CFE
Integration Manual

Proprietary and Confidential

Version 1.1

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Table of Contents

1 Introduction

1.1 Scope and Purpose

This document summarizes the integration possibilities of the Communication and Functionality Expander (CFE), and describes the CFE infrastructure.

The document is intended for system integrators and service providers who want to integrate the expand capabilities of the Cello and the CFE with their applications.

This document does not describe the basic functionality of the CFE and installation aspects. This functionality is described in documents listed in the *References* section below.

Note that sections in this document referring to "Infrastructure" are for future purposes. This is specifically referred to the Bluetooth (BT) module and COM2 port / interface.

1.2 Revision History

Version	Date	Description
1.0	10/04/2013	Initial version
1.1	20/02/2015	Product release version

1.3 References

No.	Document Name	Remark
1	CFE Product Overview	

2 CFE Description

2.1 General

The CFE is an extension device for the Cello unit and is designed to increase the number of available inputs, outputs and serial communication ports.

The CFE connects with the Cello unit via the serial port carrying a new tunneling serial protocol while implementing a serial session multiplexer over a single serial link. In addition to the serial messages multiplexing, the protocol will interchange messages regarding the inputs and outputs of the CFE.

The CFE is based on Cello Hw architecture modified for use as an interface expansion unit.

The CFE supports four serial interfaces, one of the ports (COM1) is assigned for communication with the Cello unit and three ports are used for external devices (such as a Garmin device).

The CFE serial multiplexer can extend the number of serial devices concurrently connected to the Cello. Each one of the three CFE serial ports can be configured to support one of the legacy serial protocols supported by Cello. The CFE supports up to three concurrent transparent channels.

The CFE supports also six inputs and six outputs.

When the CFE is disconnected from the Cello unit it will retain the Cello legacy serial application protocol, enabling operations such as programming and FW upload using Cellocator legacy SW tools. A list of supported SW application serial commands is available.

