Cello Inputs
Integration Manual

Version 1.0

Revised and Updated: August 15, 2011

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1 Introduction

1.1 Overview

This document describes in full the six inputs provided by Cellocator Cello units and the various configuration parameters applicable to each:

- **Ignition**
- **Lock**
- **Unlock**
- **Panic**
- **Door**
- **Shock**

1.2 Abbreviations

Abbreviation	Description

1.3 References

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

#	Reference	Description
1.		
2.		
3.		

1.4 Revision History

Version	Date	Description
1.0	13/05/2011	Tech Writer edit

2 General Description

Cellocator units provide 6 inputs; the hardware of all those inputs varies from pulled up, pulled down, wet (not equipped with 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 effect unit's logic (such as Ignition and Door)

Each input (except Ignition) has a configuration field, enabling you to set up its type and other attributes, such as 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

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)
Lock[1]	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)

[1] The provided values are valid for Cello hardware A04 and above. If you own older hardware versions, please contact our technical support for further information concerning the highest possible zero detection value.

The table below provides threshold translations from the programmed value into voltage on interface pin[2].

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
244-255	1.85v (in range value protection)

[2] Measurement error ±20mv

2.1 Ignition

Ignition input cannot be used as a general purpose input; it is used only for detection of a journey's Start and Stop, which are key events in the unit's logic and require unique treatment.

For example: the system will enter hibernation mode between the journey's Stop and journey's Start, and will start generating periodical events between the journey's Start and journey's Stop.

Therefore, in addition to the "Common Discrete Inputs Time Filter" that is applied to every input, the Start/Stop Alert Generation Time Filters are also applied.

2.1.1 *Reporting Journey Start*

Address: 126, bit 5 for event

130, bit 5 for distress

488, bit 5 for HRLS

Description: If this bit is set the unit will generate a corresponding alert upon Journey Start detection.

Default Value: Event enabled (1), Distress and HRLS – disabled (0)

2.1.2 *Reporting Journey Stop*

Address: 124, bit 5 for event

128, bit 5 for distress

486, bit 5 for HRLS

Description: If this bit is set the unit will generate a corresponding alert upon Journey Stop detection.

Default Value: Event enabled (1), Distress and HRLS – disabled (0)

2.1.3 *Inverting Ignition Input*

Address: 100, bit 5

Description: Ignition input is internally pulled down and therefore does not require an inversion in most cases.

Once inverted:

- The "high" level of signal on this input will be treated as logical "0", Journey Stop detection.
- The "low" level of signal as well as floating state on this input will be treated as logical "1", Journey Start detection.

Default Value: (0) not inverted

2.2 Lock / Unlock / Panic

This input is equipped with an internal pull up resistor and therefore can only serve as a discrete dry contact.

2.2.1 *Inverting Lock/Unlock/Panic Input*

Description: Lock/Unlock/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 the threshold programmed in the parameter above) on this input will be treated as logical "1" (active).
- The "high" level of signal, as well as the "not connected" state on this input will be treated as logical "0" (not active).

Default Value: (1) inverted

2.2.2 *Threshold for Lock/Unlock/Panic Input*

Description: This threshold defines the highest voltage on this input, which is still 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 continually samples voltage on this input and compares the average measurement (refer to the 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 the default (200).

Default Value: 200 (1.85V)

2.2.3 *Averaging Factor for Lock/Unlock/Panic Input*

Description: The unit continually samples 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 determine the logical level of the input.

NOTE: In the operational modes listed below, the unit ignores averaging factors and processes each measurement sample separately:

a) In Full Hibernation mode, including the Modem/GPS On Time

b) In Signal Correlation Mode (applicable in security builds only)

Default Value: 10 samples

2.2.4 *Reporting Signal Falling On Lock/Unlock/Panic*

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level falling from 1 to 0. If this input is inverted, it will mean the generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

2.2.5 *Reporting Signal Rising On Lock/Unlock/Panic*

Description: If this bit is set the unit will generate a corresponding alert upon detection of logical level rising from 0 to 1. If this input is inverted, it will mean the generation of the alert upon connection of this input to (-).

Default Value: zeros – disabled (0)

2.3 Door / Shock (Multipurpose inputs)

2.3.1 *Door/Shock Input Type*

Description: This input is equipped with a pair of internal resistors, which can be programmed into pull up, pull down or even canceled. Therefore the input can serve as digital or analog input of the types described in the following table, 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
5-7	Reserved

Default Value: zero - Discrete Dry Contact

2.3.2 *Function assigned to Door / Shock input*

Description: This field enables the assigning of certain functionality to a Door / Shock input.

