# Driver Feedback Device (DFD) Overview

Cellocator Division
Pointer Telocation Ltd.

Proprietary and Confidential

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POINTER

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# 1 Introduction

## 1.1 Document Purpose and Scope

The purpose of this document is to provide high-level information required by service providers who are considering the integration and operation of the Cello family (Cello-IQ and Cello-CANiQ) devices, including the DFD, with their fleet management applications.

This document specifically describes the Driver Feedback Device (DFD), HW and MMI interfaces, mechanical attributes, functions, configuration and specifications, which are required as an accessory connecting to the Cello product.

## 1.2 Definitions, Acronyms and Abbreviations

| Abbreviation | Description |
|---|---|
| **DBM** | Driver Behavior Monitoring |
| **Cello-IQ** | Cellocator Safety, DBM and Eco-driving monitoring device |
| **Cello-CANiQ** | Cellocator high-end device supporting Safety, DBM and Eco-driving monitoring with interface to the vehicle CAN Bus. |
| **Cello Family** | Comprises of the Cello-IQ and Cello-CANiQ |
| **COP** | Cellocator Open Platform |
| **CSA** | Cellocator Safety Application |
| **CM** | CSA Manager |
| **CDB** | Cellocator Driver Behavior |
| **DFD** | Driver Feedback Device |
| **EDR** | Emergency Data Recording |

*Table 1: Acronyms and Abbreviations*

## 1.3 References

| # | Reference | Description |
|---|---|---|
| 1 | Cello-IQ GNSS Product Overview | Describes the features and capabilities of the Cello-IQ product. |
| 2 | Cello-CANiQ Product Overview | Describes the features and capabilities of the Cello-CANiQ product. |

| # | Reference | Description |
|---|---|---|
| 3 | Cello Family Hardware Installation Guide | Describes how to install and verify the proper functioning of the installation kit elements, as well as installation of the DFD. |
| 4 | DFD Customization | Describes how to customize the DFD branding label and the DFD announcements to fit to the specific requirements of the service provider. |

*Table 2: References*

## 1.4 Revision History

| Version | Date | Description |
|---|---|---|
| 1.0 | 18/11/2015 | Initial version |

*Table 3: Revision History*

# 2 Driver Feedback Display (DFD) Overview

Cellocator's DFD is a **Driver Feedback Display**, available as an accessory connecting to the Cello product. The DFD provides visual and audible notifications intended for friendly Eco-driving coaching and real-time assistance to help improve the driver's safety level. The DFD also supports the following functionalities:

- Driver identification reminder
- In-vehicle installed tracking device reminder (for non-identified drivers)
- System operation / health status indication

The real-time notifications to the driver are generated based on the Cello embedded 3D accelerometer, GPS/VSS speed data, the vehicle's RPM signal (optional), and executed maneuver detection algorithms running on the CSA.

The DFD is designed to support and coach fleet drivers rather than to punish or preach to them. It is meant to be used as the driver's mentor for safety and eco driving, and continuous improvement.

*Figure 1: DFD*

# 3 The HW and MMI Interfaces

## 3.1 HW Interface

The DFD is connected to the main device through an RS232 serial connection. The DFD is a slave device, controlled solely by the Cello. Only the initial boot and self-test operations are triggered by the DFD itself.

The DFD is powered from the main device harness and does not require a separate VCC/GND connection. The DFD is powered only during the 'ignition on' state of the vehicle.

## 3.2 MMI – Man Machine Interface

### 3.2.1 *Overview*

The DFD was designed to provide a clear and intuitive user interface. It comprises bright colourful LEDs and icons, visible even in a daylight environment. Icons and graphics are used rather than text labels in order to achieve immediate recognition by the driver. The audible interface is a combination of human voice and tones (fully configurable) for maximum flexibility. It offers a selection of programmable languages and can support additional languages, dialects or a male/female voice upon request.

