

CR400

Product Overview





Cellocator Division
Polaris Telemetry Ltd.

Proprietary and Confidential

Version 1.0

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FCC & IC Compliance Statement

The FCC Wants You to Know

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- a) Reorient or relocate the receiving antenna.
- b) Increase the separation between the equipment and receiver.
- c) Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.
- d) Consult the dealer or an experienced radio/TV technician.

CAN ICES-3 (B) / NMB-3 (B)

This Class B digital apparatus complies with Canadian ICES-003.
Cet appareil numérique de classe B est conforme à la norme canadienne ICES-003.

If shielded cables were used for testing include:

<<< In order to maintain compliance with FCC regulations, shielded cables must be used with this equipment. Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. >>>>

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Part 18 warning

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For devices approved under Part 18, information on the following shall be provided to the user in the instruction manual, or on the packaging if an instruction manual is not provided (Section 18.213)

- The interference potential of the device or system.
- Maintenance of the system.
- Simple measures that can be taken by the user to correct interference.
- For RF lighting devices, provide an advisory statement, either on the product packaging or with other user documentation, similar to the following:

“
This product may cause interference to radio equipment and should not be installed near maritime safety communications equipment or other critical navigation or communication equipment operating between 0.45-30 MHz.
”

Variations of this language are permitted provided all the points of the statement are addressed, and may be presented in any legible font or text style.

Appendix C1 - Modification statements

FCC Warning (Modification statement)

Modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment under FCC Rules.

Or

Powerfleet has not approved any changes or modifications to this device by the user. Any changes or modifications could void the user's authority to operate the equipment.

ISED Warning (Modification statement)

Augury n'approuve aucune modification apportée à l'appareil par l'utilisateur, quelle qu'en soit la nature. Tout changement ou modification peuvent annuler le droit d'utilisation de l'appareil par l'utilisateur.

Appendix C2 - RF Exposure Warnings

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Interference statement (if it is not placed in the device)

This device complies with Part 15 of the FCC Rules and Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause interference, and (2) this device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Wireless notice

This device complies with FCC/ISED radiation exposure limits set forth for an uncontrolled environment and meets the FCC radio frequency (RF) Exposure Guidelines and RSS-102 of the ISED radio frequency (RF) Exposure rules. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Le présent appareil est conforme à l'exposition aux radiations FCC / ISED définies pour un environnement non contrôlé et répond aux directives d'exposition de la fréquence de la FCC radiofréquence (RF) et RSS-102 de la fréquence radio (RF) ISED règles d'exposition. L'émetteur ne doit pas être colocalisé ni fonctionner conjointement avec à autre antenne ou autre émetteur.

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General Description of installation

device installed under the dashboard in defied location.

The distance between user and products should be no less than 20cm

La distance entre l'utilisateur et de produits ne devrait pas être inférieure à 20cm

Installation of device under Dashboard behind steering wheel:



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1 Introduction

The purpose of this document is to describe the features and capabilities of this new platform of CR400 LTE product, and is intended for product, marketing, support and sales teams of Cellocator partners, integrators and service provider customers.

1.1 Document Scope

The document describes the high-level system features and capabilities of the CR400 New Platform. This document does not deal with the protocols and interfaces between the CR400 device and the SW backend, nor with the low-level algorithms, state machines and logic engine implemented in order to deliver a complete remote diagnostics and enhanced driver behavior system. These protocols, APIs, algorithms, and state machines are described in separate documentation, as listed in the following sections.

1.2 Definitions, Acronyms and Abbreviations

Name	Description
CR400	Cellocator's mid end fleet management solution based LTE modem

Table 1 – Definitions, Acronyms and Abbreviations

1.3 References and Bibliography

No.	Document Name
1	Cellocator Cello Programming Manual
2	Cellocator Wireless Communication Protocol
3	Cellocator Serial Communication Protocol
5	Cellocator Programmer Manual
7	Evaluation Manual
8	Cello Family Hardware Installation Guide

Table 2 – References

1.4 List of Changes

Version	Change	Remarks	Date Approved
1.0	First Draft		27.2.2020

Table 3 – List of Changes

2 System Overview

2.1 General

The Cellocator CR400 is Cellocator's mid-level unit for the CR platform, and is based on the Telit xE910 LTE CAT M1/2G modem family.