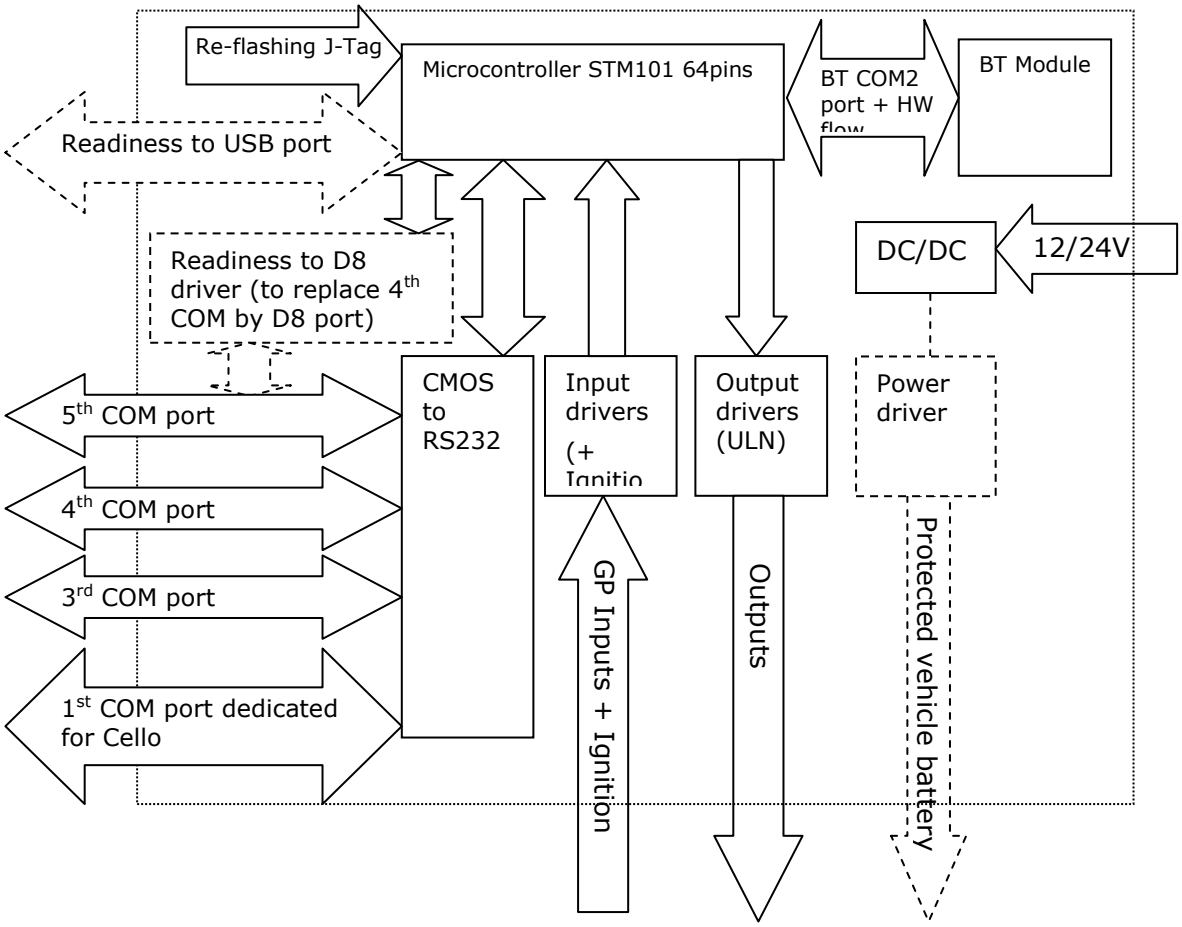
2.2 CFE infrastructure

2.2.1 *CFE infrastructure capabilities*

The CFE infrastructure is designed to support the following capabilities:

- One serial port (COM1) for communication with the Cello Unit.
- Three serial ports (COM3, COM4, COM5) for communication with external devices (such as a Garmin device).
- Bluetooth module which use one serial port (COM2) (infrastructure, not assembled)
- Six general purpose inputs, one of which can be programmed as Ignition input.
- Regulated Vout (5V, 300mA).
- Six general purpose outputs
- USB (infrastructure, not assembled).
- Optional DTCO D8 interface on one of the COM ports (infrastructure, not assembled).

2.2.2 *CFE Block Diagram*



2.3 CFE Connector / Harness Description

2.3.1 *20 pins Connector / Harness Description*

Connector		Harness	
Pin number	**Function**	**Wire / length / caption**	**Termination connector**
1	In1	Jacket, **"Main Power & GPIn1/Ignition",** 150 cm, 20#	N/A
2	Main Power		N/A
3	N/A	N/A	(N/A)
4	N/A	N/A	
5	GND	Jacket, **"Main Power & GPIn1/Ignition",** 150 cm, 20#	N/A

Connector		Harness	
Pin number	**Function**	**Wire / length / caption**	**Termination connector**
6	COM 1 (Cello) TX	Jacket, 30cm, 22#, shielded "**Cello COM 1**",	RJ45 (F)
7	COM 1 (Cello) RX		
8	COM 3 TX	Jacket, 30cm, 22# shielded **"COM3 / MDT"**	RJ45 (M)
9	COM 3 RX		
10	COM 4TX	Jacket, 30cm, 22# shielded **"COM4"**	DB9 (M)
11	COM 4 RX		
12	COM 5 TX	Jacket, 30cm, 22# shielded **"COM5"**	DB9 (M)
13	COM 5 RX		
14	Out 1	22#, 30cm, **White**	N/A
15	Out 2	22#, 30cm, **Yellow**	N/A
16	Out 3	22#, 30cm, **Green**	N/A
17	Input 2	22#, Shielded, 30cm, **"GPIn 2"**	N/A
18	Input 3	22#, Shielded, 30cm, **"GPIn 3"**	N/A
19	GND		N/A
20	V out	*22#, Jacket ,30cm, **"Orange"**	N/A

2.3.2 *6 pins Connector (P2) / Harness*

Connector		Harness	
Pin number	**Function**	**Wire / length / Color**	**Termination connector**
1	Out 6	22#, 30cm, Pink	N/A
2	Input 4	22#, 30cm, Brown	N/A
3	Out 5	22#, 30cm, Blue	N/A
4	Input 5	22#, 30cm, White/Green	N/A
5	Out 4	22#, 30cm, Gray	N/A
6	Input 6	22#, 30cm, Violet	N/A

3 CFE Maintenance

3.1 CFE Reflashing

The CFE supports FW upgrade through its COM ports using the same tools designed for Cello (Serial CSF STK Flasher), whenever it is disconnected from the Cello unit.

