priority*

Address: 6550-6574

Description: Geo-Fences are defined by a center coordinate, and latitude + longitude displacements from center (i.e. only rectangular zones can be defined).

Thus, when trying to cover a road (which obviously has turns and curves) with the rectangular Geo-Fences, some overlapping between Geo-Fences is necessary.

In some cases, this causes the unit to produce too many speed violation events, which may cause excess workload and confusion to the operator.

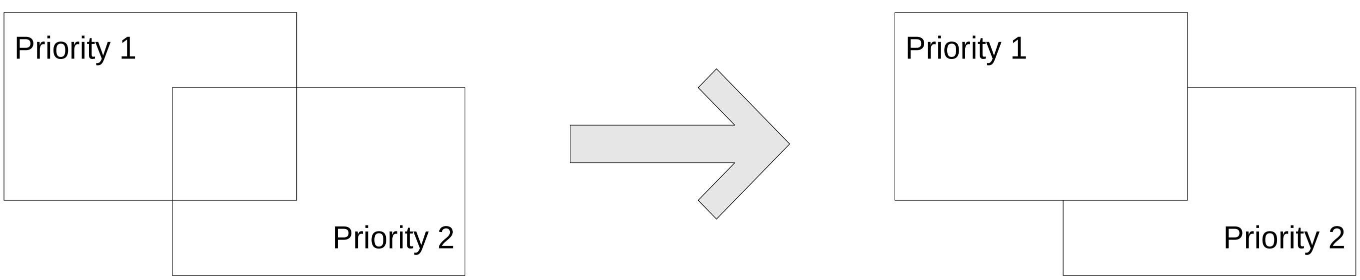
To solve this and create zone "continuity", a configurable priority is assigned for each Geo-Fence.

The priorities are:

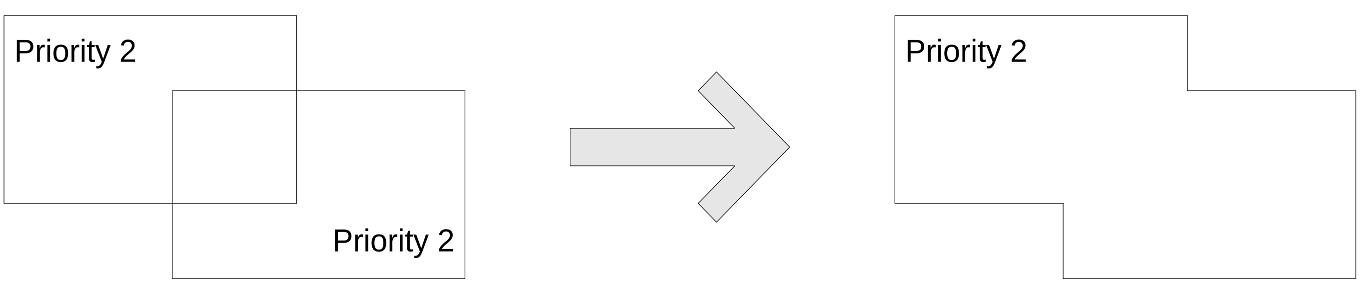
Priority	Value
1 (highest)	00
2	01
3	10
4 (lowest) - default	11

Address 6574								…	Address 6550							
GeoFence 100		GeoFence 99		GeoFence 98		GeoFence 97		…	GeoFence 4		GeoFence 3		GeoFence 2		GeoFence 1	
1	1	1	1	1	1	1	1	…	1	1	1	1	1	1	1	1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0	…	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

When the priorities of overlapping Geo-Fences are different, the unit considers only the boundary of the highest priority Geo-Fence:



When the priorities of overlapping Geo-Fences are equal, the unit considers them as one Geo-Fence with common boundaries:



12 Towing Detection and Towed Mode (supported on Cello and CR families and CT-LTE-power)

12.1 Towing Detection

Towing detection logic is activated in Engine Off mode irrespective of Hibernation mode. The unit will store the coordinates upon Stop alert generation (only if the location considered as valid).

During parking (continually, upon GPS peek, as per hibernation mode settings; the GPS peek can also be activated upon movement detection by accelerometer) the unit will examine its location and speed. If the location changes from the Journey Stop or speed are detected while ignition switch is off – the towing alert will be triggered.

12.1.1 *Towing Detection - Speed Threshold*

Address: 132 –133

Description: The unit will trigger "Speed Detected During Parking" alert if:

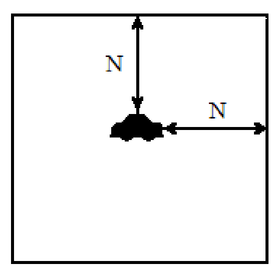
- The measured value of speed will be higher than the value programmed in this parameter.
- Towing detection alert (event or distress) is enabled

Data format: 16-bit unsigned. [km/h] units.

Default value: 200 (~7.2 km/h)

12.1.2 *Towing Detection - Geo-Fence Perimeter*

Address: 134-135



Description: The unit will trigger "Geo-fence violation" alert if latitude or longitude of the current location differ from the location recorded upon Stop by more than programmed in this parameter.

Note that this alert will not be triggered if the location recorded upon Journey Stop is invalid.

Data format: 16-bit unsigned integer, 10^{-8} radians resolution.

Default value: 4096

12.1.3 *Towing Detection and Towed Mode Time Filter*

Address*:* 137

Description: This parameter defines the time of which towing speed or location violation are required to be detected for Towing Detection, or accelerometer movement is required to be detected for Towed Mode.

Note this value should be larger than the value of parameter "Start Event time filter" (Address 104).

Range: 0-255 Seconds

Default value: 12 Seconds

12.1.4 *Enable GPS Wake Up upon Movement for Towing Detection*

Address: 467, bit 1

Description: This parameter only affects if Movement detection source is set as "Ignition Input". If this bit is set, the unit will wake up GPS for immediate legacy Towing Detection procedure upon movement detection while ignition is off.

Default value: 1– wake up GPS

12.1.5 *Towing Alerts (Distress and Event) Control*

12.1.5.1 Enable Alert upon Towing Speed Detection

Address: 99, bit 6 for event

102, bit 6 for distress

Description: This parameter enables generation of the Towing Speed alert upon detection.

Default Value: 0 – Disabled

12.1.5.2 Enable Alert upon Towing Location Detection

Address: 99, bit 7 for event

102, bit 7 for distress

Description: This parameter enables generation of the Towing Location change alert upon detection. Note that this alert will only be generated if valid GPS location was recorded upon Trip Stop.

Default Value: 0 – Disabled

12.2 Towed Mode

Towed mode allows to detect vehicle movement, when the in Ignition Off, depending on accelerometer (rather than the older Towing Detection feature which depends on GPS).

The pre-conditions for entering Towed Mode are:

- "Enable Towed Mode" (address 467, bit 6) is enabled
- "Use accelerometer for Start&Stop" (address 467, bit 0) is set to 0 (Ignition (Legacy)) – Towed Mode feature works only when connecting the unit to physical ignition line.
- Ignition is Off

Given that those pre-conditions exist, the unit will enter Towed Mode when movement is detected for longer than the time defined in "Towing Detection and Towed Mode Time Filter" (address 137).

The movement threshold depends on "Movement Detection type" (address 467, Bit 2), "Sensitivity" (address 467, 3-4), and on the unit mode (Operational/Hibernation).

During Towed Mode the unit will behave exactly as it would do during Ignition On, except for the following:

- The Ignition switch will remain Off
- If "Enable Start-Stop Towed Mode event/distress" (address 470, bit 0/1) are enabled:
  - Instead of Driving Start event (TR69) the unit will send Towed Mode Start event (TR8/STR1)
  - Instead of Driving Stop event (TR53) the unit will send Towed Mode Stop event (TR8/STR2)
- Unit Mode of Operation field in all corresponding Wire and Wireless messages will contain Towed Mode (0x10).

The unit will exit Towed Mode when:

- Ignition switches to On (physical input status). In this case the unit will send:
  - Towing Mode Stop event (TR8/STR2)
  - Driving Start event (TR69)
- Idling (lack of movement) is detected for longer than defined in "Towing Detection and Towed Mode Time Filter" (address 137). In this case the unit will send Towing Mode Stop event (TR8/STR2).

12.2.1 *Enable Towed Mode*

Address 467, bit 6

Description: This parameter allows to enable Towed Mode.

Default Value: 0 – Disabled

12.2.2 *Enable Towed Mode Start-Stop Distress/Event*

Address: 470, bit 0 - for event

bit 1 – for distress

Description: These parameters allow to enable Towed Mode Start-Stop events (TR8, STR1 or 2) upon entrance or exit to or from Towed Mode.

Default value: 0 – Disable

13 External Keyboard (Cello-AR Advance Recovery)

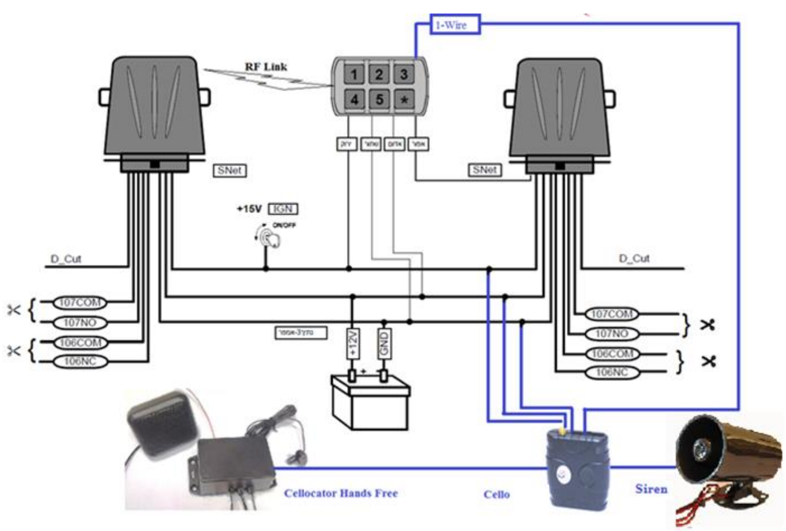
This section is only applicable for Cello-AR modifications.

The Cellocator units, integrated with the external security system, are a budgetary alternative to the integrated alarm systems used today in the SVR market.

The Cello AR system contains the Cello unit, keyboard for driver authentication, up to 2 wired immobilizing devices and unlimited number of wireless immobilizing devices.

The Cello AR system supports Cello 31e features codebase and wireless access to immobilizing system:

- Security states: armed, disarmed, standby, garage / service, keypad locked. The states also include manual and automatic procedures for entering and exiting the states.
- Disarming the system via user code, master code, and emergency disarming using the ignition switch.
- Changing the user code.
- Identifying, assigning and removing the assignment of the immobilizing devices.
- The CelloAR is adding the following functions to the legacy functions of key pad.
- OTA communication with control center for Event reporting, parameters programming and commands receiving.
- Identification and authentication method based on user code, and authentication code (Rav Kodan® – more info is provided in the Driver Identification and Authentication section in this document).
- ECall and BCall using Cellocator Hands Free.



- The key pad is integrated with Cello unit through proprietary protocol based on 1-Wire™ protocol (refer to 1-Wire Interface Protocol).

13.1 Pairing Procedure

Pairing is a procedure of setting the detected Keyboard ID as a "valid" keyboard. Once pairing procedure is completed, the unit will validate continuous presence of the specific keyboard (if bit 5 of address 1910 is set the unit will not validate continuous presence of the keyboard).

Once the specific keyboard disconnected or replaced, the unit reacts by an immediate message generation and/or Alarm Cadence (configurable).

The pairing procedure is initiated by the keyboard: certain user activity inserts the system into a pairing mode.

During pairing process the LED on the Keyboard is indicating pairing mode.

The keyboard ID, received during Pairing Request session is recorded as valid ID into a non-volatile memory.

Any previous paired keyboard ID is erased upon new pairing.

Upon the Pairing Procedure end the unit will generate a msg. Type 0 with TR 91, STR 11 – pairing accomplished

13.2 Keyboard Configuration

13.2.1 *Enable Keyboard*

Address: 1709, bit 0

Description: If this bit is enabled (1) – the system will:

- Allow data forwarding from/to the keyboard, connected to the 1-Wire port (using OTA Msg type 9, sub-data 0xB)
- Allow particular parsing of the data received from keyboard (as described below) and its monitoring in position messages.

Default value: 1 – Enable

13.2.2 *Keyboard Msg Type 9 Data Source*

Address: 1709, bit 1

Description: This bit defines OTA delivery method of messages type 9, triggered by keyboard activity.

- Zero – will cause the unit to deliver this message as a logged event using the same rules (same numerator sequence, requires acknowledge)
- One – will cause the unit to deliver it as a real time event. In this case the ACK is unnecessary; the message will be delivered by first available communication transport.

Default value: 1 – Real time event

13.2.3 *Wrong Keyboard ID Detection*

Address: 1709

bit 2 Alarm Cadence

bit 3 Distress

bit 4 Event

Description: If a corresponding bit is enabled, and Pairing Procedure was accomplished, the unit will activate an Alarm Cadence (see below in this document), generate and event or distress upon detection of wrong (not paired) keyboard.