The intended market for the CR400 is Track&Trace and security applications.

The CR400 is based on the CR300B code base. Several features and improvements have been added to the product, as detailed in this document. The CR400 supports all available maintenance and debugging (excluding external debug line) features as at CR300. In addition, the CR400 is equipped with a built-in BLE 5 and Cellular and GNSS LEDs indications.

In addition, the C400 now includes driver behavior logic.

2.2 Hardware

The CR400 includes the following components:

- ✦ **HW variants:**
 - CR400 LTE
- ✦ **SIM Holders:**
 - Nano SIM or eSIM
- ✦ **Cellular GNSS:**
 - Telit ME910-C1 Cat M1/2G WW + GNSS
- ✦ **Backup battery:** 1000mAh
- ✦ **1-wire** port (Dallas) for Driver-ID
- ✦ **1 wire interface** supports power for one temperature sensor
- ✦ **Memory** supporting 5000 logged events
- ✦ **Accelerometer** for Motion sensor
- ✦ **Ignition** input
- ✦ Two multipurpose **GPIOs** supporting digital/analog/frequency input
- ✦ Two **digital outputs** (open collector)
- ✦ **Gradual immobilizing** as one of the outputs (LEDs or Lights output)
- ✦ **RS232** Serial port for programming
- ✦ **2 LEDs** indication (Cellular, GNSS)
- ✦ **10-pin** main connector

2.3 System Narrative

The CR400 fulfills the following objectives:

- ✦ It addresses the evolving fleet management market, which is trending towards Track & Trace (AVL), Stolen Vehicle Recovery (SVR) and Anti-theft.

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- It keeps pace with industry standards of communication technologies, location finding sensitivity and accuracy, and jamming immunity via advanced Cellular and GPS/GNSS engines.

3 Feature Improvements

3.1 Two Multipurpose GPIOs

The CR400 supports two multipurpose GPIOs that support digital/discrete analog.

NOTE: When connecting 12V to a GPIO programmed as output, the port is likely to be damaged. Therefore, when programming the port as output, first validate that no voltage is connected.

In addition, there is no ability to test the output capabilities on the programmable GPIO.

CR400 – Plug Pinout Functionality						
Plug Pins	Pin Name	Pins Configurable Functionality. "*" Defines: Applicable by HW for selection by PL.				
		Analog Input	Digital Dry Contact Input	Digital "Wet" Input	Frequency Input	Output (Sink)
2	LED/ Lock		*			*
3	Lights/ Unlock		*			*
4	Ignition	*				
5	Doors	*	*	*	*	
9	Shock	*	*	*	*	
1	Main Power	POWER				
6	Main GND	GND				
7	RS-232 Tx	RS-232 Port				
8	RS-232 Rx					
10	1-Wire	1-Wire Interface				