3.2 CFE Programming

The CFE configuration memory can be upgraded in three ways, as described in the following table:

Configuration	Interface	Description
Standalone	Serial	Use the legacy programmer connected directly to CFE COM1.
Connected to CFE	Serial	Use the legacy programmer, connected to CFE COM3, and download either the complete PL of the Cello or only the CFE PL section. The PL will be downloaded to the Cello unit via the CFE.
	OTA	Use the legacy OTA programmer.

4 Programming aspects of the CFE Integration

4.1 Using CFE as the Cello I/O Extender

Address: 6, bit 0

If the "Enable CFE" (6, bit 6) programming bit is set together with the "Using CFE as Cello's I/O extender" parameter, upon every power up the Cello device initializes the CFE to issue a periodic/unsolicited Extended I/O Status message.

Default: 0 (disable)

When the Cello unit is configured to co-work with the CFE the Cello's serial baud rate is automatically set to 460800 bps, overriding the programmed Cello serial speed. The serial protocol maintained between the Cello and the CFE will also detect communication failures if the CFE does not reply to Cello interrogations.

4.2 Driver Behaviour Violation Indications

4.2.1 *Driver behavior violation - feedback bitmask*

Address: 2377 for first output

2380 for second output

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

4.2.2 *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 the number of outputs that are activated upon driver behavior violations.

Output name	Output 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: 1 to 5

Default value: zero

4.2.3 *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 name	Output 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: (0) Notification disabled

4.3 Response to Change on Discrete Type of CFE Inputs

Address: For Inversion 100-101

Inputs Events on Failing 124-125

Inputs Events on Raising 126-127

Inputs Distress on Failing 128-129

Inputs Distress on Raising 130-131

HRLS Trigger Mask of Inputs Falling 486-487

HRLS Trigger Mask of Inputs Raising 488-489

Security inputs mask bitmap 422-425

Lower byte

Unlock	Panic	Driving Status (Ignition or accelerometer based)	CFE IN1	Unused		Shock	Door
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Upper byte

Ignition port status	Accelerometer status	CFE IN6	CFE IN5	CFE IN4	Lock	CFE IN3	CFE IN2
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

4.4 CFE Inputs Configuration

<table>
<tr><th>Address</th><th>Parameter</th><th>Description</th></tr>
<tr><td>1714-1715</td><td>COM 1 (Cello Port) configuration</td><td>Address: 0
<table><tr><td colspan="5">Reserved</td><td colspan="3">Baud rate
(for COM1 and COM2 (BT) hardcoded to 460800)</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>Address: 1
<table><tr><td>Reserved</td><td colspan="2">Flow Control</td><td colspan="2">Stop Bits</td><td colspan="3">Parity</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>1716-1717</td><td>COM 3 configuration</td><td>Same as UART 1 configuration</td></tr>
<tr><td>1718-1719</td><td>COM 4 configuration</td><td>Same as UART 1 configuration</td></tr>
<tr><td>1720-1721</td><td>COM 5 configuration</td><td>Same as UART 1 configuration</td></tr>
<tr><td>1722-1725</td><td>Spare</td><td></td></tr>
<tr><td>1726</td><td>Vout Control</td><td><table><tr><td colspan="7">Reserved</td><td>Enable Vout (5V)</td></tr><tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table></td></tr>
<tr><td>1727</td><td>Hibernation setting bitmask</td><td><table><tr><td colspan="6">Reserved</td><td>Keep UART1 on during Full hibernation</td><td>Enable Full Hibernation</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>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.</td></tr>
<tr><td>1728-1753</td><td>Reserved</td><td></td></tr>
<tr><td>1754</td><td>Reserved for Bluetooth</td><td></td></tr>
<tr><td>1755-1756</td><td>Reserved</td><td></td></tr>
<tr><td>1757-1809</td><td>Reserved for Bluetooth</td><td></td></tr>
<tr><td>1810</td><td>Input1 Type / Assigned function</td><td rowspan="3">Configuration of input 1 (Enable Ignition functionality on On IN1)</td></tr>
<tr><td>1811</td><td>Averaging factor for Input1</td></tr>
<tr><td>1812-1813</td><td>Scaling Factor for Frequency report 1</td></tr>
<tr><td>1814</td><td>Discrete Wet/Dry Threshold</td><td>Value span for wet type: 0 (0V) to 255 (30V).
Default Value: 125 (14.7V)</td></tr>
</table>