Event/ Distress

The event/distress message type 0 with TR 91, STR 10.

The unit will repeat event/distress every ignition on until the correct keyboard will be detected or pairing procedure will be repeated.

Alarm Cadence

The unit will repeat the Alarm Cadence every ignition on until the correct keyboard will be detected or pairing procedure will be repeated.

Default value: All zeros (Disable)

13.2.4 *Keyboard Disconnection Detection*

Address: 1709

bit 5 Alarm Cadence

bit 6 Distress

bit 7 Event

Description: If this bit is enabled, and Pairing Procedure was accomplished, the unit will activate an Alarm Cadence (see below in this document), generate and event or distress 16 seconds after last Keyboard ID detection.

Event/ Distress

The event/distress message type 0 with TR 201, STR 0.

The Com. Status bit in byte 33 will contain 1 (Communication Loss).

The unit will repeat event/distress every ignition on until the correct keyboard will be detected or Pairing procedure will be repeated.

Alarm Cadence

The unit will repeat the Alarm Cadence every ignition on until the correct keyboard will be detected or pairing procedure will be repeated.

Default value: All zeros (Disable)

13.2.5 *Enable Forwarding Data from Keyboard to Serial Port*

Address: 1710, bit 0

Description: If this bit is enabled, any message forwarded from the Keyboard is duplicated both to wire and to wireless channels.

Otherwise message forwarded from the Keyboard is only forwarded to to the wireless channel.

Default value: Zero (Disable)

13.2.6 *Enable Malfunction Report*

Address: 1710

bit 1 Distress

bit 2 Event

Description: If those bits are enabled upon reception of the corresponding message from the keyboard the unit will trigger OTA message type 0 (event or distress) with transmission reason 91 and STR described in the table below.

STR	Description
0	Keypad Undefined Failure
1	Immobilizer device wires disconnection
2	Keypad locked
3	Relay malfunction
4	Ignition wire disconnected
5	Starter signal detection

STR	Description
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 Keyb
14	Alarm Cadence Deactivated by Keyb
128*	ECALL Initiated
129*	BCALL Initiated

* This STR is sent as single real time event before call initiation irrespectively from the status of the bits.

Default value: **bit 1** Distress – 1 (Enable)

bit 2 Event 1 – (Enable)

13.2.7 *Activate Alarm Cadence upon Hotwiring Detection*

Address: 1710, bit 3

Description: If this bit is enabled the unit will auto-activate Alarm cadence upon reception of corresponding (Hot Wiring) malfunction report from 1-Wire channel.

Default value: 1 (Enable)

13.2.8 *Generate Msg. Type 0 Reply for Commands Addressed to Keyboard*

Address: 1710, bit 4

Description: If this bit is enabled in programming (address 1710, bit 4=1) the unit will generate an active ACK (Message type 0, Reply) to OTA Messages type 9, sub-type B. This ACK will contain command ID of the corresponding message type 9, sub-type B in its message numerator field.

Default value: 1 (Enable)

13.2.9 *Disable Pairing*

Address: 1710, bit 5

Description: 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 indicating Communication Loss with the Keyboard 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 indicating Keyboard communication loss only.

Default value: 1 (Enable)

13.3 Alarm Cadence

Alarm Cadence is an activation of selected outputs for session of sequential pulses, used for visual and audio alarm notification.

It is possible to activate an Alarm Cadence:

- By OTA command type 0, Command Code 0x06, data field 1 – '1' to activated, '0' to deactivate. Data Field 2 – don't care.
- The 1-Wire interface, using keyboard initiated Msg h88, code 2.
- Self activation, further to detection of wrong keyboard ID or keyboard disconnection (per configuration).

13.3.1 *Alarm Cadence outputs selection*

Address: 450

Bit 0 – Siren (pin 8, unavailable in CAN variants)

Bit 4 – Blinkers (pin 18)

Description: During Alarm Cadence the unit will activate selected outputs according to the template described below.

Default value: both 1 – Enable

13.3.2 *Alarm Cadence Template: Number of Cycles*

Address: 1712, bits 0-3

Description: This parameter defines number of activations of selected outputs during Alarm Cadence.

Default value: both 1 – Enable

13.3.3 *Alarm Cadence Template: On Time*

Address: 1713, bits 3-7

Description: This parameter defines length of activation of selected outputs during Alarm Cadence.

Resolution: 3 Seconds/bit

Default value: 1 (3 seconds)

13.3.4 *Alarm Cadence Template: Off Time*

Address: 1713, bits 0-2

Description: This parameter defines time between activations of selected outputs during Alarm Cadence.

Resolution: 3 Seconds/bit

Default value: 1 (3 seconds)

13.4 BCALL (Brake down) Destination Number

Addresses: 167-176

Description: Stores the default target address used by the unit upon BCALL (Brake down) call initiated from the Keyboard. Under normal circumstances, this will be the number of a service center.

Data format: First byte should contain the total amount of digits that make up the actual address (not including address type byte). Second byte is the address type byte, which should be 91h for international address (recommended type to use, to allow roaming) or 81h for local address. The rest of the bytes contain the actual address, encoded in BCD. The order of the transmission is bytes with lower address first, lower nibbles (nibble = 4 bit) first. If only the lower nibble of a byte is used (this is legal only in the last byte – in case this is the last digit of the address), the higher nibble should have all of its bits set (the nibble should contain 15 dec). The rest of the bytes that are not used should contain FFh.

Default value: Null

14 CFE

14.1 General

Communication and Functionality Extender is designed to split the COM port of Cello device and enables concurrent connection of multiple devices with COM interface (in the future Bluetooth or USB connectivity might be developed).

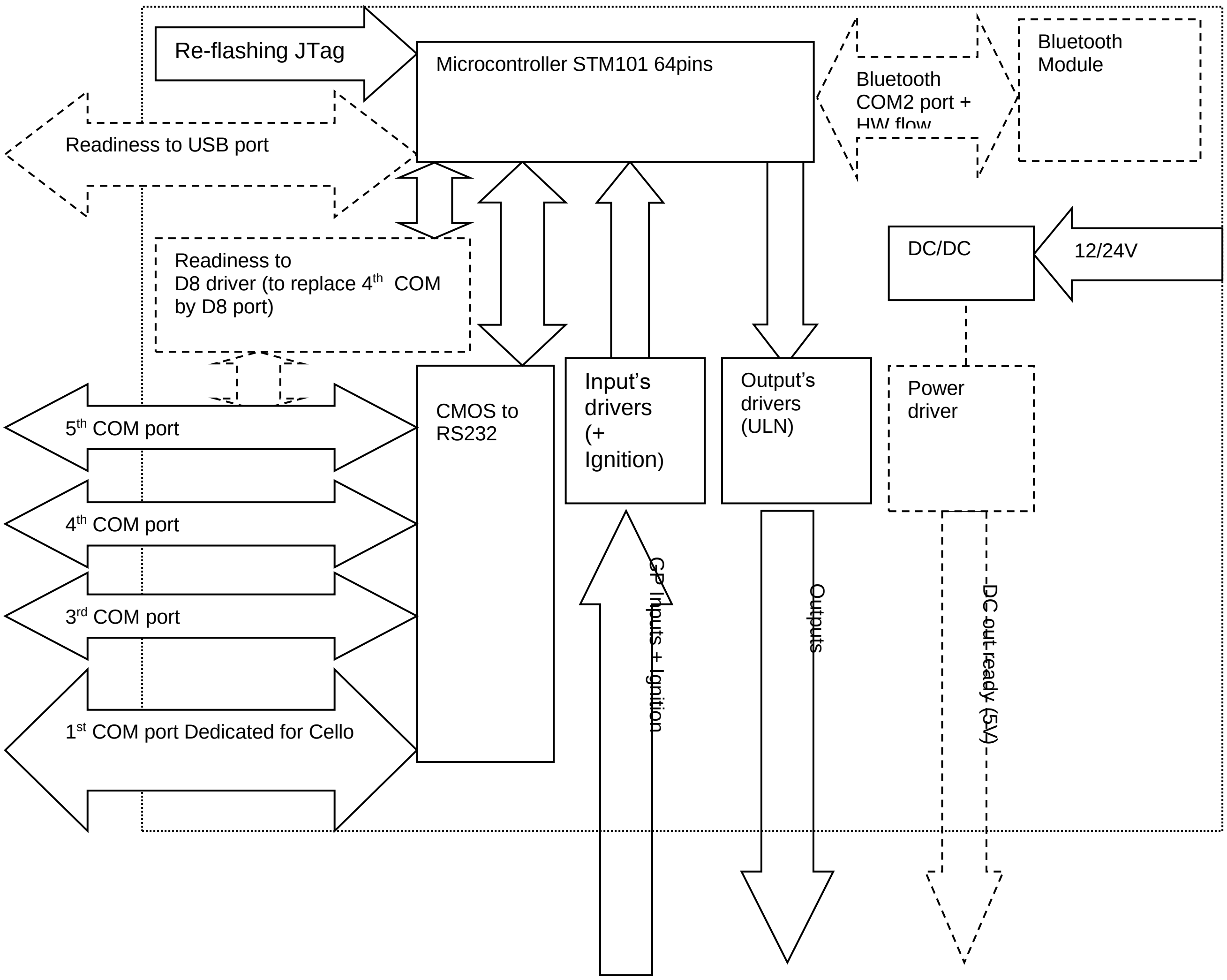
Communication and Functionality Extender is utilizing HW architecture based on Cello device and providing 26 interface pins in two connectors (6 pins and 20 pins).

The CFE used as serial multiplexer will associate between CFE serial interfaces and Cello protocols. The relations between the protocols and the serial interfaces will be defined by the PL.

In the downstream direction, each datagram coming from the OTA protocol will be processed by the Cello FW and routed to its destination CFE serial protocol.

In the upstream direction, serial messages originated by the CFE serial interfaces will be forwarded to the server (via OTA) based on the associated protocol assigned.

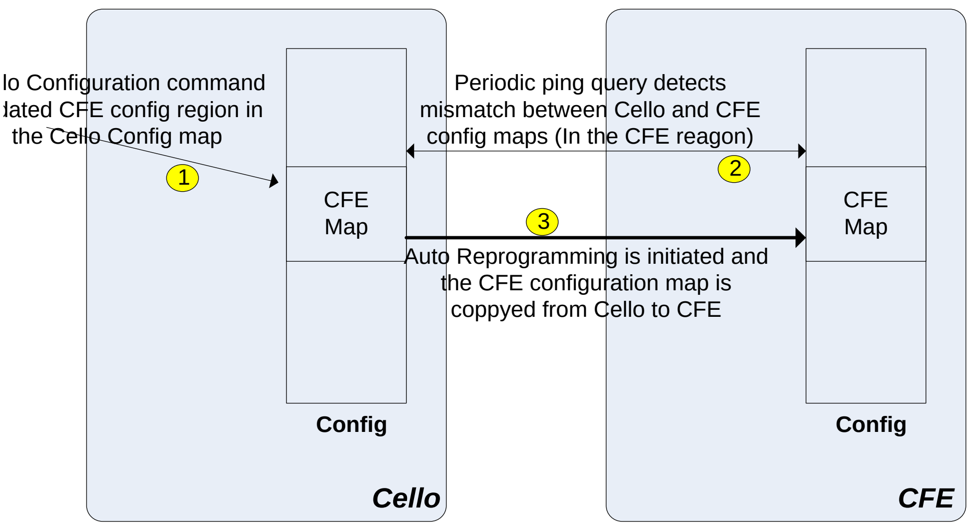
14.2 Block Diagram



14.3 Programmable CFE Parameters

The CFE programming parameters are part of the Cello configuration map. When CFE related parameters are reconfigured via OTA programming command or serial programming command an automatic process is triggered to submit the new configuration from the Cello towards the CFE configuration memory.

Please note that changing Cello's "Hibernation Mode Delay" will also initiate CFE's configuration map reprogramming as this parameter is used by CFE to coordinate full system hibernation.



14.3.1 *Enable CFE*

Address: 6, bit 6

Description: If this bit is enabled Communication and Functionality Extender and M2H protocol.

Data Range: 0 - Disable, 1 - Enable

Default value: 0 - Disable

14.3.2 *Enable CFE as IO Extender*

Address: 6, bit 0

Description: When this bit is set the CFE will start functioning as Cello IO extender.

Data Range: 0 - Disable, 1 - Enable

Default value: 1 - Enable

14.3.3 *Automatic CFE Power Mode Control*

Address: 6, bit 7

Description: If this bit is enabled the Cello unit will send a corresponding "Unit state change packet" to CFE upon any change in "Driving status", irrespectively if it is sourced from Ignition port or Accelerometer.

Data Range: 0 - Disable, 1 - Enable

Default value: 0 - Disable

14.3.4 *Enable CFE Connected & Disconnected Events*

Address: 1347, bit 2

Description: If this bit is enabled, CFE Connected/Disconnected events will be transmitted.

Data Range: 0 - Disable, 1 - Enable

Default value: 1 - Enable

14.3.5 *Enable CFE Connected & Disconnected Distress*

Address: 1347, bit 3

Description: If this bit is enabled, CFE Connected/Disconnected distress will be transmitted.