Table 4 – Pinout Scheme

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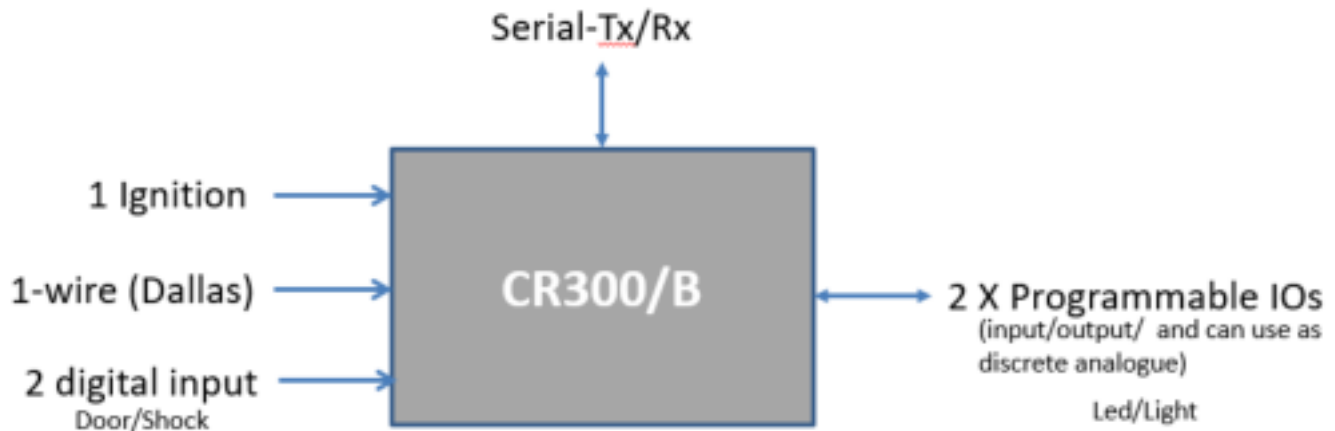


Figure 1 – IOs

3.2 Modem FOTA

Addition to Cellocator's FW OTA, also the Modem FOTA (FW over the air) process is available. The modem downloads a new FW file, and upgrades its own FW.

This feature is important in cases where a new modem FW is released or in cases when malfunctions are discovered in the modem (caused by the modem FW).

Upgrading the modem FW can only be managed by Cellocator CS.

3.3 Feature Authentication Codes

For dedicated customer projects, the "Feature Authentication Codes" option in the Programmer enables you to activate those special development projects into one source code with a "clean" PL that doesn't include non-relevant parameters.

In the Programmer, the code activation is entered in a dialog box (accessed via a toolbar button, as indicated below).



When connecting the Cello unit to the Programmer serial port for the first activation, you should click on the "Feature Authentication codes" toolbar icon and enter the code that was sent from Cellocator CS. By entering this code, the automatic relevant feature will be activated and the relevant PL folders are displayed, which will be activated for any connected device.

This feature is also supported OTA, so devices already in the field which are upgraded to a new version will also get this activation feature. For this purpose, a secured API/protocol to send the activation code to the device via the customer's backend was developed.

3.4 Jamming Detection while Ignition is ON/OFF

FW v43m includes the addition of advanced jamming detection (configurable). This feature builds a logic relationship between jamming detection and ignition reaction.

Case	Jamming	Ignition	Action
1	Yes	Off	Activate the immobilizer output (i.e. Immediate, Nested, Gradual) while monitoring jamming for a predefined duration (default: 10 seconds).
2	Yes	On	Activate the immobilizer output (i.e. Immediate, Nested, Gradual) while monitoring jamming for a predefined duration (default: 15 minutes).
3	No	On/Off	Deactivate the immobilizer output after no jamming detection for a predefined period of duration (i.e. 10 minutes). The unit notifies in the first communication that jamming was detected.

Table 5 – Jamming Detection Logic

3.5 Basic Satellite Activation

Basic Satellite Activation enables the use of an alternative satellite communication channel when the GPRS network is unavailable.

The functionality enables the turning on of the satellite modem power when the CR400 unit is out of GPRS coverage, and to switch back to GPRS when GPRS communication is once again available.

3.6 Crash Detection Feature

The unit's accelerometer is used as a source for crash detection and reporting.

The feature includes two separate RMS-based thresholds, one for a light crash and one for a heavy crash.

The detection will not be possible when in full-hibernation mode (ignition is OFF).

Note that the light crash detection requires the unit to be installed horizontally for gravity to be eliminated.

3.7 Driver behavior

The following driver maneuvers will be monitored:

- Harsh acceleration
- Harsh braking
- Harsh turn
- Over speeding

- Accident detection

For each of the above mentioned harsh maneuvers, the system shall provide two configuration parameters:

- Threshold in G for maneuver detection
- Threshold in Seconds for Minimum length of maneuver to be considered valid

3.8 Enable/Disable IP Up

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 where the SIM card is associated with a static IP, it is possible to cancel IP up events.