Address	Parameter	Description
1815	Spare	
1816	Input2 Type / Assigned function	Configuration of input 2
1817	Averaging factor for Input2	
1818-1819	Scaling Factor for Frequency report 2	
1820	Discrete Wet/Dry Threshold	Value span for wet type: 0 (0V) to 255 (30V). Default Value: 125 (14.7V)
1821	Spare	
1822	Input3 Type / Assigned function	Configuration of input 3
1823	Averaging factor for Input3	
1824-1825	Scaling Factor for Frequency report 3	
1826	Discrete Wet/Dry Threshold	Value span for wet type: 0 (0V) to 255 (30V). Default Value: 125 (14.7V)
1827	Spare	
1828	Input4 Type / Assigned function	Configuration of input 4
1829	Averaging factor for Input4	
1830-1831	Scaling Factor for Frequency report 4	
1832	Discrete Wet/Dry Threshold	
1833	Spare	
1834	Input5 Type / Assigned function	Configuration of input 5
1835	Averaging factor for Input5	
1836-1837	Scaling Factor for Frequency report 5	
1838	Discrete Wet/Dry Threshold	
1839	Spare	
1840	Input6 Type / Assigned function	Configuration of input 6
1841	Averaging factor for	

Address	Parameter	Description
	Input6	
1842-1843	Scaling Factor for Frequency report 6	
1844	Discrete Wet/Dry Threshold	
1845	Spare	
1846	CFE Inputs state update configuration	<table><tr><td>CFE Inputs update message configuration (CFE to Cello).Update period (resolution of 0.5 seconds) Default: 1</td><td>Enable unsolicited updates (upon change) 0- deactivate 1 - activate</td><td>Enable periodic updates 0- deactivate 1 - activate</td></tr><tr><td>Bit 7 – Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr></table>
1852-1913	Reserved for future use	

4.4.1 *12 bits resolution of analog inputs*

Addresses: 1810, 1816, 1822, 1828, 1834, 1840: Bits 5-7.

Every CFE input supports the new inputs types (5 and 6).

Input Type number	Description
0	Discrete Dry Contact (on board pull-up)
1	Discrete Normal (Wet Input)
2	8 bits Analog Backward Compatible (0-2.5V)
3	8 bits Analog New Range (0 – 30V)
4	Frequency meter
5	12 bits Analog Backward Compatible (0-2.5V)
6	12 bits Analog New Range (0 – 30V)
7	Reserved

4.5 CFE Serial Multiplexer Configuration

<table>
<tr><th>Address</th><th>Description</th></tr>
<tr><td>1436-1440</td><td>CFE multiplexer assignment:
<table>
<tr><th>PL Address</th><th>Supported Protocol</th></tr>
<tr><td>1437</td><td>Supported protocol for CFE serial interface 2 (infrastructure)</td></tr>
<tr><td>1438</td><td>Supported protocol for CFE serial interface 3</td></tr>
<tr><td>1439</td><td>Supported protocol for CFE serial interface 4</td></tr>
<tr><td>1440</td><td>Supported protocol for CFE serial interface 5</td></tr>
</table>

The supported protocols options are:
<table>
<tr><th>Code</th><th>Protocol</th></tr>
<tr><td>0</td><td>Serial Interface Disabled</td></tr>
<tr><td>1</td><td>Garmin</td></tr>
<tr><td>2</td><td>PSP</td></tr>
<tr><td>3</td><td>DTCO (future)</td></tr>
<tr><td>4</td><td>DFD</td></tr>
<tr><td>5</td><td>Transparent</td></tr>
<tr><td>6</td><td>RFID (future)</td></tr>
<tr><td>7</td><td>Wire Protocol</td></tr>
</table>
</td></tr>
</table>

5 Communication Aspects of the CFE Integration

5.1 CFE Additional Events

The system supports additional events as described in the table below. The appropriate transmit reasons (TR) in message type 0 are also mentioned.

