CEX Hardware Manual

Release 2.0/1.1

Embention Sistemas Inteligentes, S.A.

2026-11-19

Contents

Scope of Changes 4
Introduction 5
- Wiring Optimization 5
- Extended I/O 6
- Applications 6

Quick Start 7
- System Layout 7
- Basic Connection Diagram 7
- Warnings 8
- Requirements 8

Technical 9
- Features 9
- Mechanical Specifications 9
  - Dimensions 10
- Electrical Specifications 11
  - Power Supply 11
  - I/O Specifications 11
- Interfaces 12

Hardware Installation 14
- Pinout 14
- Harness 19
  - Dimensions 19
  - Pinout 14
    - Veronte Harness Green 68P 21
    - Dev Harness CEX 2.0 22
- CAN Assembly 23

Software Installation 25
Maintenance 26
- Preventive maintenance 26
- Software update 26

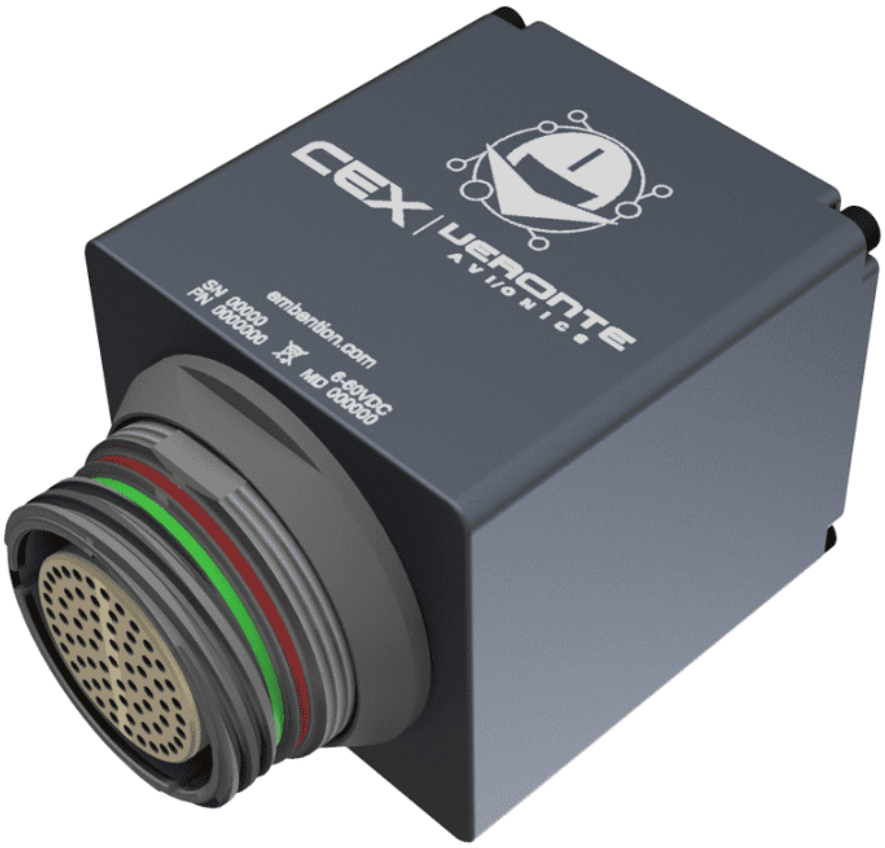
Integration examples 27
- Veronte products 27
  - Autopilot 1x connection 27

Troubleshooting 30
Forcing maintenance mode 30
Power supply 30
I2C pins 30
Acronyms and Definitions 32
Contact Data 35

Scope of Changes

- Version 1.0
  - Added:
    - First version issued
- Version 1.1
  - Removed:
    - UART reference in Extended I/O section

Introduction



CEX

CEX stands as a powerful peripheral to ease the reduction of wire in autonomous vehicles at the time it permits to increase the number of devices in the system. It makes possible to relocate and to group sensors, actuators, payloads, motor controllers... enhancing the I/O connectivity in the **Veronte Autopilot**. With its easy integration, **CEX** becomes a quick solution for increasing connectivity capacity and allowing wiring optimization, especially in large systems.

Wiring Optimization

It is especially in large vehicles, where wire optimization plays a critical role permitting a significant weight reduction. This upgrade is achieved thanks to the reduction of cable length and because of the added flexibility so the right device can be installed in the right location. Another advantage of the use of **CEX** is the robustness of the CAN Bus, being resistant to electromagnetic

interferences and permitting the installation of long cables with no signal loss. Furthermore, it includes redundancy with CAN bus isolation, making it fail operational even in case of a CAN bus line break.

Extended I/O

With the use of **CEX**, the data capacity for input and output in **Veronte Autopilots** is increased in a great manner. The advanced design makes possible to control several peripherals (PWM, Digital Output, I2C, Analog Inputs...) through the CAN Bus. It can be used for both, expanding the I/O capacity in **Veronte Autopilot**, or for controlling peripherals with a robust communications protocol. In case it is needed, multiple **CEX** boards can be installed in the same network for increasing the number of I/O ports or because of system architecture needs.