3.9 RTC from the Network

This feature enables you to get RTC from the network for devices that are fixed and located underground.

3.10 Dallas Identifier in Ignition Off

This feature enables you to also get driver identification from the Dallas in Ignition Off mode.

3.11 1-Wire Temperature Sensor Measurement Event TR Change

In the wireless protocol, the Transmit Reason of '1-wire temperature sensor measurement event' was changed to 12 (instead of 10). The sub reasons are as follows:

- 0 – High 1-Wire Temperature Sensor Measurement
- 1 – Low 1-Wire Temperature Sensor Measurement

3.12 Tilt Tamper

Tilt Tamper logic measures the orientation (by earth gravity) on each axis and changes that breach the configured angle threshold. When compared to the steady state for a longer time than the configured time threshold, the unit will report it.

3.13 Cell ID for LTE variant (Modem Telit ME910C1-ww)

The following data related to LTE Cell ID will be sent as type 9:

Black – Cat. M1 & 2G unless specified otherwise

Blue – 2G Only

Network Time & Date

Serving Cell: MCC, MNC, TAC/**LAC**, Global Cell ID, Physical Cell ID(not in 2G), RSRP, ACT

Neighbors Cells: Neighbors Count (0-6), **MCCs**, **MNCs**, **LACs**, **Global Cells IDs**, **RSRPs**, **ACTs**

Acronyms:

ACT – Access Technology (2G/Cat. M1)

RSRP - Reference Signal Received Power

LAC – Localization Area Code

TAC – Tracking Area Code

MCC – Mobile Country Code

MNC – Mobile Network Code

3.14 Overriding Operational Mode for Charging Activation

This is a new PL flag that allows the activation of charging, irrespective of the operational mode.

3.15 Delay Modem-on capability

This feature was developed for scenarios where a thief checks if a specific vehicle is equipped with a transmitting security unit by activating a GSM detector when the vehicle owner starts (Ignition On) the vehicle. If a thief successfully collects GSM transmissions (meaning a unit is installed in the car), the thief knows the transmission unit has to be removed before attempting to steal the vehicle.

To avoid these scenarios, the following logic was implemented:

When the car is started (Ignition On), the unit functions according to its standard logic, except for the modem which stays off (regardless of the unit mode before Ignition On).

The modem is switched on after expiration of a timer, which is measured from the Ignition On filter expiration (but when no Start event was transmitted). This timer is configurable via the "Modem On Delay Timer" parameter.

3.16 RSSI in Type 0

The RSSI is reported by the modem within the response to Cell ID querying, which is performed every 1 minute.

Two options were added in order to receive RSSI data:

- The OTA protocol provides four bytes in Type 0 messages, which are dedicated for the monitoring of analog inputs in a number of different message types. These bytes can contain measurements from the different fields as per the configuration. This feature added the RSSI data to the configurable measurements described above.
- The ability to always receive Cell ID sub-data with any event (Type 0), unconditionally.

4 Release Package Content

4.1 Evaluation Suite

The Cellocator Evaluation Suite Manual is a comprehensive guide that provides information required to run an initial appraisal and testing process of Cellocator units, without requiring connection to an actual vehicle during testing.

The Cellocator Evaluation Suite contains a complete set of components that simplifies bench testing of the system and serves as a demonstration platform for people wishing to understand the operational aspects of the system. The Suite is also intended to facilitate the development of interfaces to the Cellocator system by integrators or service providers.