TR	STR	Description
57	0	CFE input 1 Off
58	0	Lock input inactive event (Legacy)
59	0	CFE input 2 Off
60	0	CFE input 3 Off
61	0	CFE input 4 Off
62	0	CFE input 5 Off
63	0	CFE input 6 Off
73	0	CFE input 1 On
74	0	Lock input active event (Legacy)
75	0	CFE input 2 On
76	0	CFE input 3 On
77	0	CFE input 4 On
78	0	CFE input 5 On
79	0	CFE input 6 On
160	0	CFE Disconnected If there is no reply to 2 consecutive pings – the CFE is considered disconnected. The paired CFE's ID is erased from the Cello's NVM and a dedicated OTA alert is generated.
160	1	CFE Connected Upon reception of the new (different from paired) CFE's ID the unit updates the paired CFE's ID in the NVM and generates a dedicated OTA event.

5.2 Connected CFE Type in OTA Message Type 0

Whenever the CFE is connected, the following bits of message type 0 have to monitor its type.

Address: Service and Location Status Byte (41), bits 2, 3 and 4.

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

5.3 Connected CFE Type in Serial Unit Status/Information Packet (Type 02h) (Infrastructure)

Whenever the CFE is connected, the Cello device reports in the Serial Unit Status/Information Packet (Type 02h).

<table>
<tr><th>Byte</th><th>Data</th></tr>
<tr><td>1</td><td>0x02</td></tr>
<tr><td>2
3
4
5</td><td>Unit ID</td></tr>
<tr><td>6</td><td>Hardware Version</td></tr>
<tr><td>7</td><td>Software Version</td></tr>
<tr><td>8</td><td>Protocol Version</td></tr>
<tr><td>9</td><td>Software Subversion</td></tr>
<tr><td>10
11</td><td>Available space in buffer for data forwarding (bytes, Little Endean, valid range 0-1024, from v31c)</td></tr>
<tr><td>12</td><td>
<table>
<tr><td>Unused</td><td>ACK/NACK

ACK – 0
NACK - 1</td><td>GPS valid / Invalid</td><td>Moving / Idling</td><td>GPRS Socket available</td><td>Home (0)/ Roaming (1)</td><td>SMS available</td><td>Registered to GSM</td></tr>
<tr><td>Bit 7</td><td>Bit 6</td><td>Bit 5</td><td>Bit 4</td><td>Bit 3</td><td>Bit 2</td><td>Bit 1</td><td>Bit 0</td></tr>
</table>
</td></tr>
</table>

Byte	Data
13	CFE Type and Status

	Bit 2	Bit 1	Bit 0
Not Applicable (Legacy state)	0	0	0
Reserved	0	0	1
Reserved	0	1	0
CFE is connected	0	1	1
Reserved	1	0	0
CFE is not connected	1	1	0
Reserved	1	1	1

	Checksum

5.4 Mapping of CFE Discrete I/Os in Cello OTA and Serial Messages

The Cello device uses 4 bytes I/O bitmask in different packets sent through the serial port and OTA. Whenever the CFE is connected and identified by the Cello unit, the marked bits below (▽) will reflect the status of the CFE IO discrete inputs.

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

GP Input ♥ Unlock (11/20) ♣ ■	Panic ♠ ♣ ♥ ♦ ■	Driving Status (Ignition or accelerometer based) ■ Ignition ♠ ♣ ♥ ♦ Movement Sensor ●◇	CFE IN1 ■▽	Volume ♥ GP1 Input2 ●	Hood ♥ GP1 Input1 ●◇	Shock / Unlock 2 (15/20) ♠ ♥ ♦ ■ ♣ Distress input ●◇	Door ♠ ♣ ♥ ■ Tamper Switch ●◇
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Second byte:

Ignition port status ■	Accelerometer status ■	CFE IN6 ■▽	CFE IN5 ■▽	CFE IN4 ■▽	RC data ♥ Lock (5/20) ♣ ■	CFE IN3 ■▽	CFE IN2 ■▽
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Legend:

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

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

CFE out 5	CFE out 4	CFE out 3	CFE out 2	GPS power	Grad. Stop	Siren Control	CFE out 1
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

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

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

5.5 Mapping of CFE Measurable I/Os in Cello OTA and Serial Messages

The OTA protocol provides 4 bytes dedicated for the monitoring of measurements from an input in number of different message types (Bytes 26-29 of OTA Message 0).