Data Range: 0 - Disable, 1 - Enable

Default value: 0 - Disable

14.3.6 *Enable Auto-Programming of CFE due to CRC32 Error*

Address: 1347, bit 5

Description: If this bit is enabled, the unit will initiate reprogramming of the CFE, if the CRC of the keep alive message (between the unit and the CFE) is incorrect.

Data Range: 0 - Disable, 1 - Enable

Default value: 1 - Enable

14.3.7 *Enable CFE Data Updates during Ignition Off*

Address: 1347, bit 6

Description: When this bit is enabled the CFE will send periodic analog measurements also during ignition off.

Data Range: 0 - Disable, 1 - Enable

Default value: 0 - Disable

14.3.8 *CFE COM 1 (Cello Port) Configuration*

Address: 1714, 1715

Reserved				Baud rate (for COM1 and COM2 (Bluetooth) hardcoded to 460800)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Reserved	Flow Control		Stop Bits		Parity		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.9 *CFE COM 3 (Cello Port) Configuration*

Address: 1716, 1717

Reserved				Baud rate (for COM1 and COM2 (Bluetooth) hardcoded to 460800)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Reserved	Flow Control		Stop Bits		Parity		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.10 *CFE COM 4 (Cello Port) Configuration*

Address: 1718, 1719

Reserved				Baud rate (for COM1 and COM2 (Bluetooth) hardcoded to 460800)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Reserved	Flow Control		Stop Bits		Parity		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.11 *CFE COM 5 (Cello Port) Configuration*

Address: 1720, 1721

Reserved				Baud rate (for COM1 and COM2 (Bluetooth) hardcoded to 460800)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Reserved	Flow Control		Stop Bits		Parity		
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.12 *CFE VOUT Control*

Address: 1726

Reserved							Enable Vout (5V)
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.13 *CFE Hibernation Setting Bitmask*

Address: 1727

Reserved						Keep UART1 on during Full hibernation	Enable Full Hibernation
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

The flag "Keep UART1 ON during hibernation" is only applicable while the physical ignition (Input 1 function = Ignition) is used as an ignition source. Otherwise UART1 is always on.

14.3.14 *CFE Bluetooth Page Mode (Infrastructure)*

Address: 1754

Description: Page mode controls whether iWRAP can be seen in the inquiry and whether it can be connected. This command can also be used to change the page timeout.

0 - Bluetooth Switch off

1 - Unsupported

2 - iWRAP is NOT visible in the inquiry but answers calls

3 - iWRAP is visible in the inquiry and answers calls

4 - Just like mode 3 if there are NO connections. If there are connections, it is like mode 0. (default value)

Ignition On	Average Hibernation
Bits 4-7	Bits 0-3

14.3.15 *CFE Page Scan Mode (Infrastructure)*

Address: 1757

Description: This parameter configures the Bluetooth page scan mode. The possible values are:

0 - Mode R0 means that iWRAP IS connectable all the time. High current consumption! Since iWRAP is all the time connectable, it will not be visible in the inquiry, no matter what the page mode configuration is.

1 - Mode R1 means that iWRAP is connectable every 1.28 sec (the default value)

2 - Mode R2 means that iWRAP is connectable every 2.56 sec (lowest power consumption)

Ignition On	Average Hibernation
Bits 4-7	Bits 0-3

14.3.16 *CFE Bluetooth Pin Code (Infrastructure)*

Address: 1758-1766

First byte contains the actual length (number of chars), 0-8, ASCII

Default value: 1234

14.3.17 *CFE COM2 (Infrastructure)*

Address: 1767-1768

Infrastructure

14.3.18 *CFE Bluetooth Configuration (Infrastructure)*

Address: 1769-1777

Infrastructure

14.3.19 *CFE Local Bluetooth Device's Friendly Name (Infrastructure)*

Address: 1778-1809

Description: The maximum length of a Bluetooth friendly name is 31 characters (31 bytes). The first byte contains the actual length of the parameter (in ASCII chars). Whenever length is zero – the 32 bits paired Cello's Unit ID will be used as Local Bluetooth device's friendly name.

14.3.20 *CFE Input Type / Assigned Function*

Address: 1810, bits 5-7: Input 1

1816, bits 5-7: Input 2

1822, bits 5-7: Input 3

1828, bits 5-7: Input 4

1834, bits 5-7: Input 5

1840, bits 5-7: Input 6

Description: This input is equipped by pair of internal resistors, which can be programmatically turned into pull up, pull down or canceled at all. Therefore the input can serve as digital or analog input of the types described below as well as a frequency counter

Input Type number	Description
0	Discrete Dry Contact (on board pull-up)
1	Discrete Normal (Wet Input)
2	Analog Backward Compatible (0-2.5V)
3	Analog New Range (0 – 30V)
4	Frequency meter
5	Pulse Counter (Enables Pulse Counting mechanism)
6	12 bits Analog Backward Compatible (0-2.5V)
7	12 bits Analog New Range (0 – 30V)

Default Value: zero - Discrete Dry Contact

14.3.21 *Function assigned to CFE input*

Address: 1810, bits 0-4: Input 1

1816, bits 0-4: Input 2

1822, bits 0-4: Input 3

1828, bits 0-4: Input 4

1834, bits 0-4: Input 5

1840, bits 0-4: Input 6

Description: This field enables assignation of certain functionality to a CFE input.

Function number	Description	Comment
0	Use as a GP input (default)	
1	Use as a GP frequency meter (refer to frequency metering section in this document)	Only compatible to Type 4 (Frequency meter)
2	Use as a Speed source (refer to frequency metering section in this document)	
3	CFE Ignition input	Only for CFE Input 1

Default Value: zero – GP input

14.3.22 *Scaling Factor for Frequency Report on CFE Input*

Address: 1812, Input 1

1818, Input 2

1824, Input 3

1830, Input 4

1836, Input 5

1842, Input 6

Name in Programmer: Scaling Factor Frequency

Description: Applicable only if CFE is selected as input type 4. The scaling factor is intended to be used for conversion of the measured frequency into common unit of speed (cm/sec) in case the measurement is utilized as a speed source or into any other common format, if the input is used as a GP pulse frequency counter.

NOTE: This value may be calculated and programmed by the unit automatically during the Auto-Calibration Process. (Refer to the Frequency Metering Section in this document)

Stored value of Scaling Factor (Sf * 1000)	
First Configuration Byte (MSB)	Second configuration byte (LSB)

In case of Speed Source (Input's type 4, Assigned function 2):

The value utilized as a speed [cm/sec] will be calculated as follows:

$$S = Fs * Sf[{}^{cm}/_{sec}]$$

S – Momentary value of speed [cm/sec]

Fs – Measured frequency

Sf – scaling factor

(The scaling factor is stored as follows: Sf=stored value/1000).

NOTE: In this case the scaling factor is given by the specific vehicle and actually translating number of pulses into a speed (in cm/sec).

Example:

When calibrating a vehicle at 40 Km/h (1111cm/sec), the index obtained is 54 (that is, 54 pulses per second). When the measured value is 108 pulses, it means that the vehicle is running at 80 Km/h (2222cm/sec).

In this case the scaling factor will be Sf=1111 /54=20.576

Maximum value of an scaling factor of speed is Sf=65.535

The stored value of Sf will be 65535

In case of GP pulse frequency counter (Input's type 4, Assigned function 1):

The scaled value of the measurement will be reported in every position update from the unit in one of the Analog Inputs monitoring bytes, as per the configuration described above in this document.

The scaling factor, similarly to the previous case, is stored as follows:

Sf=stored value/1000

NOTE: Unlike the previous case the scaling factor here is a variable, adapted by the user to report the measured frequency value with best possible resolution in one byte.

Example:

Assuming the GP Pulse Frequency input is used to measure the engine speed (in RPM);

When calibrating a vehicle at 2000 RPM, the measured value is 116 (that is, 116 pulses per second). When the system receives 232 pulses it means that the vehicle is running at 4000 RPM.

If maximum available engine speed is 8kRPM, let's set a resolution of 32RPM/Bit (8000/255) in order to be able to report the measured value in single byte.

In our example we measure 2000/116=17.24 RPM/bit. Using simple proportion lets calculate the scaling factor:

Sf=17.24/32=0.53875

(stored value will be 0539)

The value reported in OTA message type 0 will be therefore:

$$Es = Fs * Sf[32RPM/Bit]$$

Es – reported value of engine speed [32RPM/Bit]

Fs – Measured frequency

Sf– scaling factor

Default Value: 32

14.3.23 *Threshold for CFE Input (Discrete Wet/Dry)*

Address: 1814, Input 1

1820, Input 2

1826, Input 3

1832, Input 4

1838, Input 5

1844, Input 6

Description: Applicable only for discreet types (wet and dry)

This threshold defines the highest voltage on this input, which will still be considered as logical zero. Any voltage above the value programmed in this parameter (as well as open contact in case of dry) will be considered as logical "one".

NOTE: The type of input affects the voltage value; the same value will mean different voltage for wet and discrete types.

The unit is continually sampling voltage on this input and comparing the average measurement (refer to parameter below) with the threshold programmed in this parameter.

Value span for wet type: 0 (0V) to 255 (30V).

Default Value: 125 (14.7V)

Value span for discrete type: 57 (0.2V) to 160 (1.45V). Any measured value below 57 or above 160 causes the unit to convert this value to default (125).

Default Value: 125 (1V)

14.3.24 *Averaging Factor for CFE Input*

Address: 1811, Input 1

1817, Input 2

1823, Input 3

1829, Input 4

1835, Input 5

1841, Input 6

Description: The unit is continually sampling voltage on this input every 10 msec. The moving average of sample's number (preprogrammed in this parameter) is reported to the application and/or compared with the threshold (previous parameter) in order to decide concerning the logical level of the input.

NOTE: In Full Hibernation mode the unit is ignoring averaging factor and processing each measurement sample separately

Default Value: 10 samples

14.3.25 *CFE Inputs State Update Configuration*

Address: 1846

Update period (resolution of 0.5 seconds)						Enable unsolicited updates (upon change) 0- Deactivate 1 - activate	Enable periodic updates 0- Deactivate 1 - activate
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Description: This configuration byte controls the CFE I/O extender update message behavior. Inputs sampled by the CFE are updated towards the Cello using periodic or unsolicited messages. Usually we will use periodic updates if one of the inputs is configured as Analog.

CFE inputs update message format is described in section: 4.5 CFE: Periodic / Unsolicited Extended I/O Status upon change.

Default value: 0 (Disable) for bits 0, 1; 1 second for bits 2-7

14.3.26 *Cello: Analog Measurements Update Period*

Addresses: 520 – Home network

521 – Roaming network

NOTE: Modification does not require reset.

Resolution: 4 or 90 seconds as per resolution bit in a control byte.

Default value: both 1 minute (15)

Cello: Analog measurements update configuration bitmask.

Period multiplied by the resolution defined in Bit 2.	Resolution definer	Enable RT	Enable logged

					0 – 4 seconds 1 – 90 seconds	0 – disable 1 - enable	0 – disable 1 - enable
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

14.3.27 *CFE Serial MUX Protocol Selection*

Addresses:

1438 - Serial interface 3

1439 - Serial interface 4

1440 - Serial interface 5

Upon reset the Cello FW shall read the PL and assign a protocol for each CFE interface. The supported protocols are listed in the below table.

NOTE: The Serial programmer can be connected to any CFE serial interface provided the programmer's serial physical layer format is compatible with the connected CFE serial interface configuration. The only exception is when the CFE interface is in transparent mode.

The supported protocols options are:

Code	Protocol
0	Serial Interface
1	
2	PSP
3	DTCO
4	DFD
5	Transparent
6	RFID
7	Wire Protocol

For more detailed descriptions of the protocols, see the relevant section in this document or in the OTA protocol document.

15 Crash Detection Feature

15.1 General

The unit's accelerometer is used as a source for crash detection and reporting.

The feature includes 2 separate RMS based thresholds, one for light crash and one for heavy crash.

The detection will not be possible when in full-hibernation mode (ignition is OFF).

The light crash detection requires the unit to be installed horizontally for gravity to be eliminated.

Cellocator FW samples and calculates the average of Accelerometer Data at 100 Hz rate.

Only 3 consequential samples which violate the crash threshold are considered a crash.