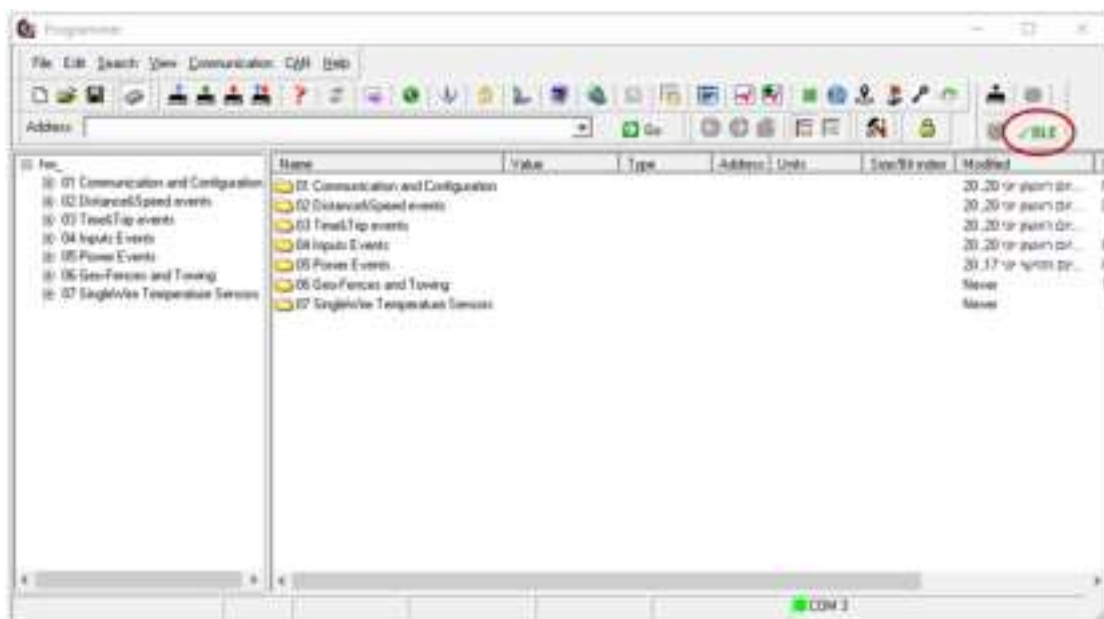
4.1.1 Cellocator Programmer

The Cellocator Programmer enables you to perform the following:

- Modify a PL file to suit your communication needs.
- Upload and download PL files to Cellocator units via its serial interface.
- Test and debug units using a variety of features, including a platform manifest, the ability to test a unit's inputs and outputs, and the ability to forward data to a wireless channel.

The Cellocator Programmer is mainly used for the initial configuration of a unit, and typically communication settings such as the destination IP address, target port phone, and SMS numbers.

Addition bit enable was added to Cellocator Programmer interface to control on BLE activation. You can enable/disable the BLE interface from it:



For more information, refer to the *Cellocator Programmer Manual*.

4.1.2 Communication Center

The CR400 supports the use of the Communication Center tool. The Communication Center performs the following:

- Receives, parses and monitors GPRS and SMS messages.
- Sends commands through GPRS or SMS communications.
- Interrogates the unit in order to get the current location (in text format) and the unit status (inputs, outputs, GPS data, etc.).
- Receives and monitors emergency transmissions from the unit (input triggering).
- Controls the unit's outputs. Programs the unit's behavior OTA (by changing the unit's EEPROM content).
- Upgrades the unit firmware.

For more information, please refer to the *Cellocator Evaluation Suite Manual*.

4.2 Cellocator+

The Cellocator+ System is a web-based application that enables Cellocator customers to perform configuration and firmware updates to Cellocator devices and view the status of these updates in real time and through reports via an intuitive interface.

The Cellocator+ System supports customers wishing to directly view and modify their device information. The user can request displays of device data and status and configuration management, and can perform configuration updates by attaching PL (Programming Library) files or firmware versions to a device or set of devices while the system manages the programming session.

The Cellocator+ System has a number of important features and benefits, including:

- Provides Cellocator customers with all major provisioning tools at the click of a mouse.
- Eliminates the need of all customers to maintain provisioning tools in their systems.
- Reduces time to market for new customers.
- Provides reports on update history (to be implemented in future versions).
- Cellocator+ manages the whole device management process.
- Customers can view update statuses in real time through the Web.

4.3 Integration Package

The Cellocator Gateway is a set of SW components offered to Cellocator customers wishing to integrate the Cellocator OTA protocol into their production environment.