These bytes can contain measurements from the different fields as per the configuration below.

Pin Number/Field Name	Number to be programmed	Remarks
Non	0	
Pin 14 / Door	1	
Pin 15 / Shock	2	Default for byte 29 of OTA Message 0
Pin 16 / Panic	3	
Pin 11/ Unlock	4	
Pin 5 / Lock	5	

Pin Number/Field Name	Number to be programmed	Remarks
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
Regulated voltage	8	
Input voltage (Vin)	9	Default for byte 26 of OTA Message 0
CFE In 1	10	
CFE In 2	11	
CFE In 3	12	
CFE In 4	13	
CFE In 5	14	
CFE In 6	15	
CFE Vin	16	

5.6 Reporting all Analog Inputs Values OTA

It is possible to report all analog inputs values at the same time by request. The existing infrastructure of OTA Message type 0 only enables the reporting of up to 4 analog inputs values at a time, while the system maintains up to 8 different measurements at a time:

Cello Pin 14 / Door
Pin 15 / Shock
CFE In 1
CFE In 2
CFE In 3
CFE In 4
CFE In 5
CFE In 6

5.6.1 *Analog measurements update period*

Addresses: 520 – Home network

521 – Roaming network

Note that modifications do not require a reset.

Resolution: 4 or 90 seconds as per resolution bit in a control byte.

Default: both 1 minute (15).

Period multiplied by the resolution defined in Bit 2					Resolution definer 0 – 4 seconds 1 – 90 seconds	Enable RT 0 – disable 1 - enable	Enable logged 0 – disable 1 - enable
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.6.2 *OTA request of analog measurements*

Byte Number	Byte Data	
N	Sub-data type	0x18
N+1	Sub-data length	2
N+2	Spare	zeros
N+3	Spare	

5.6.3 *OTA CFE inputs update message (Msg type 9, sub-data type 0x18)*

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

Byte no.	Description	Containing
13	Packet Control Field	0x00
14	Total Data length	0d55
15	Sub-Data Type	0x18
16	Sub-Data Length	0d26
17	Spare	
18		
19	Pin 14 / Door Type / Assigned function (same as in a configuration) Since legacy Cello does not support 8/12 bit ADC resolution, this message will always send 12 bit resolution.	
20	Measurement LSB Door (in case of discrete 0 for 0, 255 for 1)	
21	Measurement MSB Door	
22	Pin 15 / Shock Type / Assigned function (same as in a configuration) Since legacy Cello does not support 8/12 bit ADC resolution, this message will always send 12 bit resolution.	
23	Measurement LSB Shock (in case of discrete 0 for 0, 255 for 1)	
24	Measurement MSB Shock	
25	Input1 Type / Assigned function (same as in a configuration)	
26	Measurement LSB In1 (in case of discrete 0 for 0, 255 for 1)	
27	Measurement MSB In1	
28	Input2 Type / Assigned function In2 (same as in a configuration)	
29	Measurement LSB In2 (in case of discrete 0 for 0, 255 for 1)	

Byte no.	Description	Containing
30	Measurement MSB In2	
31	Input3 Type / Assigned function In3 (same as in a configuration)	
32	Measurement LSB In3 (in case of discrete 0 for 0, 255 for 1)	
33	Measurement MSB In3	
34	Input4 Type / Assigned function In4 (same as in a configuration)	
35	Measurement LSB In4 (in case of discrete 0 for 0, 255 for 1)	
36	Measurement MSB In4	
37	Input5 Type / Assigned function In5 (same as in a configuration)	
38	Measurement LSB In5 (in case of discrete 0 for 0, 255 for 1)	
39	Measurement MSB In5	
40	Input6 Type / Assigned function In6 (same as in a configuration)	
41	Measurement LSB In6 (in case of discrete 0 for 0, 255 for 1)	
42	Measurement MSB In6	
43	Sub-data Type	4
44	Sub-data Length	0d25
45	Location status (flags)	See the description of sub-data type 4 in *Wireless Protocol*.
46	Mode 1 (from GPS)	
47	Mode 2 (from GPS)	
48	Number of satellites used (from GPS)	
49-52	Longitude	
53-56	Latitude	