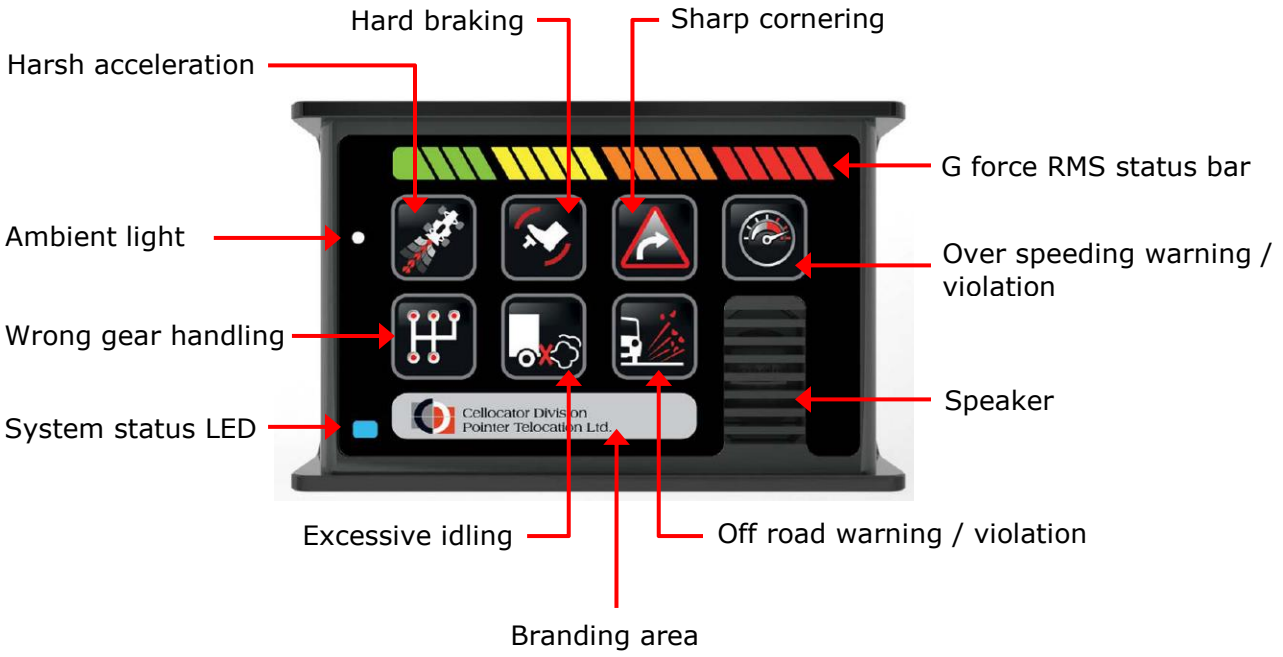


*Figure 2: DFD UI*

### 3.2.2 *System Status Indications*

The DFD provides the following system indications:

- Self-test: while performing a self-test, a short alarm beep is played and all LEDs are turned on sequentially in order to verify their functionality. For the rest of the time, as long as the self-test is taking place, all LEDs are turned off.
- System Ready: indicated when the blue LED is ON.
- System Error: the System Error announcement is played and the blue LED blinks in 1Hz as long as the system is in error state.
- Communication Error: the Communication Error announcement is played and the blue LED blinks in 0.5Hz as long as the system is in error state.

### 3.2.3 *Driver Status Indications*

The DFD provide the following system indications:

- Monitored Vehicle: upon System Ready and only when driver identification is not required, the system announces that the vehicle is monitored by a tracking system.
- Driver ID Received: upon successful driver identification, the welcome announcement is played.
- Unidentified driver reminder: if the vehicle ignition is switched on and no driver identification is provided within the expected time, the Unidentified Driver Reminder announcement is played.

### 3.2.4 *Maneuver Events Indications*

The DFD provides 3 types of indications per event: beep, announcement and display. Each one of these indications is programmable per event.

| UI Event | Trigger | Audible Indication | Visual Indication | Remarks |
|---|---|---|---|---|
| **Acceleration Alert** | Acceleration maneuver is terminated. | 0.5 second beep is played followed by the Acceleration Alert announcement. | Acceleration icon is turned on and the status bar displays the corresponding severity for programmed Time period. | - |
| **Braking Alert** | Braking maneuver is terminated. | 0.5 second beep is played followed by the Braking Alert announcement. | Braking icon is turned on and the status bar displays the corresponding severity for programmed Time period. | - |
| **Cornering Alert** | Cornering maneuver is terminated. | 0.5 second beep is played followed by the Cornering Alert announcement. | Cornering icon is turned on and the status bar displays the corresponding severity for programmed Time period. | - |