Customers using Cellocator Gateway benefit from a quicker and easier integration process, and are also entitled to software upgrades, technical support and more. Cellocator Gateway is a multi-platform solution and can run on Windows or selected Linux OS. The integration package provides high availability and load balancing options, as well as enabling clients the opportunity to integrate and start working with Cellocator units without investing a large amount of time and resources.

5 CR400 Hardware Components

The CR400 hardware components are listed in the table below.

Name/Part Number	Description	Picture
CR400 LTE PN: CT7801216-000	<p>Mid-level fleet device.</p> <p>Telit ME910C1-WW Combo Module (GNSS + Modem) LTE Cat.M1/2G</p> <p>HW44.</p>	
<p>Ten wire mold main Harness</p> <p>PN: 711-00412</p>	<p>10 wire harness, which supports all CR400 interfaces (inc. serial port)</p>	
<p>Simulation harness</p> <p>PN: 711-00413</p>	<p>CR400 Vehicle Simulator Harness</p>	
CR400 Evaluation Kit PN:	<p>Evaluation Kits</p>	

Table 6 – CR400 Components

6 Documentation

The product is supported by set of documents including Evaluation, Integration and Installation manuals, Protocols description, programing reference etc. For more information, refer to the documents listed in section 1.3.

7 Technical Specifications

Cellular Communication	
Supported Technologies & Bands	LTE Dual mode CAT M1 with 2G Fallback, World Wide Support. CAT M1: B1,B2,B3,B4,B5,B8,B12,B13,B18,B19,B20, B26, B28. 2G: B2(1900), B3(1800), B5(850), B8(900)
Data rates	LTE Cat M1: Uplink, up to 375 kbps, Downlink, up to 300 kbps EGPRS (2G Fallback):Uplink, up to 236 kbps, Downlink, up to 296 kbps
Maximum RF Power Output (dBm)	<ul style="list-style-type: none"> • (LTE) CAT-M1: 23±2 (Class 3) • GSM850, GSM900 - GPRS (GMSK): 33±2 (Class 4) • GSM850, GSM900 - EDGE (8PSK): 27±2 (Class E2) • DCS1800, PCS1900 - GPRS (GMSK): 30 ±2 (Class 4) • DCS1800, PCS1900 - EDGE (8PSK): 26 ±2 (Class E2)
SIM Card Compatibility	Nano SIM, eSIM is Applicable per specific order customization.
Antenna	Internal
Packet Data	TCP/IP, UDP/IP
SMS	PDU
Local Communication Interfaces	
BLE	Secure BLE 4, Wireless Connectivity, with PC & Smartphones. BLE 5 Ready (Future Firmware Update).
RS-232 Port	Wired Serial Communication. 9600 bps or 115000 bps, 8 bit; 1 Stop Bit; No Parity. May be used for Configuration Update / Firmware Upgrade.
1-Wire™ (Dallas port)	DS1990A, DS1971 compliant for driver management. Extended bus current source with 7mA driving capability. DS18B20 compliant for temperature sensors.
GNSS (GPS+GLONASS)	
Sensitivity (Tracking)	-161 dBm
Acquisition Average TTFF	Cold 32 Sec; Warm 21 Sec; Hot <1 Sec
Antenna	Internal Antenna
Configurable Discrete Inputs / Outputs	
Connector Pin 2 (LED/Lock)	<ul style="list-style-type: none"> • When configured as Dry Contact Input: Contact Sink to GND. • When Configured as Output: Open Drain Sink Output.