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

5.6.4 *Activation of CFE Outputs by OTA Command*

The following command activates the appropriate CFE output in accordance with the required cadence.

Command Code	Meaning, Data Fields assignments
0x03	Output state change. Data field contains output change information, according to this table: Data field 1 value: function 00h / 10h: Siren (off / on) 03h / 13h: Ext Immobilizer (same output as Gradual Stop) (off / on) 04h / 14h: Blinkers (off / on) 05h / 15h: Standard immobilizer 1 (off / on) 06h / 16h: CFE Out 1 07h / 17h: CFE Out 2 08h / 18h: LED (off / on) 09h / 19h: CFE Out 3 0Ah / 1Ah: CFE Out 4 0Bh / 1Bh: CFE Out 5 0Ch / 1Ch: CFE Out 6 0Eh: Lock (performs pulse), in Car sharing and Olympic modifications only

Command Code	Meaning, Data Fields assignments
	0Fh: Unlock (performs pulse), in Car sharing and Olympic modifications only Data field 2 and 2 bytes of Command Specific Data field: Contains time of the output activation with one second resolution. Value of 0 causes permanent output change. Example: Activate Siren for 5 minutes (300 seconds). MCGP 00 ID ID ID ID 00 00 00 00 00 03 03 10 10 2C 2C 01 01 00 00 CS Nested output activation: If the MSBit of the 3rd byte of command specific data field is set, the command will be executed only after the vehicle stops, e.g. after Ignition off or after 10 (by default) valid GPS packets showing a speed lower than 1 km/h. Example: Activate Siren Nested for 5 minutes (300 seconds). MCGP 00 ID ID ID ID 00 00 00 00 00 03 03 10 10 2C 2C 01 01 80 00 CS

5.7 Geo-fence Output Control

Geo-fence violations can trigger output activations. This feature is designed to let the unit automatically notify the driver that they are violating a 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

It is required to support activation of CFE outputs together with Cello's legacy outputs as follows:

Output name	Output number
Feature Disabled	0
Siren	1
Gradual Stop	2
St. Immobilizer	3
LED	4
Blinkers	5

Note that the Nested activation type is also supported.

5.8 OTA Forwarding to CFE serial

5.8.1 *Outbound OTA MSG type 8*

Byte 13 will contain the source serial port number.

Source of payload 0. All Aux (backward compatible mode COM3,4,5) 1. N/A 2. COM2 (BT) 3. COM3 4. COM4 5. COM5 6. CFE Micro 7. N/A			CFE connected	Unused			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.8.2 *Outbound OTA MSG type 7*

Byte 13 will contain the source serial port number.

Source of payload 0. All Aux (backward compatible mode COM3,4,5) 1. N/A 2. COM2 (BT) 3. COM3 4. COM4 5. COM5 6. CFE Micro 7. N/A			CFE connected	Static field, contains 0b111 (7)			
Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

5.8.3 *Inbound OTA MSG type 5*

Settings Byte.

Destination of payload 0. All Aux (backward compatible mode COM3,4,5) 1. N/A 2. COM2 (BT) 3. COM3 4. COM4 5. COM5 6. CFE Micro 7. CFE Micro 8. N/A)	Unused	Packet to Garmin (compatible to Garmin's serial protocol)

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

6 Hibernation

6.1 Functionality during Hibernation

During hibernation, the CFE unit will consume minimal energy while still maintaining the following functionalities:

- Handle inputs events (for example, discrete dry input was connected to ground).
- Answer ping requests.
- Monitor the Ignition state as reflected by the ping messages.

6.2 Automatic CFE Power Mode Control

It is possible to install the CFE without an ignition connection. In such cases, the Cello unit informs the CFE about changes in Ignition input state.