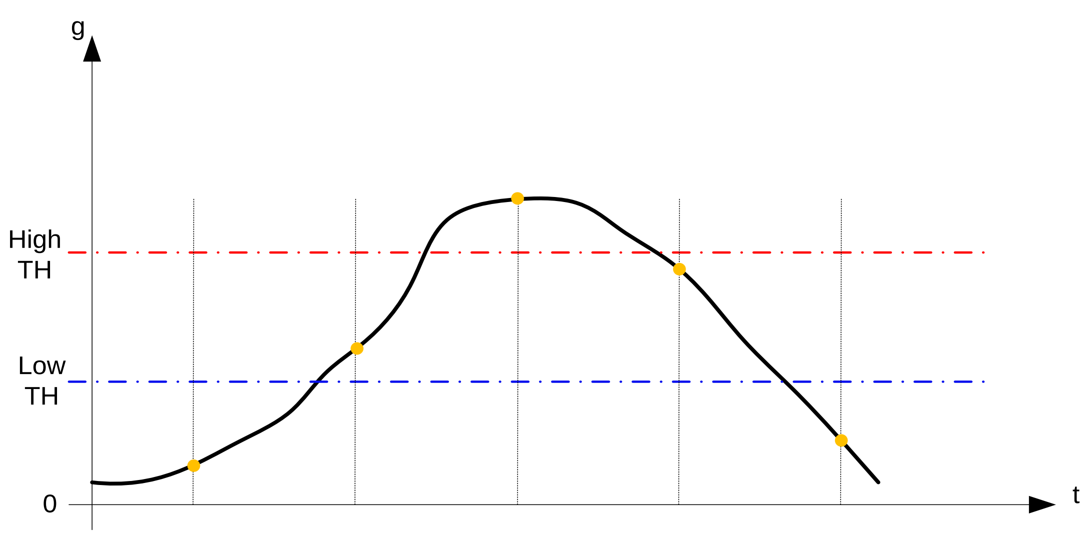
The following confusing case may certainly occur:

Unit reports on "Light" crash and shows the value of "g" which is greater than the "Heavy" crash threshold.

The reason for such behavior:

1. Reporting on crash, Unit picks up only the highest value of "g" for its reports.
2. It is still deemed "Light" crash, not "Heavy", because only one sample violates the "High Threshold".

Also, the timeout value to be expired making it possible to generate the next crash event, is 2 seconds.



Some improvement from FW release 33x and later:

1. This feature will work also in ignition-off state as long as the Hibernation is not full.
2. This feature will work also while the accelerometer is the Ignition source.

15.2 Crash Detection Configurable Parameters

15.2.1 *Light Crash Detection Threshold*

Address: 2384 bits 0÷6 - Light crash detection threshold

Description: This parameter contains the value of acceleration RMS (gravity eliminated), used to detect a light crash (any acceleration higher than this threshold and lower than the threshold of heavy crash for longer than 3 sequential samples (30ms) will be considered a light crash).

Resolution: 0.072g

Valid range: 2g≤X≤9.2g, higher and lower programmed values are automatically saturated.

Default value: 2g

15.2.2 *Heavy Crash Detection Threshold*

Address: 2385 bits 0÷6 - Heavy crash detection threshold

Description: This parameter contains the value of acceleration RMS (gravity included), used to detect a heavy crash (any acceleration higher than this threshold for longer than 3 sequential samples (30ms) will be considered a heavy crash).

Resolution: 0.072g

Valid range: 2g≤X≤9.2g, higher and lower programmed values are automatically saturated.

Default value: 5g

15.2.3 *Enable Crash Detection Events for Light/Heavy Crash*

Address: 2390 bit 0 for Light Crash

2390 bit 1 for Heavy Crash

Description: If this bit is enabled, the unit will issue an event containing reason and sub-reason when thresholds are crossed. If the light crash is enabled, the unit's logic assumes it is installed parallel to ground (horizontally) and ignoring Z axis.

Default value: 0 – Disable

15.2.4 *Enable Distress for Light/Heavy Crash*

Address: 2390 bit 2 for Light Crash

2390 bit 3 for Heavy Crash

Description: If this bit is enabled, the unit will issue a distress event containing reason and sub-reason. If the light crash is enabled, the unit is assuming that it is installed in parallel to ground (horizontally) and ignoring Z axis.

Default value: 0 – Disable

15.2.5 *Enable Light/Heavy Crash Detection in Ignition Off*

Address: 2390 bit 4 for Light Crash

2390 bit 5 for Heavy Crash

Description: This parameter enables light/heavy crash detection when in Ignition Off and configured to average hibernation (crash detection in full hibernation is not available due to system limitation).

Default value: 0 – Disable

16 CAN Bus Support

The CAN configurable parameter is divided into two categories:

- Traditional configurable values designed to enable/disable or set values of functional parameters.
- Array of configurable memory designed to hold CAN triggers and events as generated by the CAN Editor.

16.1.1 *CAN Operation Bitmask*

Address: 4100

OBDII MIL Detection	J1939 Flash Lamp Detection	Reserved	Enable DTC	CAN operational mode select			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.1.2 *CAN Operational Mode Select*

Address: 4100, Bits 0-3

Description: These 4 bits control the Cello-CANiQ/Cello-4 CAN bus operational mode. The following table describes the modes and their corresponding codes:

Code	Mode	Description
0	Disable CAN	In this mode the unit will not perform any CAN activity
1	RX Only Mode	In this mode the unit will function as J1939 CAN bus listener. The user can program the unit to monitor selected J1939 information elements and use them to feed predefined system variables such as RPM, Speed, Fuel Level etc.
2	Full OBD RX & TX Mode	In this mode the unit will function as OBDII CAN master. The unit will interrogate user selected OBDII CAN information elements and use them to feed predefined system variables such as RPM, Speed, Fuel Level etc. In addition, the following TX capabilities will be supported: OTA CAN commands, CAN Query operator, DTC querying.
3	Special RX & TX Mode	In this mode the unit will function as CAN bus listener, but will also support partial TX capabilities. This mode will not support periodic standard and custom queries for predefined system variables, but will support OTA CAN

Code	Mode	Description
		commands, CAN Query operator, and DTC querying.

Default value: 0 - Disable CAN

16.1.3 *Enable DTC*

Address: 4100, Bit 4

Description: When this bit is set the unit will automatically mange the vehicle DTC (Diagnostic Trouble Codes), depending on the selected CAN Operational Mode (address 4100, bits 0-3). If the unit is configured to Full RX&TX (OBDII) Mode, it will periodically poll for the DTC events counter. When new DTC event is detected, a Type 11 module 1 (DTC Event) will be sent to the server. If the unit is configured to RX Only (J1939) Mode, it will listen the DTC events counter. When new DTC or lamp event is detected, a Type 11 module 38 (J1939 DTC Appeared/Disappeared) will be sent to the server. In addition, the server is able to query for the current J1939 DTC status. In that case, the unit will send Type 11 module 37 (Current J1939 DTC Status) to the server.

Data Range: 1 - Enable, 0 - Disable

Default value: 0 – Disable

16.1.4 *J1939 Flash Lamp Detection*

Address: 4100, Bit 6

Description: This parameter enables to process flash lamps status changes in DTC over J1939. When enabled, whenever a change in one (or more) flash lamps status will be discovered, a corresponding OTA message (Type 11 module 38) will be sent.

Data Range: 1 - Enable, 0 - Disable

Default Value: 0 – Disable

16.1.5 *OBDII MIL Detection*

Address: 4100, Bit 7

Description: This parameter enables to interrogate the MIL status over OBDII. When enabled (and the unit is configured to Full RX&TX (OBDII) Mode), whenever a change in the MIL status will be discovered, a corresponding OTA message (Type 11 module 3) will be sent.

Data Range: 1 - Enable, 0 - Disable

Default Value: 0 - Disable

16.2 CAN Physical Layer Bitmask

Address: 4101

		OBD2 CAN Bus Format		CAN Bus Rate			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.2.1 *CAN Bus Rate*

Address: 4101, Bits 0-3

Description: These 4 bits control the CAN bus data rate.

Code	CAN Bus rate
0	125 Kbps
1	250 Kbps
2	500 Kbps
3	1 M Kbps
4	50 Kbps
5	62.5 Kbps
6	83.333 Kbps
7	100 Kbps
8	33.333 Kbps
9-14	Reserved
15	Auto baud rate

Default value: 1 – 250 Kbps

16.2.2 *OBD2 CAN Bus Format*

Address: 4101, Bits 4-5

Description: These 2 bits control the OBD2 CAN bus data format.

Code	OBD2 CAN Bus Format
0	11 bits
1	29 bits

Default value: 1 – 29 bits

16.3 AutoCAN feature

16.3.1 *Overview*

The Cello-CANiQ and Cello-4 devices have the ability to connect to a vehicle's CANBUS and read the vehicle's ECU parameters. As there is no standard for vehicle ECU parameter IDs (except for a very limited number of parameters), technicians typically needed to reverse engineer each vehicle's manufacturer, type, manufacturing year and engine type in order to read and understand these parameters.

Cellocator's FAE team created huge libraries of more than 2,600 vehicle types. However, for each installed unit one needs to select the correct XML file. This process takes time and requires the onsite installer to define exactly the vehicle type and request from the NOC (Network Operations Center) Manager to search for this file and download it to the unit.

With the new AutoCAN feature, this process is done automatically and the installer no longer needs to define the vehicle model/type and the NOC Manager no longer needs to manage and administer the correct XML files. The AutoCAN feature also automatically detects the interface of the CANBUS baud rate with no installer or backend intervention.

This feature is relevant for installations on private/commercial vehicles. For trucks, no automatic procedure is required since the Cello units already contains a list of 35 parameters (FMS, plus other important parameters; see the table on the next page).

The entire AutoCAN procedure should take 2-3 minutes (depending on cellular network performance).

NOTE: The AutoCAN procedure can return one of the following XML files:

- Full XML file: when there is a sampled record for the specific vehicle.
- Partial XML file: when there was not a sampled record for the specific vehicle but some ECU parameters could be read from other existing records in the database.
- No XML file found: when both of the above two options could not be fulfilled.

In addition, note that each XML file in the database has a unique record file number which is also sent to the Cello-CANiQ / Cello-4 unit and to the NOC. This file number can be used for other Cello installations of the same vehicle type without the need to re-activate the AutoCAN procedure.

The 35 parameters related to trucks (part of them are standard FMS) are listed in the table below:

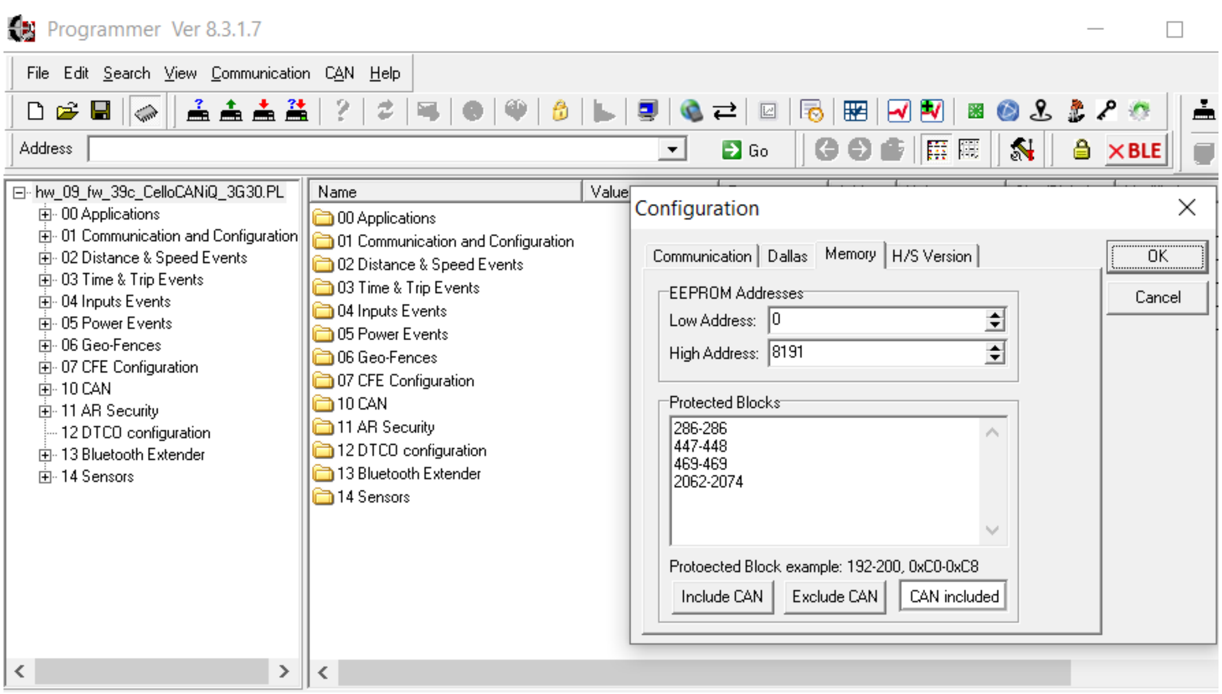
1	ABS/EBS Amber Warning Signal
2	Accelerator Pedal Position
3	Actual Engine - Percent Torque
4	Battery Potential
5	Brake Lining Remaining, Front Axle, Left Wheel
6	Brake Pedal Switch
7	Catalyst Tank Level
8	Catalyst Tank Temperature
9	Clutch Pedal Switch
10	Cruise Control Enable Switch
11	Engine Coolant Level
12	Engine Coolant Temperature
13	Engine Fuel Rate
14	Engine Fuel Temperature
15	Engine Intake Manifold 1 Pressure
16	Engine Intake Manifold 1 Temperature
17	Engine Oil Pressure
18	Engine Oil Temperature
19	Engine Retarder Selection / Engine Brake
20	Engine speed (RPM)
21	Engine Total Fuel Used
22	Engine Total Hours of Operation
23	Engine Total Idle Fuel Used
24	Engine Total Idle Hours
25	Fuel Level
26	Hydraulic Retarder Oil Temperature
27	Parking Brake Switch
28	PTO Governor State
29	Service Brake Circuit 1 Air Pressure
30	Service Brake Circuit 2 Air Pressure
31	Total Vehicle Distance
32	Transmission Oil Temperature
33	Transmission Selected Gear
34	Vehicle Speed
35	Water in Fuel Indicator

16.3.2 *Prerequisites*

This section lists the prerequisites for working with the AutoCAN feature:

- Upgrade the Cello-CANiQ FW to version 38u or later, or Cello-4.
- Use Cellocator C+.
- Installation of the default STD XML file at the server site (one-off activity).
- You can continue using the CAN Editor Tool after the AutoCAN process downloads the XML file to the device.