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	<ul style="list-style-type: none"> ○ ON & Loaded: 250 mA max (assignable functionality by configuration)
Connector Pin 3 (Lights/Unlock)	<ul style="list-style-type: none"> • When configured as Dry Contact Input: Contact Sink to GND. • When Configured as Output: Open Drain Sink Output. <ul style="list-style-type: none"> ○ ON & Loaded: 250 mA max (assignable functionality by configuration)
Connector Pin 4 (Ignition)	Ignition Switch signal Analog Input: *0V–32V range. (assignable functionality by configuration)
Connector Pin 5 (Doors)	<ul style="list-style-type: none"> • When configured as Analog Input: 0V-30V DC range. • When configured as Dry Contact Input: Sink to GND. • When configured as Digital “Wet” Input: 0V-30V VDC range, Configurable Threshold. • When configured as Frequency Counter: 0Hz-5kHz range@ configurable Amplitude. (assignable functionality by configuration)
Connector Pin 9 (Shock)	
Internal Analog Input	Vehicle Power Voltage monitoring (assignable functionality by configuration)
Internal Analog Input	Internal Regulated, System Power Voltage monitoring. (assignable functionality by configuration)
Accelerometer	
Internal	3D, 16g range, 12 bit representation, 1mg resolution
Display	
LED Indicators	GNSS Status LED & Cellular Connectivity Status LED. Operates only during installation and shuts off after installation completion.
Connector	
1	10 pin connector.
Power	
Input Voltage (Vehicle Power)	*9-32 VDC

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Unit's Current Consumption, 12V Power Installation.	<p>Average Current Consumption when BLE is On and battery is full:</p> <ul style="list-style-type: none"> • During Timed GPRS Sessions: 44.5mA • Idle GPRS Session: 21mA • Hibernation: 3.8mA <p>Average Current Consumption when BLE is Off and battery is full:</p> <ul style="list-style-type: none"> • During Timed GPRS Sessions: 40mA • Idle GPRS Session: 19.5mA • Hibernation: 2.3mA <p>Maximum Current Consumption Peak: 1.5A (both outputs loaded to maximum)</p>
Internal Backup Battery	<p>Rechargeable Li-Ion Polymer, 3.7V, 1000mAh.</p> <p>Battery Protections: Temperature, Voltage and Current.</p> <p>Applicable Discharge Temperature: -20°C to +60°C.</p> <p>Applicable Charging Temperature Range: 0°C to +45°C.</p>
Vehicle Environment Immunity	
Immunity	<p>Compliant with ISO 7637 till test level #4 (In accordance with E-mark directive)</p>
Applicable Environmental Conditions	
Operating Temperature	-30°C to +70°C full performance (External Power)
Storage Temperature	-20°C to +45°C
Humidity	95% non-condensing
Protection	IP40 (Upgradable to IP 66 with added protector accessory)
Climatic, Vibration, Impact	ISO 16750
Vehicle Installation Methods	
Mounting	Tie-Wraps and/or Double-Sided Adhesive Tape
Certifications	
FCC	Part 15 Subpart B, part 22/24 compliant
PTCRB	All Applicable Bands
CE	<p>Radio Equipment directive (RED) 2014/53/EU</p> <p>CE EMC Article 3.1(b) Electromagnetic Compatibility</p> <p>CE Radio Article 3.2 Effective Use of Spectrum</p> <p>CE Safety Article 3.1(a) Health & Safety</p>

CR400 LTE Product Overview



	Automotive Directive 2004/104/EC (E-Mark)
IC	Industrial Canada
1-wire temperature sensor ratings EN12830	<p>Suitability: T</p> <p>Climatic environment:</p> <ul style="list-style-type: none"> • w/o CR Protector – B • with CR Protector – D <p>Accuracy class:</p> <ul style="list-style-type: none"> • (-10)°C to (+85)°C - 1 • <(-10)°C, > (+85)°C - 2 <p>Range: -55°C to +125°C</p>
Environmental Protection	
RoHS	Directive 2011/65/EU, including Directive (EU) 2015/863 amendment.
Conflict Minerals Law	Production Conformity with U.S. Conflict Materials provisions of the Dodd-Frank Wall Street Reform and Consumer Protection Act, HR 4173, Section 1502 (Conflict Minerals Act).
Dimensions and Weight	
Dimensions	90.8 x 70.5 x 22.9 mm
Weight	130gr (unpacked, without harness, battery included)
Harness	
P/N: 711- 00412	Full harness, including RS-232 serial communication plug.

Table 7 - Technical Specifications