If the CFE is enabled and Automatic CFE Power Mode Control is enabled, the Cello unit will send a corresponding "Unit state change packet" to the CFE upon any change in "Driving status", regardless of whether it is sourced from the Ignition port or the Accelerometer.

7 Application Notes

7.1 Data Forwarding Via CFE

The application note below describes the unit's ability to forward data from up to three serial CFE channels to the server side.

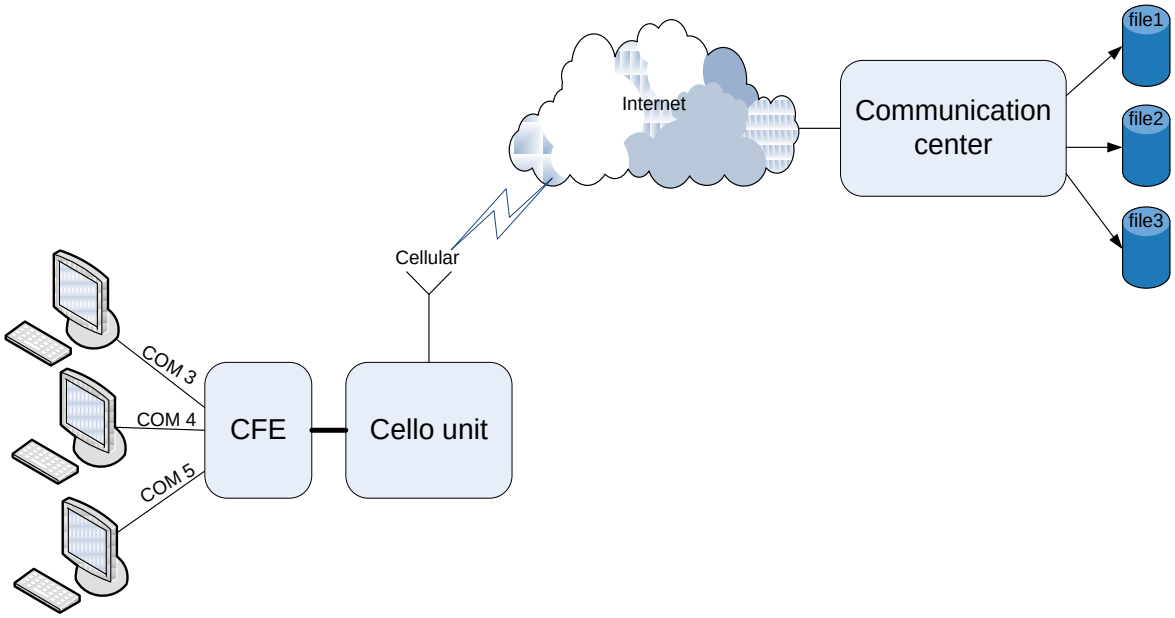
7.1.1 *Overview*

The legacy forwarding mechanism has been extended and can now support multiple serial interfaces via the CFE hardware.

This section covers concurrent serial uploading of three files using forwarding type-7 (logged) messages only.

In the figure below, three computers connected using serial COM ports to the CFE unit function as a serial MUX interface.

The CFE unit passes the information via cable to the Cello unit and from there via the cellular IP network to the communication center at the CCC.



7.1.2 *Setup and configuration*

The door input will be used to enable/disable the forwarding mode.

To activate forwarding transparent mode, perform the following steps:

1. Configure the following via the Cellocator Programmer tool:
    a. Set parameters "09 CFE Configuration\Serial Mux\CFE Serial port 3" and "09 CFE Configuration\Serial Mux\CFE Serial port 4" and "09 CFE Configuration\Serial Mux\CFE Serial port 5" to "Transparent".
    b. Set parameter "01 Communication and Configuration\Communication settings\Data Forwarding from COM port\ Enable Data forwarding through log" to enable.

c. Set parameter "01 Communication and Configuration\Communication settings\COM port settings\Transparent mode" to enable.

d. Set parameter "04 Inputs Events\14 - Door\Invert Door" to 1 (Inverted).

2. Upload the PL.
3. Ground Pin 14 (Door input) to permanently enable this mode.