| UI Event | Trigger | Audible Indication | Visual Indication | Remarks |
|---|---|---|---|---|
| **Turn&Brake Alert** | Turn&Brake maneuver is terminated. | 0.5 second beep is played, followed by the Turn&Brake Alert announcement. | Cornering and Braking icons are turned on and the status bar presents the corresponding severity for programmed Time period. | - |
| **Turn&Accel Alert** | Turn&Accel maneuver is terminated. | 0.5 second beep is played, followed by the Turn&Accel Alert announcement. | Cornering and Acceleration icons are turned on and the status bar presents the corresponding severity for programmed Time period. | - |
| **Lane Departure Alert** | Lane Departure maneuver is terminated. | 0.5 second beep is played, followed by the Lane Departure Alert announcement. | Cornering icon is turned on and the status bar presents the corresponding severity for programmed Time period. | - |
| **Off-Road Warning** | Off-Road maneuver is detected for programmable time period. | Off-Road Warning announcement is played followed by short repeating beeps. | Off-Road icon blinking in 1Hz frequency. | Ends upon Off-Road Alert provisioning or end of Off-Road session. |
| **Off-Road Alert** | Off-Road maneuver continues for programmable time period after provisioning of the Off-Road Warning. | 0.5 second beep is played followed by the Off-Road Alert announcement. | Off-Road icon is turned on till the end of the maneuver. | - |
| **Speeding Warning** | Speeding maneuver is detected for programmable time period. | Speeding Warning announcement is played followed by short repeating beeps. | Speeding icon blinks in 1Hz frequency. | Ends upon Speeding Alert provisioning or end of Speeding session. |
| **Speeding Alert** | Speeding maneuver continues for programmable time period after provisioning of the Speeding Warning. | 0.5 second beep is played followed by one of the Speeding Alert announcements (green, yellow or red according to the severity of the maneuver). | Speeding icon is turned on till the end of the maneuver. | - |
| **Wrong Gear Warning** | Wrong Gear maneuver is detected for programmable time period. | Wrong Gear Warning announcement is played followed by short repeating beeps. | Wrong Gear icon blinks in 1Hz frequency. | Ends upon Wrong Gear Alert provisioning or end of Wrong Gear session. |

| UI Event | Trigger | Audible Indication | Visual Indication | Remarks |
|---|---|---|---|---|
| **Wrong Gear Alert** | Wrong Gear maneuver continues for programmable time period after provisioning of the Wrong Gear Warning. | 0.5 second beep is played followed by the Wrong Gear Alert announcement. | The Wrong Gear icon is turned on till the end of Wrong Gear maneuver. | - |
| **Idling Warning** | Idling maneuver is detected for programmable time period. | Idling Warning announcement is played followed by short repeating beeps. | Idling icon blinks in 1Hz frequency. | Ends upon Idling Alert provisioning or end of Idling session. |
| **Idling Alert** | Idling maneuver continues for programmable time period after provisioning of the Idling Warning. | 0.5 second beep is played, followed by the Idling Alert announcement. | Idling icon is turned on till the end of Idling maneuver. | - |

*Table 4: DFD UI Events*

### 3.2.5 *Cello Announcements and Language Support*

The following table describes the default phrases announced to the driver as required. These phrases can be modified upon request in order to comply with the operational needs of the DBM service provider.

| Type | Announcement |
|---|---|
| System Error | Sorry, System error detected. Please contact your service provider. |
| Communication Error | Sorry, Communication error detected. Please contact your service provider |
| Monitored Vehicle | Welcome, This vehicle is fitted with a wireless tracking system. Please drive carefully. |
| Identified Driver | Welcome, please drive carefully. |
| Unidentified Driver | Hello, please input your driver ID. |
| Harsh Acceleration | Harsh acceleration recorded. Please accelerate with caution. |
| Hard Braking | Hard braking recorded. Please anticipate a safe stopping distance. |
| Sharp Cornering | Sharp cornering detected. Please Slow down. |
| Turn&Brake | Risky turn recorded. Please slow before turning. |
| Turn&Accel | Harsh cornering recorded. Maintain speed thru turn. |
| Lane Departure | Unsafe lane change recorded. Please pass carefully when road conditions allow. |

| Type | Announcement |
|---|---|
| Off Road Warning | You may be off-road. If so, please return to the main road. |
| Off Road Alert | Off-road driving recorded. Return to the main road. |
| Over Speed Warning | You may be speeding. Please slow down and observe the speed limit. |
| Over Speed Green Alert | Minor Speed limit violation recorded. Slow down. |
| Over Speed Yellow Alert | Moderate Speed limit violation recorded. Slow down. |
| Over Speed Red Alert | Extreme Speed limit violation recorded. Slow down. |
| Wrong Gear Warning | You are in the wrong gear. Please shift to the correct gear. |
| Wrong Gear Alert | Wrong gear recorded. Shift to the correct gear. |
| Idling Warning | Please start driving or turn off the engine. |
| Idling Alert | Excessive idling recorded. Start driving or turn off the engine. |