Important note: After AutoCAN process is completed, to preserve the found configuration, the CAN related areas in the PL must be protected by using the PL programmer tool -> press Configuration icon () -> Memory tab -> Press "**Exclude CAN**" button -> OK -> Save. See below:



For any further information, please contact your Sales Manager.

16.4 CAN Application Control 1

Address: 4102

Description: This parameter contains a bitmap controlling the CAN bus application.

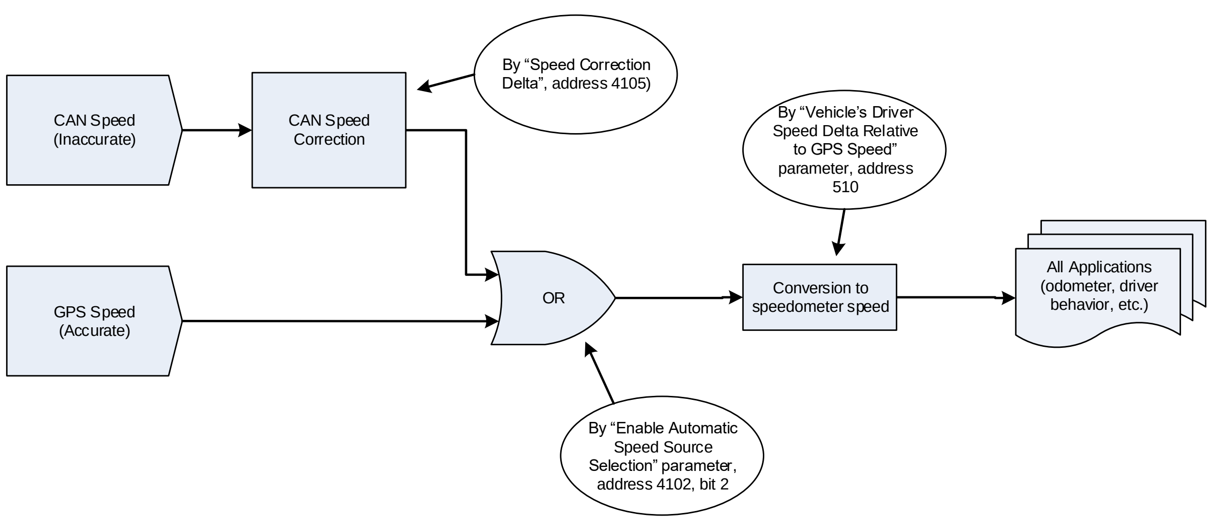
Speedometer Speed Source Selection	Reserved	Reserved	Enable CAN as VIN Source	Enable CAN#2 as VIN Source	Enable Automatic Speed Source Selection	Enable send empty variables	Enable RPM As Ignition Assistant
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.4.1 *Speed and Odometer Management*

Cellocator legacy systems enable selection of one of 4 optional sources for Odometer information:

1. GPS provides speed value every second and it is used for Odometer calculation
2. Frequency counter input (Door or Shock) provides Speed value every second, and this value is used for Odometer calculation
3. CAN bus supplies real odometer (rear cases)
4. CAN bus provides Speed value periodically, as frequently as polled, and this value is used for Odometer calculation

By default, the system will utilize automatic selection between CAN and legacy speed sources (GPS/Frequency counter), configured in Enable Automatic Speed Source Selection parameter. The problem is that the speed, reported by the CAN bus is inaccurate. It reflects the speed shown to the driver on Speedometer (vehicle vendors manipulate it). Still, most of unit's applications (odometer, over speeding, idling and driver behavior) had to use this manipulated speed in order to synchronize between driver experience and unit's reporting. For this reason legacy systems used CAN Speed Correction Delta and Vehicle's Driver Speed Delta Relative to GPS Speed parameters, which multiplies an existing system speed by pre-programmed signed value:



Obviously, this solution is harming odometer estimation.

Our recent discovery shows that the inaccuracy of CAN speed (same as Speedometer reading) is non-linear and should be calibrated with GPS speed.

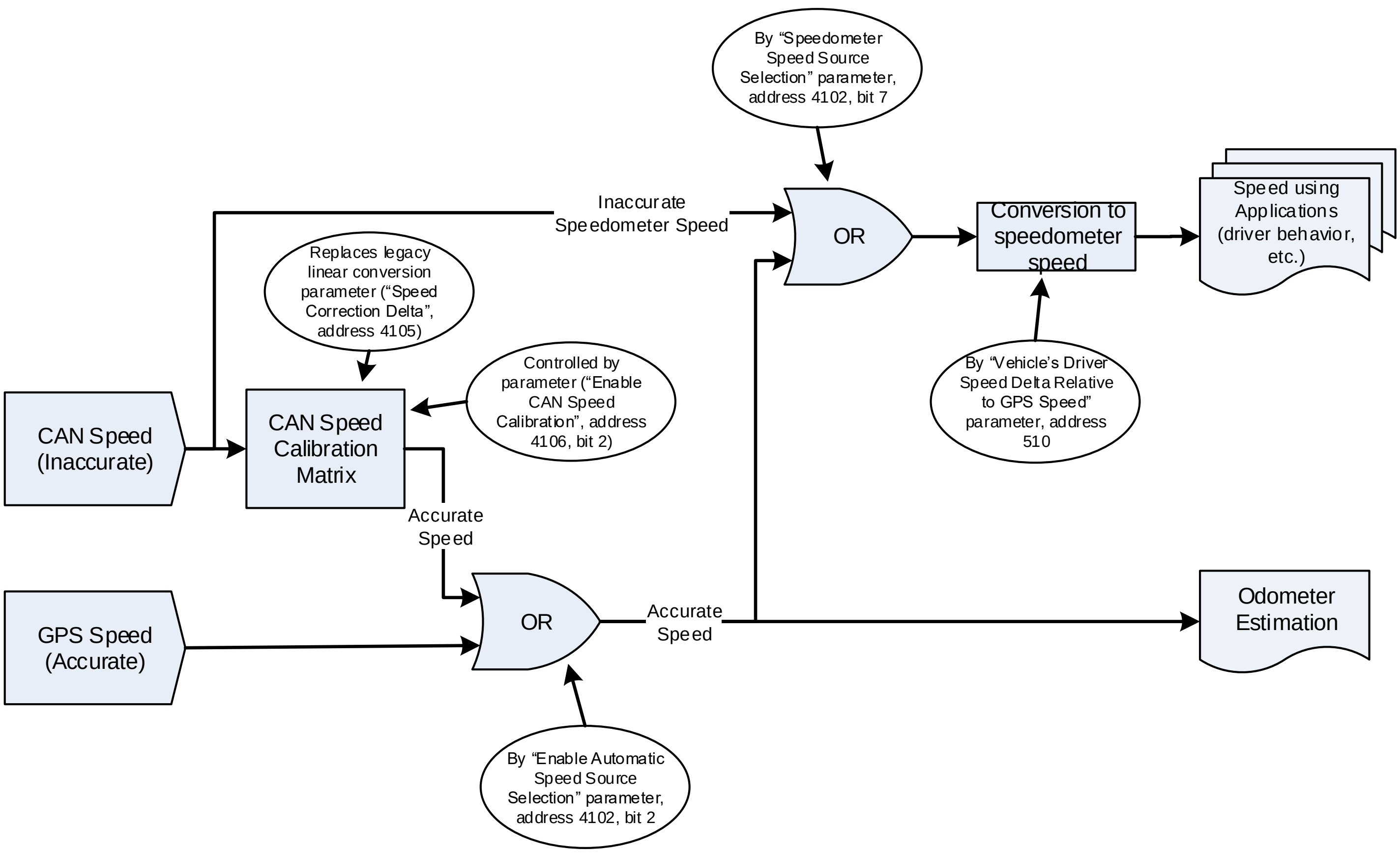
This way, instead of single conversion parameter, the unit utilizes an array of conversion coefficients (a coefficient for each speed range) and it should differentiate between a speed used for odometer calculation and other applications.

This mechanism will be switched on/off by a new Enable CAN-GPS Speed Calibration parameter.

In addition, a new Speedometer Speed Source Selection parameter will allow to select the source of manipulated speed: from the output of legacy Enable Automatic Speed Source Selection parameter, or directly from CAN bus.

This parameter will be applicable for Cello-CANIQ and Cello-4 variants only. Cello-IQ variants will use the output of Speed Source Selection parameter.

The legacy Vehicle's Driver Speed Delta Relative to GPS Speed parameter will allow another degree of manipulation after this selection.



16.4.1.1 Enable Automatic Speed Source Selection

Address: 4102, Bit 2

Description: This parameters enables to automatically select the speed source for the unit (CAN or legacy GPS). When this parameter is set to Disable, the unit will use CAN as speed source if a parameter with Speed assigned function has been configured in the CAN editor, or GPS as speed source if such parameter has not been configured in the CAN editor. When this parameter is set to Enable, the unit will switch between CAN (if a parameter with Speed assigned function has been configured in the CAN editor) and GPS as speed sources, according to source availability.

Data range: 0 - Disable, 1 - Enable

Default value: 1 – Enable

16.4.1.2 Enable send empty variables

Address: 4102, bit 1

Description: When this parameter is set to '1', the unit will send also the empty variables (with value of 0) via Module-2, else they will be filtered out and not sent.

0 - Disable

1 - Enable

Default value: 0 - Disable

16.4.1.3 Speedometer Speed Source Selection

Address: 4102, Bit 7

Description: This parameter allows to select the source of manipulated speed: from the output of legacy "Speed Source Selection" parameter, or directly from CAN bus.

Data range: 0 - Output of legacy Speed Source Selection parameter, 1 - Directly from CAN bus

Default value: 1 - Directly from CAN bus

16.4.1.4 Speed Correction Delta[4]

Address: 4105

Description: This parameter represents the difference between GPS speed and the Vehicle's speed as read from the CAN interface. Usually the vehicle's speed measured by the CAN interface is around 5% lower than the speed measured by the GPS. This parameter enables the user to adjust the vehicle's CAN based speed to the GPS by multiplying the CAN VSS by this signed fraction value. The correction delta represents a signed value between -127 to 128 with resolution of 0.1%.

Speed = CAN_VSS * (1+ SpeedCorrectionDelta)

[4] Canceled from FW version 33x and later (Replaced by non-linear CAN-GPS calibration matrix)

Default value: + 50 (+5 %)

16.4.2 *Fuel Functions Management*

Cellocator units can be configured to receive CAN data for concluding the vehicle fuel level and trip fuel consumption.

Fuel Level

The unit is able to calculate the fuel level relying on the Fuel Level parameter. This parameter indicates the fuel level in the vehicle tank [% units], and by multiplying it with the fuel tank capacity (configurable by "Fuel Tank Capacity" parameter (address 4103-4104)), the unit concludes the fuel level in litter units.

16.4.2.1 Fuel Tank Capacity

Address: 4103 - 4104

Description: This configurable parameter holds the vehicle's fuel tank capacity. The parameter uses 100 ml resolution for max possible tank volume of 6553.6 Litters. This value is used by the unit for converting between relative fuel tank levels, as sent over the CAN bus, and the real amount of fuel in the vehicle's tank.

Default value: 400 (40 Litters)

Since the fuel level measurement is very noisy (depends on vehicle movement and fuel slashing in the tank), FW version 35g and later support filtration of this parameter. For this, IIR (Infinite Impulse Response) filter with configurable factor was implemented.

16.4.2.2 Fuel Level IIR Filter Factor

Address: 5238-5239

Description: This parameter defines the factor of the IIR filter used for fuel level filtering. The factor have an influence on the "reaction" time (time increases as the factor increase). 0 - cancels the Fuel Level filtering. Unit will limit it to maximum of 10000.

Resolution: 1

Data Range: 0-65535 (Valid range is 1-10000).

Default Value: 0

Trip Fuel Consumption

Legacy FW versions were able to calculate trip fuel consumption relying on 2 parameters:

- Total Fuel Consumed
- Fuel Rate

Since these parameters are not available for every vehicle, FW version 35g and later support added fuel consumption functions, relying on other CAN parameters (Fuel Level, MAF, RPM+FIQ, RPM+IMAP+IAT, MAF+O2).