0	Use as a GP input (default)	
1	Use as a GP frequency meter (refer to Frequency Metering Section in the Programming Manual)	Only compatible to Type 4 (Frequency meter)
2	Use as a Speed source (refer to Frequency Metering Section in the Programming Manual)	
3-31	Reserved	

Default Value: zero – GP input

2.3.3 *Scaling Factor for Frequency report on Door / Shock input*

Description: Applicable only if Door / Shock is selected as input types 4. The scaling factor is intended to be used for conversion of the measured frequency into common unit of speed (cm/sec) if 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 the Programming Manual).

Stored value of Scaling Factor (Sf * 1000)	
First Configuration Byte (MSB)	Second configuration byte (LSB)

2.3.3.1 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.

2.3.3.2 In case of GP pulse frequency counter (Input's type 4, Assigned function 1):

The scaled value of the measurement is 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 a 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

2.3.4 *Thresholds on Door / Shock as a General Purpose Frequency counter*

Description: This parameter defines the minimum, maximum or range (as per the configuration byte) thresholds for frequency measurement on Door / Shock GP Frequency measurement inputs. 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.

The threshold is applied on General Purpose Pulse Measurement input only.

2.3.5 *Time Filter for Door / Shock*

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)

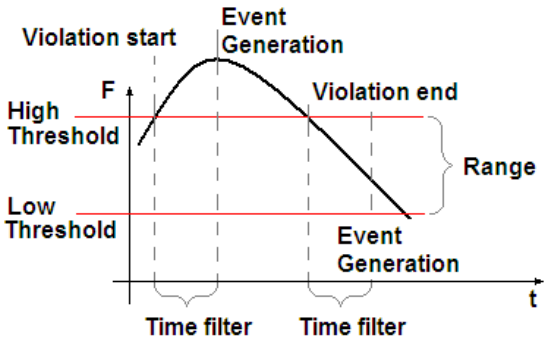
2.3.6 *Door / Shock freq. input violation type*

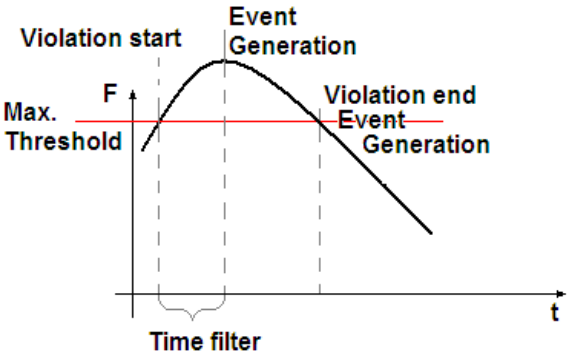
Description: This parameter defines the violation type as follows:

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 the type of the violation: threshold or range. If threshold type is selected, bit 0 defines 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.





2.3.7 *Threshold for Door / Shock Input*

Description: Applicable only for discreet types (wet and dry). This threshold defines the highest voltage on this input, which is still 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 voltages for wet and discrete types.

The unit continually samples voltage on this input and compares the average measurement (refer to the 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 the default (125).

Default Value: 125 (1V)

2.3.8 *Averaging Factor for Door / Shock Input*

Description: The unit continually samples 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 (see the previous parameter) in order to determine the logical level of the input.

NOTE: In Full Hibernation mode the unit ignores the averaging factor and processes each measurement sample separately.

Default Value: 10 samples

2.3.9 *Inverting Door / Shock Input*

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 the threshold programmed in the 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

2.3.10 *Reporting Signal Falling On Door / Shock*

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. If this input is inverted, it will mean generation of the alert upon disconnection of this input from (-).

Default Value: zeros – disabled (0)

2.3.11 *Reporting Signal Rising On Door / Shock*

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. If this input is inverted, it will mean generation of the alert upon connection of this input to (-).

Default Value: zeros – disabled (0)

2.4 Additional Important Input Related Parameters

2.4.1 *Common Discrete Inputs Time Filter*

Address: 136

Description: This parameter is aimed to protect the unit's input from noise influence and defines the time from the input's level change to the event trigger.

Data format: 8-bit unsigned, Resolution 10 msec

Value span: 00h to FFh

Default value: d10

2.4.2 *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

2.4.3 *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: Disable Logical

2.4.4 *Analog (and Frequency[3]) inputs in OTA message*

Address: 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 to the monitoring of analog inputs in a few different message types. These bytes can contain measurement from the different fields as per the following table.

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

[3] Frequency counters are supported from FW30c

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	
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	9	Default for byte 26 of OTA Message 0