*Table 5: Cello Announcements*

The DFD supports the following languages:

- English
- Spanish
- French
- Russian
- Hebrew
- Moroccan Arabic
- Swedish
- Polish
- German
- Turkish
- Chinese

# 4 Mechanical Attributes

The DFD is a compact and aesthetical device with approximate dimensions of 75mm x 45mm x 20mm (2.95’ x 1.77’ x 0.8’). It can be installed using screws or double-sided adhesive on any vertical or horizontal surface on the dashboard.

The DFD is made of standard automotive materials and should be able to sustain the same vehicular and environmental conditions applicable for the tracking device itself including vibration, temperature, exposure to direct sunlight, etc.

*Figure 3: DFD Mechanical View*

# 5 DFD Functions

- The DFD performs a self-test upon powering up and provides a visual indication of this ongoing process to the driver.
- The DFD provides indication for system readiness and proper connectivity to the main device (Cello).
- Lack of connectivity or an identified error is clearly signaled on the system LED of the DFD.
- The DFD optionally provides a verbal indication to the driver that their driving is being monitored.
- The relative amplitude of the G forces sensed by the system is presented at any time on the color LED bar, with a minimum refresh rate of 5Hz.
- Detected aggressive driving, speeding, idling or other supported maneuvers is indicated by a visual and/or verbal alert (configurable).
- A registered event is designated by all or a subset of the following indications:
  - Typical tone followed by verbal message announcing the type of violation
  - Turning on the applicable maneuver icon concurrently with turning on the applicable severity level (Green / Yellow / Red) on the LED array for two seconds
- Whenever possible, a warning will be first delivered in order to allow the driver to correct their unsafe / wasteful driving behavior. Only if a correction does not happen within the granted grace period, a violation will be registered by the system.

# 6 Configuration

Every function mentioned in this document can be controlled by the Cello itself, including but not limited to:

- General operation on/off – whether the display is enabled or disabled
- Voice level and/or mute
- Tone / verbal messages on/off
- LED array visual indications on/off
- Icon array visual indications on/off
- Driver identification feedback enabled/disabled
- Applicable maneuver severity level to warn/report

## 6.1 Customization

The DFD branding label and announcements can be customized to fit the specific operational requirements of the service provider. The customization process is defined in the *DFD Customization* document.

# 7 DFD Specifications

| | |
|---|---|
| **Interfaces** | |
| COM1 Port (RS232) | True RS232 Levels<br>8 bit; 1 Stop Bit; No Parity, 115200 BPS.<br>Proprietary Serial Protocol |
| Connectors | 4 pin connector: GND, Power Supply, RS232 TX, RS232 RX |
| **Power** | |
| Input Voltage | 7-32VDC |
| Power consumption | Hibernation: 760uA at 12 V<br>Operational : up to 5.4 W assuming all LEDs are illuminating |
| **Display** | |
| Led Array | 12 white LEDs |
| **Audio** | |
| Recorded messages | 128Mbytes SDCARD holding voice recordings. |
| Loudspeaker | 1W |
| Recording Format | Sampling rate: 16Khz<br>Encoding: Signed 16 Bit PCM<br>RAW data file format. |
| **Environment** | |
| Temp, operating | -15°C to +65°C full performance |
| Temp, storage | -20°C to +85°C |
| Humidity | 95% non-condensing |
| Protection | IP40 |
| **Certifications** | |
| FCC | Part 15 Subpart B, part 22/24 compliant |
| CE | CE EMC & R&TTE according to 89/336/EEC or 1999/5/EC<br>CE Safety EN60950-1:2001+A11:2004<br>Automotive Directive 2004/104/EC (E-Mark) |
| IC | Industrial Canada |

| Mechanical Attributes | |
|---|---|
| Dimensions | ~ 73 x  47x 18.6  mm |
| Weight | ~ 62 grams |
| Stand | Manually adjustable view angle with screw |
| Mounting | Double-sided adhesive tape or screws |
| Cable | 4 wires, 28 Gauge, 30 cm long |
| Connector | 4 Pins, 2.54 mm Pitch, Single row |

*Table 6: DFD Specifications*