For this purpose, a number of assigned functions were added to the CAN editor, and some legacy assigned functions were improved and renamed for clarity:

- Fuel Consumption **Direct** – this function is meant to be used with Total Fuel Consumed parameter, which indicates the total accumulated fuel consumed by the vehicle [l units]. The unit calculates the trip fuel consumption by subtracting the parameter value at trip start from its value at trip stop.
- Fuel Consumption Estimation **FL** – this function is meant to be used with Fuel Level parameter, which indicates the current fuel level [% units]. The unit calculates the trip fuel consumption by subtracting the parameter value at trip start from its value at trip stop, and multiplying this delta with the fuel tank capacity (configurable by "Fuel Tank Capacity" parameter (address 4103-4104)).
- Fuel Consumption Estimation **FR\MAF** – this function is meant to be used with Fuel Rate parameter, which indicates the current fuel rate [l/h units]. The unit calculates the trip fuel consumption by performing a summation (integral) over time on this parameter. In a similar manner, the MAF (Mass Air Flow) parameter [g/sec units] can be also used with this function, by converting it to fuel rate units. This is done by multiplying it with a MAF - FR conversion coefficient (0.331), which can be programmed in the CAN editor.
- Fuel Consumption Estimation **RPMFIQ RPM** and Fuel Consumption Estimation **RPMFIQ FIQ** – these 2 functions are meant to be used with the following parameters, respectively: 4106
    - RPM (Revolutions per Minute) which indicates the current engine rotary speed [RPM units]
    - FIQ (Fuel Injection Quantity) which indicates the current injected fuel amount [mg/strk units]

  The unit calculates the trip fuel consumption by multiplying these 2 parameters, and then converting this multiplication to fuel rate units. This is done by multiplying it with a RPM_FIQ - FR coefficient (0.00014124) and the RPM/FIQ inherent coefficients, which can be programmed in the CAN editor.
- Fuel Consumption Estimation **RPMIMAPIAT RPM**, Fuel Consumption Estimation **RPMIMAPIAT IMAP** and Fuel Consumption Estimation **RPMIMAPIAT IAT** – these 3 functions are meant to be used with the following parameters, respectively:
    - RPM (Revolutions per Minute) which indicates the current engine rotary speed [RPM units]
    - IMAP (Intake Manifold Air Pressure) which indicates the air pressure in the intake manifold [kPa units]
    - IAT (Intake Air Temperature) which indicates the air temperature in the intake manifold [C units]

  The unit calculates the trip fuel consumption by multiplying/dividing these 3 parameters according to following formula: MAF = RPM*IMAP/IAT, and then converting this calculated MAF to fuel rate units. This is done by multiplying it with a conversion MAF - FR conversion coefficient (0.331), and the RPM/IMAP/IAT inherent coefficients, which can be programmed in the CAN editor.

- Fuel Consumption Estimation **MAFO2 MAF** and Fuel Consumption Estimation **MAFO2 O2** – these 2 functions are meant to be used with the following parameters, respectively:
    - MAF (Mass Air Flow) which indicates the amount of air which flows into the engine per a defined time interval [g/sec units]
    - O2 Lambda Commanded Equivalence Ratio defines the momentary commanded Fuel/Air ratio in diesel engines (on top of the Minimal Fuel/Air ratio in diesel engines which is 1/14.5) [no units]

  The unit calculates the trip fuel consumption by dividing these 2 parameters according to following formula: MAF/O2, and then converting this multiplication to fuel rate units. This is done by multiplying it with a MAF_O2 - FR coefficient (0.298) and the MAF/O2 inherent coefficients, which can be programmed in the CAN editor.

The user is able to configure the desired parameter and assigned function. Only one fuel consumption function will be allowed to be programmed in a given time.

16.4.3 *Enable CAN as VIN Source*

Address: 4102, Bit 4

Description: This control bit selects CAN interface (OBD2 or J1939) as the vehicle's VIN (Vehicle's Identification Number) source. Setting this bit to "0" will select preprogrammed string as the vehicle's VIN. The preprogrammed VIN is controlled by Type 11 messages designed to program the VIN to a non-volatile memory. When this control bit is set to "1" VIN will be read from the CAN bus interface.

Code	MODE	Description
0	Disable	The VIN source is the unit's nonvolatile memory. The server side can program the unit's VIN using dedicated Type 11 messages as described in the unit wireless communication manual.
1	Enable	The VIN is coming from the OBD2 CAN interface.

Default value: 0 – Disable

16.4.4 *Enable CAN #2 as VIN Source*

Address: 4102, Bit 3

Description: This control bit selects CAN #2 interface (only if is in J1939 mode) as the vehicle's VIN (Vehicle's Identification Number) source. Setting this bit to "0" will select preprogrammed string as the vehicle's VIN. The preprogrammed VIN is controlled by Type 11 messages designed to program the VIN to a non-volatile memory. When this control bit is set to "1" VIN will be read from the CAN bus interface.

Code	MODE	Description
0	Disable	The VIN source is the unit's nonvolatile memory. The server side can program the unit's VIN using dedicated Type 11 messages as described in the unit wireless communication manual.
1	Enable	The VIN is coming from the CAN #2 interface.

Default value: 0 – Disable

16.5 CAN Application Control 2

Address: 4106

Description: This parameter contains a bitmap controlling the CAN bus application.

Spare					Enable CAN-GPS Speed Calibration	Enable Fleet End Of Trip Emergency Report	Enable Fleet End Of Trip Logged Report
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.5.1 *Enable Fleet End-Of-Trip Logged Event*

Address: 4106, Bit 0

Description: This bit enables Fleet Logged End-Of-Trip report. The event is a Type 9 message with new sub type code 0x16 carrying trip related information such as the Odometer and the fuel consumed during the trip.

Default value: 1 – Enable

16.5.2 *Enable Fleet End-Of-Trip Distress Event*

Address: 4106, Bit 1

Description: This bit enables Fleet Distress (RAM) End-Of-Trip report. The event is a Type 9 message with new sub type code 0x16 carrying trip related information such as the Odometer and the fuel consumed during the trip.

Default value: 0 – Disable

16.5.3 *Enable CAN-GPS Speed Calibration*

Address: 4106, Bit 2

Description: This parameter enables the CAN-GPS speed calibration mechanism.

Default value: 1 – Enable

16.6 CAN Application Control 3

Address: 4107

Description: This parameter contains a bitmap controlling the CAN bus application.

Spare	Spare	Enable CAN#2 Bus Event	Monitor CAN#2 bus while ignition off	Stop CAN&K-Line query upon geo-fence	Enable CAN Bus Events	Monitor CAN bus while ignition off	Spare
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.6.1 *Enable CAN Bus Events*

Address: 4107, Bit 2

Description: This parameter enables CAN Bus Event for disconnect/reconnect of CAN bus interface (Type 11, Module 28, Event Category 0, Event Code 2)

Data range: 0 - Disable, 1 - Enable

Default value: 1 – Enable

16.6.2 *Stop CAN&K-Line query upon geo-fence*

Address: 4107, bit 3

Description: When entering any of the "Keep out" kind geo-fence areas defined in the system, only the query of both CAN and K-Line buses will stop working. The receive parameters will continue working as usual.

Data range: 0 - Disable, 1 - Enable

Default value: 0 – Disable

16.6.3 *Monitor CAN bus while ignition off*

Address: 4107, bit 1

Description: When this bit is enabled, the unit will sample the CAN bus for activity also when vehicle in ignition off mode. This is intended to support electrical vehicles in recharging, and only works in average-hibernation and no-hibernation power modes, and the parameter of "Enable Unit Wake Up from Hibernation upon Connecting Electrical Vehicle to Charging Source" is disabled.

0 - Disable

1 - Enable

Default value: 0 - Disable

16.6.4 *Monitor CAN#2 bus while ignition off*

Address: 4107, bit 4

Description: When this bit is enabled, the unit will sample the CAN#2 bus for activity also when vehicle in ignition off mode. This is intended to support electrical vehicles in recharging, and only works in average-hibernation and no-hibernation power modes, and the parameter of "Enable Unit Wake Up from Hibernation upon Connecting Electrical Vehicle to Charging Source" is disabled.

0 - Disable

1 - Enable

Default value: 0 - Disable

16.6.5 *Enable CAN#2 Bus Event*

Address: 4107, Bit 5

Description: This parameter enables CAN #2 Bus Event for disconnect/reconnect of CAN bus interface (Type 11, Module 28, Event Category 0, Event Code 34).

Data range: 0 - Disable, 1 - Enable

16.7 CAN Application Control 4

Address: 4125

Description: This parameter contains a bitmap controlling the CAN application.

Spare	Spare	Spare	Spare	Spare	Spare	Spare	Disable OBD protocol on CAN bus #1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.7.1 *Disable OBD protocol on CAN bus #1*

Address: 4125, bit 0

Description: This parameter disables OBD protocol on CAN bus #1.

0 - Enable OBD

1 - Disable OBD

Default value: 1 - Disable OBD

16.8 CAN Application Control 5

Address: 6498

Description: This parameter contains a bitmap controlling the CAN #2 bus application.

Spare	J1939 #2 Flash Lamp Detection	Spare	DTC Enable for CAN #2 (DTC process control)	CAN #2 Operational Modes			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.8.1 *CAN #2 Operational Modes*

Address: 6498, Bits 0-3

Description: These 4 bits control the Cello-CANiQ's CAN bus #2 operational mode. The following table describes the modes and their corresponding codes:

Code	Mode	Description
0	Disable CAN	In this mode the unit will not perform any CAN activity
1	RX Only Mode	In this mode the unit will function as J1939 CAN bus listener. The user can program the unit to monitor selected J1939 information elements and use them to feed predefined system variables such as RPM, Speed, Fuel Level etc. No ACKs (or anything) will be transmitted from the unit to the bus.
2	Full RX & TX Mode	In this mode the unit will function as CAN master. The unit will interrogate user selected CAN information elements and use them to feed predefined system variables such as RPM, Speed, Fuel Level etc. In addition, the following TX capabilities will be supported: OTA CAN commands, CAN Query operator.
3	Special RX & TX Mode	In this mode the unit will function as CAN bus listener, but will also support partial TX capabilities. This mode will not support periodic standard and custom queries for predefined system variables,

Code	Mode	Description
		but will support OTA CAN commands, CAN Query operator, and DTC querying.

Default: 0 - Disable CAN

16.8.2 *DTC Enable for CAN #2 (DTC process control)*

Address: 6498, Bit 4

Description: When this bit is set the unit will automatically mange the vehicle DTC (Diagnostic Trouble Codes), depending on the selected CAN Operational Mode (address 6498, bits 0-3). If the unit is configured to RX Only or Special (J1939) Mode, it will listen the DTC events counter. When new DTC or lamp event is detected, a Type 11 module 38 (J1939 DTC Appeared/Disappeared) will be sent to the server. In addition, the server is able to query for the current J1939 DTC status. In that case, the unit will send Type 11 module 37 (Current J1939 DTC Status) to the server.

0 – Disable

1 - Enable

Default: 0 – Disable

16.8.3 *J1939 #2 Flash Lamp Detection*

Address: 6498, Bit 6

Description: This parameter enables to process flash lamps status changes in DTC over J1939. When enabled, whenever a change in one (or more) flash lamps status will be discovered, a corresponding OTA message (Type 11 module 38) will be sent.

0 – Disable

1 - Enable

Default Value: 0 – Disable

16.9 CAN Application Control 6

Address: 6499

Description: This parameter contains a bitmap controlling the CAN #2 bus application.

Spare	Spare	CAN bus #2 Format		CAN bus #2 rate			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

16.9.1 *CAN bus #2 rate*

Address: 6499, Bits 0-3

Description: These 4 bits control the Cello-CANiQ's CAN bus #2 data rate.

Code	CAN Bus rate
0	125 Kbps
1	250 Kbps
2	500 Kbps
3	1 M Kbps
4	50 Kbps
5	62.5 Kbps
6	83.333 Kbps
7	100 Kbps
8	33.333 Kbps
9-14	Reserved
15	Auto baud rate

Default: 1 – 250 Kbps

16.9.2 *CAN bus #2 Format*

Address: 6499, Bits 4-5

Description: These 2 bits control the Cello-CANiQ's OBD2 CAN bus #2 data format.

0 – 11 bits

1 – 29 bits

Default: 1 – 29 bits

16.10 CAN Standard Parameters Querying

CAN/K-Line buses designed by the vast majority of vehicle manufacturers support a reduced set of common parameters, also known as standard parameters:

SID (Hex)	PID (Hex)	Data Bytes	Parameter Name	Min Value	Max Value	Units	Conversion Formula
01	01	4 (bits 0-6 of the 1st byte	Number of Pending DTCs	0	127	Counts	X*1

		holds the parameter)					
01	01	4 (bit 7 (MSB) of the 1st byte holds the parameter)	MIL Status	0	1		X*1
01	04	1	Calculated Engine Load	0	100	%	X/2.55
01	05	1	Engine Coolant Temperature	(-40)	215	Degrees C	X-40
01	0C	2	Engine RPM	0	16384	RPM	X/4
01	0D	1	Vehicle Speed	0	255	km/h	X*1
01	0D	1	Real Ground Vehicle Speed	0	7083	cm/sec	X*1000/36
01	0F	1	Intake Air Temperature	(-40)	215	Degrees C	X-40
01	11	1	Throttle Position	0	100	%	X/2.55
01	21	2	MIL On Distance	0	65535	km	X*1
01	06	1	Short Term Fuel Trim - Bank 1	(-100)	100	%	X/1.28-100
01	07	1	Long Term Fuel Trim - Bank 1	(-100)	100	%	X/1.28-100
01	10	2	Mass Air Flow Rate	0	655.35	g/sec	X/100
01	1F	2	Engine On Time	0	65535	Seconds	X*1
01	2F	1	Fuel Level	0	100	%	X/2.55
01	30	1	Number of Warmups Since Codes Cleared	0	255	Counts	X*1
01	31	2	Distance Since Codes Cleared	0	65535	km	X*1
01	33	1	Barometric Pressure	0	255	kPa	X*1
01	3C	2	Catalyst Temperature Sensor 1 - Bank 1	(-40)	6553	Degrees C	X/10-40
01	41	4	Monitor status this drive cycle			Enum	X*1
01	42	2	Control Module Voltage	0	65.535	Volt	X/1000
01	43	2	Absolute Load Value	0	25700	%	X/2.55
01	44	2	Fuel-Air Commanded Equivalence Ratio	0	2		X/32768
01	45	1	Relative Throttle Position	0	100	%	X/2.55
01	46	1	Ambient Air Temperature	(-40)	215	Degrees C	X-40
01	47	1	Absolute Throttle Position B	0	100	%	X/2.55
01	48	1	Absolute Throttle Position C	0	100	%	X/2.55
01	49	1	Accelerator Pedal Position D	0	100	%	X/2.55
01	4A	1	Accelerator Pedal Position E	0	100	%	X/2.55
01	4B	1	Accelerator Pedal Position F	0	100	%	X/2.55
01	4D	2	Time Run with MIL On	0	65535	Minutes	X*1
01	51	1	Fuel Type			Enum	X*1
01	5E	2	Engine Fuel Rate	0	3276.75	L/h	X/20

In legacy CAN units logics, the unit automatically queried for all of the standard parameters, holding their characteristics hardcoded. However, usage experience has showed that some of the standard parameters may not be supported in some vehicle models.

In FW version 36v and later, the unit queries the vehicle bus for its real supported parameters, sends the information to the programmer/CAN editor tool, and the tool builds the standard parameters (and supporting filters and queries) according to the real data that the vehicle provides.

Note: "Real Ground Vehicle Speed" is a synthetic parameter that the tool builds for reasons of internal calculation simplicity (the unit calculates speed in cm/sec, not in km/h).

16.11 CAN Custom Queries Configuration

Address: 5300-5843

Description: This section enables the user to control up to 32 Non Standard CAN/K-Line/J1708 queries properties. The interface enables detailed defining of the OBD2 Non Standard query and it is associated with the parser or filter used for the query answer processing.

The user should note that this table is configured by the Programmer Software tool.

Byte Offset	CAN Field Name	CAN #1/2 Description	K-Line Description	J1708 Description
0	Control Byte 1	See below		
1	Polling time 100mSec: Value of "0" represents no periodic polling	Polling time		
2	Query Response time out 10mSec resolution	User defined Shall not exceed 300 mS		
3	Query ID	User defined (Little Endian 32 bits)	spare	MID (GUI:Hex value)
4	Query ID		Format byte [FMT] (GUI:Hex value)	PID (GUI:Hex value)
5	Query ID		Target Address (GUI: Hex value)	Query data 1 (GUI:Hex value)
6	Query ID		Source Address (GUI: Hex value)	Query data 2 (GUI:Hex value)
7	Query Data Byte 0	User defined		Query data 3

				(GUI:Hex value)
8	Query Data Byte 1			Query data 4 (GUI:Hex value)
9	Query Data Byte 2			Query data 5 (GUI:Hex value)
10	Query Data Byte 3			Query data 6 (GUI:Hex value)
11	Query Data Byte 4			Query data 7 (GUI:Hex value)
12	Query Data Byte 5			Query data 8 (GUI:Hex value)
13	Query Data Byte 6			Query data 9 (GUI:Hex value)
14	Query Data Byte 7			Query data 10 (GUI:Hex value)
15	Control byte 2	bits 0-2: Interface Type 0- First CAN 1- Second CAN 2- K-Line 3- J1708 (GUI: Per tab) Bits 3-7: Spare (=0)	bits 0-2: Interface Type 0- First CAN 1- Second CAN 2- K-Line 3- J1708 (GUI: Per tab) Bits 3-7: Spare (=0)	bits 0-2: Interface Type 0- First CAN 1- Second CAN 2- K-Line 3- J1708 (GUI: Per tab) Bits 3-7: Spare (=0)
16	Control byte 3	Spare	Spare	Spare

Query control byte 1 content:

Bit	Name	CAN #1/2	K-line	J1708
0	Query State	0 - Not Active 1- Active		
1	Encryption Status	0 – Not encrypted 1 - Encrypted		
2-3	Identifier Extension	1 - Global (default, taken from CanPhysicalLayerConfig) (Manufacturing mode only) 2 - Can 11bits (User defined only) 3 - Can 29 Bits (user Defined Only)	Spare (=0)	
4-7	DLC – Data Length Code	User Defined Only Defines the actual number of payload bytes 0-8 (by default set to 8)	**Transmit payload length** Not including K-Line header and the checksum at the end. (Relevant for ISO-9141 only)	**Transmission Packet size** Includes all J1708 packet size, from MID until checksum.

			(GUI: Add column in decimal value, limit it to 8)	

16.12 CAN Filters Configuration

Address: 4530-5233

Bytes	Description
0	Filter control word (see below)
1	
2	Filter ID
3	
4	
5	
6	Filter mask
7	
8	
9	
10	Spare

Filter control word:

Bits	Description
0	Active 0 – No 1 - Yes
1	Frame Format 0 – Auto 1 – 11 bit 2 – 29 bit
2	
3	Encrypted Status 0 – Not encrypted 1 - Encrypted
4	0 – CAN #1 1 – CAN #2

5-15	Spare

Note: When DTC mode is enabled, the filters quantity is reduced by 3 per CAN bus.

16.13 CAN Trigger Configuration

Address: 4530-6499

Description: This section configures CAN/K-Line triggers. This area is list based data structure describing the relations between variables, trigger operators and trigger action operators. The data structure shall be generated by the CAN editor which is part of the Cellocator Programmer.

16.14 K-Line Configuration

16.14.1 *K-Line Init Type*

Note: This parameter is available only via the CAN-editor GUI in the Cellocator programmer tool and not via the parameters tree of the PL.

Address: 4119, Bits 0-2

Description: This parameter selects which kind of initialization (if any) to perform to the K-Line bus.

This also determine what kind of bus Protocol/Standard the bus is using.

Code	Line Init Type	Note
0	Disable K-Line	This value disables the entire K-Line interface. If this is selected the K-Line is ignored completely (even if connected)
1	Reserved	
2	ISO 9141-2 / 14230-2 Slow Init	The selection between the 2 standards shall be automatic according to the answer.
3	ISO 14230-2 Fast Init	
4	Automatic Init Type Selection	

Default value: 4 - Automatic Init Type Selection

16.14.2 *Enable K-Line Bus Event*

Address: 4119, Bit 3

Description: This parameter enables K-Line Bus Event of receiving/not receiving answer for standard parameters query on the K-Line bus interface (Type 11, Module 28, Event Category 0, Event Code 3).

Data range: 0 - Disable, 1 - Enable

Default value: 0 – Disable

16.14.3 *Enable K-Line as MIL source*

Note: This parameter is available only via the CAN-editor GUI in the Cellocator programmer tool and not via the parameters tree of the PL.

Address: 4119, Bit 4

Description: This parameter enable/disable taking K-Line interface as the MIL source of the system.

Default value: 0 – Disable

16.14.4 *Enable K-Line as DTC source*

Note: This parameter is available only via the CAN-editor GUI in the Cellocator programmer tool and not via the parameters tree of the PL.

Address: 4119, Bit 5

Description: This parameter enable/disable taking K-Line interface as the DTC source of the system.

Default value: 0 - Disable

16.14.5 *Enable K-Line as VIN source*

Note: This parameter is available only via the CAN-editor GUI in the Cellocator programmer tool and not via the parameters tree of the PL.

Address: 4119, Bit 6

Description: This parameter enable/disable taking K-Line interface as the VIN source of the system.

Default value: 0 - Disable

17 J1708 Support (CANiQ-M only)

17.1 J1708 General idea

- J1708 developed together with J1587 to enable communication between the different ECU's in the vehicle.
- Those protocols are developed SAE, and firstly published in 1998.
- This protocol is in use in medium and heavy-duty vehicles.
- J1708 described the low level of protocol and J1587 described the upper layer.
- The physical layer is based on:
  - RS485 (balanced twisted pair, 18 AWG, 120 Ω)
  - Baud rate of 9600bps.
  - 8 bits of data with one stop bit.
  - The data format is in little-endian format.
- Our implementation supports Single Frame and an appropriate query
  - Maximum message size 21 bytes.
  - Basic fame includes MID, PID\SID, data and checksum.
    - MID: Message Identification. For example:
      - MID 00-07: engine.
      - MID 08,09: breaks, tractor.
    - PID: Parameter Identification.
    - SID: Subsystem Identification Numbers.
    - The data length is according to PID value.
    - Checksum: in two's complementary method. Mean that sum of all the frame bytes modulo 255 should be equal to zero.
  - Up to **80** variables can be extracted
  - Up to **32** queries can be fed into the unit

17.2 J1708 Bus operation

- The entire bus and related feature are enabled/disabled by a configuration bit.
- After HW reset, the default state of the bus appears as "connected".
- When the unit senses the J1708 bus state was changed to connected (receive legal packet structure) or disconnected (not receives legal packet structure for more than 1 minute, counted from physical Ignition-ON) the unit will generate an appropriate event.
- The connection status is also reported in Master Status packet (serial and Wireless) and OTA Type 11, Module 28/31 (J1708 Bus event).

- In case the bus is disabled, the unit will report the bus as disconnected.
- The maximum response packet size (from the vehicle side) should not exceed 21 bytes while the maximum payload 17 bytes. Packets larger than that will not be processed.
- Note: all above mentioned configuration bits are controlled by the CAN editor GUI under "Interface Settings" tab.
- DTC and VIN are not supported in this version (blocked in the code) but still shown in the GUI. It will also be documented in RN

17.3 Configuraiton of J1708

17.3.1 *J1708 bus enable*

Address: 4124, bit 0

Description: When this bit is enabled, the entire J1708 bus and feature is enabled.

0 - Disable

1 - Enable

Default value: 0 – Disable

17.3.2 *J1708 Connection/Disconnection event*

Address: 4124, bit 2

Description: When this bit is enabled, the unit will create an event on every change from connect to disconnect state of the J1708 bus.

The event will be of Type-11, Module-28, Event Category-4, Event Code 31

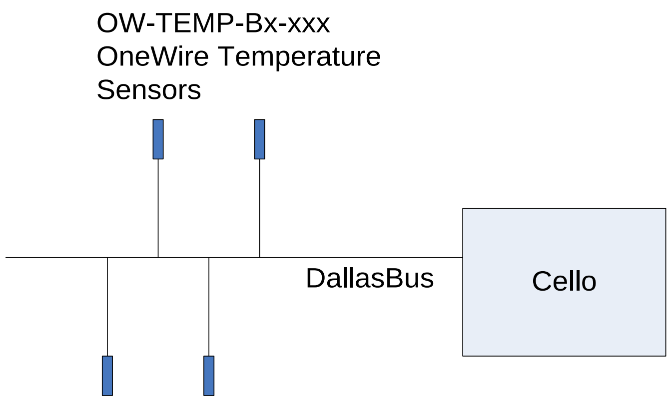
0 - Disable

1 - Enable

Default value: 0 - Disable

18 OneWire Temperature Sensors

The oneWire Temperature Sensors feature enables "new platform" HW units to be connected to up to 4 oneWire temperature sensors. The oneWire temperature sensors are based on Maxims's DS18B20 chip, see: http://datasheets.maximintegrated.com/en/ds/DS18B20.pdf. The user can connect up to 4 oneWire temperature sensors in parallel. The users need first to enable the oneWire Bus mode.



Type 0 message includes 4 bytes containing 4 possible measurement sources. The user can select the source of these 4 bytes by configuring the measurement source as described in Bytes 26-29 of OTA Message 0. It is possible to select each one of the 4 oneWire temperature sensors as source. If Type 0 measurements are required, the user needs to configure the "OneWire Update Period" to be none zero value and configure "Enable RT" or "Enable Logged" configuration bits. See: oneWire temperature measurement update configuration for more information. The user has also the ability to poll the unit for measured temperature results by issuing a type 9 request. The unit will process the request and send a consolidated Type 9 message response with all the 4 measurements. It is mandatory to set non-zero "Update Period" to enable the temperature sensors before issuing Type 9 request. The detailed Type 9 message format is described in: Cellocator Wireless Communication Protocol: "Section 2.6.21: oneWire Temperature Sensor Measurement – OutBound (Sub. Data 0x19)" and section 3.6.15: oneWire Temperature Sensor Measurement Request– InBound (Sub Data 0x19).

The feature supports different "Update Periods" for GSM Home and Roam network. When both "update Periods" values are set to 0, the feature is considered disabled.

In addtion, user can configure the unit to create type-0 events when the temperature is crossing high and/or low thresholds.

18.1 One Wire Temperature Measurement Update Configuration

Address: 2459: Home Network

2460: Roam Network

Description: This parameter contains a bitmap controlling the functioning of One Wire temperature sensors.

Configuration Byte Format:

<table>
<tr><td colspan="6">Update period (1 minute resolution)</td><td>Enable RT
0 – disable
1 – enable</td><td>Enable logged
0 – disable
1 – enable</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>

Configuration Byte Modes:

Update Period	Enable RT	Enable Logged	Description
0	0	0	The feature is disabled
0	0	1	
0	1	0	
0	1	1	
≠0	0	0	The temperature sensors are polled in the rate defined under: "Update Period". Measurements are not logged and not sent in real time (Type 9). The unit will answer Type 9 measurements requests.
≠0	0	1	The temperature sensors are polled in the rate defined under: "Update Period". Measurements are logged and not sent in real time (Type 9), according to legacy logged/RT events logics. The unit will answer Type 9 measurements requests.
≠0	1	0	The temperature sensors are polled in the rate defined under: "Update Period". Measurements are sent in real time (Type 9), according to legacy logged/RT events logics.

			The unit will answer Type 9 measurements requests.
≠0	1	1	The temperature sensors are polled in the rate defined under: "Update Period". Measurements are logged and sent in real time (Type 9), according to legacy logged/RT events logics. The unit will answer Type 9 measurements requests.

Note:

According to legacy logged/RT events logics:

- Logged event – transmitted during occurrence only if there is a GPRS connection
- RT event – transmitted during occurrence unconditionally (i.e. wakes the unit if it's in hibernation mode, and/or send the event by SMS if GPRS is not available)

Default value: 0 - Feature Disabled

18.2 1-Wire Temperature Sensor High Threshold

Address: 2462

Description: This parameter contains the temperature which above the unit generates a "High 1-Wire Temperature Sensor Measurement" event.

Data format: Signed integer

Data Range: (-127) ÷ (+127) degrees °C

Resolution: 1 degree °C

Default value: 85 (+85°C)

18.3 1-Wire Temperature Sensor Low Threshold

Address: 2463

Description: This parameter contains the temperature which below the unit generates a "Low 1-Wire Temperature Sensor Measurement" event.

Data format: Signed integer

Data Range: (-127) ÷ (+127) degrees °C

Resolution: 1 degree °C

Default value: -10 (-10°C)

18.4 1-Wire Temperature Sensor Filter

Address: 465, bits 5-7

Description: This parameter contains the number of consecutive samples required to trigger a "High/Low 1-Wire Temperature Sensor Measurement" event. 0 disables the feature.

Data format: 3 bit integer

Data Range: 0 – 7 samples

Resolution: 1 sample

Default value: 2

18.5 Enable 1-Wire Temperature Sensor Logged Events

Address: 465, bit 3

Description: This parameter enables 1-Wire temperature sensors logged events.

Data format: Flag

Data Range: 0 – Disable, 1 – Enable

Default value: 1 – Enable

18.6 Enable 1-Wire Temperature Sensor Distress Events

Address: 465, bit 4

Description: This parameter enables 1-Wire temperature sensors distress events.

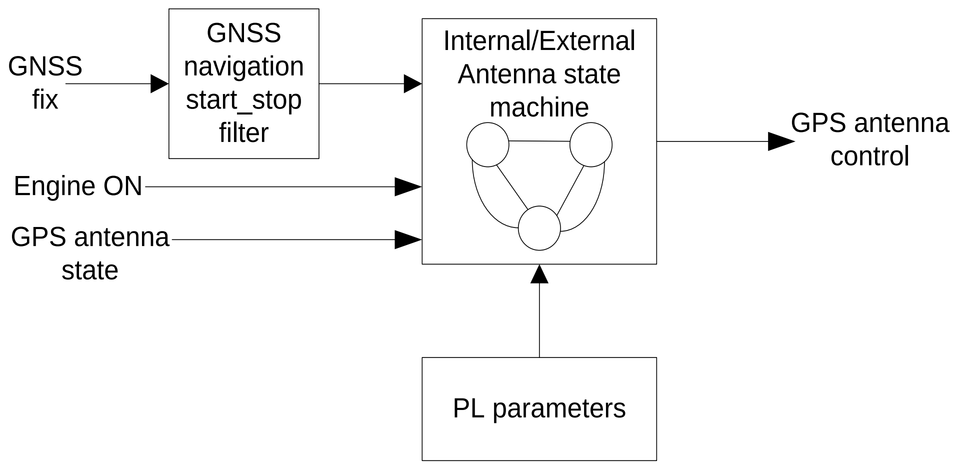
Data format: Flag

Data Range: 0 – Disable, 1 – Enable

Default value: 0 – Disable

19 GNSS External/Internal Antenna (Only GNSS)

Cello Units supporting GNSS (Global Navigation Satellite System) can automatically select between External and Internal Antenna based on user configurable parameters and GNSS reception quality. The block diagram bellow shows the inputs affecting the decision logic which includes the current Antenna selection state, The GNSS Fix status and the configuration. The decision logic implemented as state machine will select the best antenna source. It is also possible to disable one of the possible antenna sources. The GNSS configurable parameter define the no-fix timeout for moving between External and Internal GNSS Antenna sources.



Summary of configurable states:

External no-fix-time	Internal no-fix-time	Decision
0	0	Fixed on **internal** antenna only
0	Non-Zero	Fixed on **internal** antenna only
Non-Zero	0	Fixed on **External** antenna only
Non-Zero	Non-Zero	Default (initial state of) antenna will be the **External**

19.1 GNSS Internal Antenna No-Fix-Time Timeout (GNSS Variants only)

Address: 518

Description:

Internal no-fix-time: Time in seconds, 0=Disable , Minimum value = 40 Sec , default = 0 (disable)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

19.2 GNSS External Antenna No-Fix-Time Timeout (GNSS Variants only)

Address: 519

Description:

Internal no-fix-time: Time in seconds, 0=Disable , Minimum value = 40 Sec , default = 0 (disable)							
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

20 Auxiliary Satellite Unit

Compatibility: GNSS units support this feature natively and CRx00 units (starting 41x firmware) as an optional feature.

This feature enables an auxiliary satellite communication device to be activated when the Cello unit losses GSM or GPRS connectivity. The Auxiliary Satellite unit could be activated in two operational modes:

Basic Auxiliary Satellite Mode:
In this mode the Cello unit turns on the Auxiliary Satellite modem when “No GSM” or "no GPRS" condition is detected. In this mode the Auxiliary Satellite modem autonomously generate location events based on its embedded GPS. The Auxiliary Satellite Modem will be turned off, and control will be moved to the GSM network when the Cello unit detects GSM or GPRS network connectivity.

The "Blinkers" output control the Auxiliary Satellite device. While Cello or CRx00 is hibernating, its auxiliary satellite device will be turned off. The end unit will automatically turn the auxiliary unit on when GSM or GPRS is lost for the time defined in section 22.1.1. The Cello unit will automatically turn off the auxiliary unit when GSM or GPRS is restored for at least the time defined in 22.1.2.

Advanced Auxiliary Satellite Mode (implemented in Cello family only):
The advanced Auxiliary Satellite support uses the Auxiliary Satellite unit as an alternative path for communication with the server. Unlike the basic mode, the advanced mode will send the legacy Cellocator messages via the satellite link to the server. The messages sent over the satellite communication link are stored into the Satellite service provider server’s data base and sent via the internet to the fleet management server.

Both Basic and advanced Satellite share the same criteria for declaring “GSM / GPRS Loss” and “GSM / GPRS reconnect”. The feature's configurable options include timeout values defining "GSM loss" and "GSM reconnect" timeouts. Both values must be Non Zero for the feature to be operational.

20.1 Auxiliary Satellite: Cellular network connect-reconnect criteria

Address: 650, Bit 0

Description: This bit defines the criteria for declaring cellular network availability. Setting the bit to 0 (GSM) will switch the unit to Satellite mode when GSM network is not found. Setting the bit to 1(GPRS) will switch to Satellite mode when GPRS network is not found (while GSM might be available).

0 - GSM

1 - GPRS

Default value: 0 – GSM

20.2 Falling Back to Satellite

20.2.1 *Auxiliary Satellite: No GSM-GPRS Timeout (Basic, Advanced)*

Address: 1345, Bits 0-3

Description: This configurable parameter defines No-Cellular network time criteria for the unit to switch on its auxiliary satellite device. The NO-Cellular configurable timeout has configurable resolution of 0.5 or 16 minutes per bit. The configurable parameter must be non-zero for the feature to function.
This parameter is common for both Basic and Advanced Auxiliary Satellite modes.

Default value: 0 – Feature Disabled

NOTE: Please note that when the "Auxiliary Satellite Unit- Cellular network connect reconnect criteria" (Add. 650, Bit 0) is configured for "GPRS", the minimal value must be 2 (1 Minute).

20.2.2 *Auxiliary Satellite: Timeout Resolution for No GSM-GPRS*

Address: 650, Bit 1

Description: This parameter defines the resolution for NO GSM-GPRS Timeout.

Auxiliary Satellite: Timeout Resolution for No GSM-GPRS	Resolution
0	30 Seconds
1	16 Minutes

Default value: 0 – 30 Seconds

20.3 Restore Cellular

20.3.1 *Auxiliary Satellite: GSM-GPRS Reconnect Timeout (Basic, Advanced)*

Address: 1345, Bits 4-7

Description: This parameter defies the criteria for declaring Cellular network as restored. This configurable parameter defines the "Cellular Network Reconnect" timeout in programmable resolution (0.5 minutes or 16 minutes). The configurable parameter must be non-zero for the feature to function.
This parameter is common for both Basic and Advanced Auxiliary Satellite modes.

Default value: 0 – Feature Disabled

20.3.2 *Auxiliary Satellite: Timeout Resolution of GSM-GPRS Reconnect*

Address: 650, Bit 2

Description: This parameter defines the resolution for NO GSM-GPRS Timeout.

Auxiliary Satellite: Timeout Resolution of GSM-GPS Reconnect	**Resolution**
0	30 Seconds
1	16 Minutes

Default value: 0 – 30 Seconds

20.4 Satellite Control Bitmask

Address: 650

Reserved	Auxiliary Satellite Unit- Satellite Operational Mode 0-Basic 1-Advanced	Reserved	Reserved	Auxiliary Satellite Unit- Enable Periodic Distress Events 0-Disable 1-Enable	Timeout resolution of GSM-GPRS Reconnect	Timeout resolution for No GSM-GPRS	Auxiliary Satellite Unit- Cellular network connect reconnect criteria: 0-GSM 1-GPRS
Bits 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Default value: 0 – GSM

20.4.1 *Auxiliary Satellite Unit- Enable Periodic Distress Events*

Address: 650, Bit 3

Description: When the unit is in Advanced Satellite mode and NO GSM condition is detected and this bit is enabled, the unit will start sending periodic Distress events with Transmit Reason 44 (Timed Event). If the unit is in hibernation, the periodic distress will turn on the Auxiliary Satellite for a distress transmission session. The Period between the Distress Event is defined in the parameter: Auxiliary Satellite Unit- Periodic Distress Report Period, Address 656.

Default value: 0 – Disabled

20.4.2 *Auxiliary Satellite Unit - Satellite Operational Mode*

Address: 650, Bit 6

Description: This bit defines the Auxiliary Satellite Operational mode. The bit selects between Basic and Advanced mode. The basic mode only turns the Auxiliary Satellite unit on while the advanced mode uses the satellite unit as an alternative transmission channel to the fleet server.

0-Basic Satellite Mode

1-Advanced Satellite Mode

Default value: 0 – Basic

20.4.3 *Auxiliary Satellite Unit - Periodic Distress Report Period*

Address: 656

Description: This parameter defines the period between Periodic Distress Events. This parameter is only relevant when: Auxiliary Satellite Unit - Enable Periodic Distress Events is enabled.

Resolution: 30 Seconds

Default value: 10 – 5 Minutes

21 Driver Behaviour

21.1.1 *Driver Behavior (CSA) Disable*

Address: 1350, Bit 7

Description: When this bit is set (Cello-CANiQ and CANiQ-M) the driver behavior will be completely disabled.

Note, that the driver behaviour configuration parameters are described in a separate document: "Cellocator CSA Programming Manual.docx"

Data format: 0 – Driver Behavior Enabled, 1 – Driver Behavior Disabled.

Default value: 1 – Driver Behavior Disabled

22 EBLE block

EBLE (Evolution-BLE) is the successor for the older CBLE block.

Address: 2084

Enable BLE 0 – Disable 1 – Enable	In use of CelloTrack Nano and CelloTrack-4 family			In use of BT-Extender (in Cello-CANiQ only)		Enable BLE in hibernation 0 – Disable 1 – Enable	Spare
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Description: These parameters define the operability of the EBLE, depending on the unit power mode.

Data Range: 0 – Disable, 1 – Enable

Default value: 0 – for all parameters