Applications

In aviation, a field where weight means such an important agent in design, struggling with wiring is one of the most common issues faced during the vehicle design. With the use of **CEX**, not only this issue would be reduced, but a bunch of opportunities for different sensors and payload could arise:

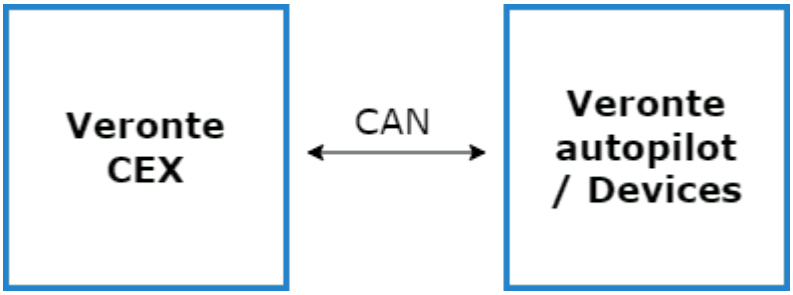
- By adding more I/O interfaces, a more complex payload control can be achieved, improving connectivity.
- Advanced control of actuators and peripherals becomes feasible, being possible to condensate the connection of control, feedback, sensors... in a single board.
- Devices can be installed at long distances from the autopilot with no signal degradation thanks to the robustness of the CAN Bus.

Quick Start

This document describes how to install and use the **CEX**, including its technical specifications.

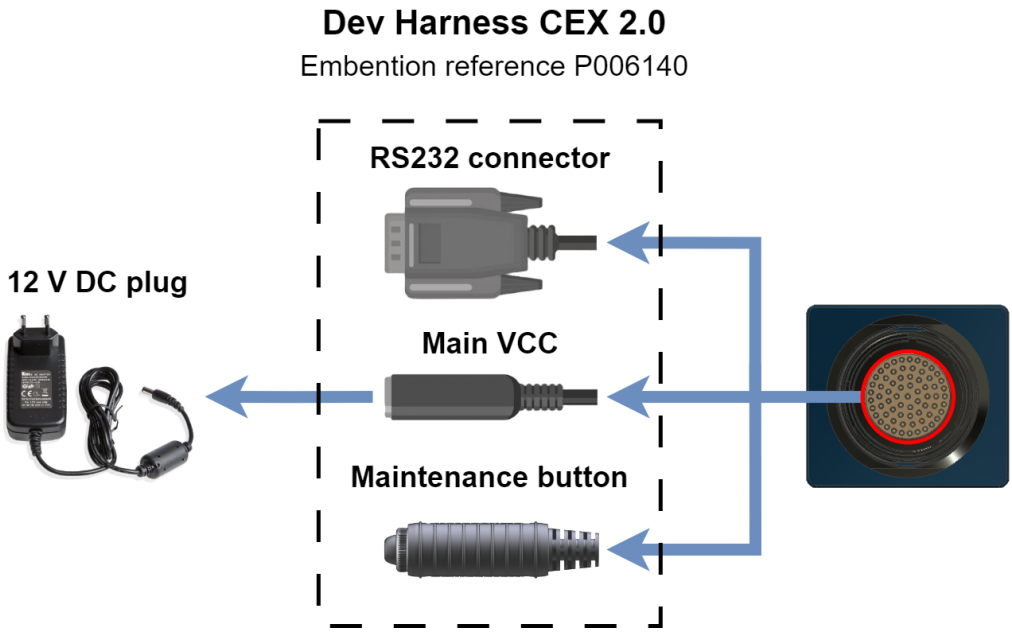
System Layout

The following image shows the standard **CEX** system layout for operation:



CEX standard layout

Basic Connection Diagram



For further information on the Dev Harness CEX 2.0 connectors, refer to the Dev Harness CEX 2.0 - Hardware Installation section of the present manual.

Warnings

- Disassembling, improper installations or bad connections may invalidate the warranty. Please contact Technical Support if you suspect a faulty or defective component.
- **CEX** will always produce heat as a by-product of its operation. Keep in mind an adequate heat dissipation on installation.
- RS-485 has internal termination resistor.
- I2C is equiped with 4.7K internal pull-ups.
- Pins 1 and 2 (see Pinout) can be powered by 2 power supplies with different voltages as they are independent. Although they do have to share the Ground.
- Not to exceed the values of any of the Electrical specification.
- **CEX** does not integrate a termination resistance in order to allow the connection of multiple **CEX** or other CAN Bus devices to the same line. To do this, visit section CAN assembly of this manual.

Requirements

- Veronte Link (v6.8.X or higher).
- CEX firmware version/CEX PDI Builder (v6.8.X or higher).
- Veronte Autopilot firmware (v6.4.X or higher).
- Veronte Updater (v6.8.X or higher).

Technical

Features

- **Communications**
  - 2x Isolated CAN buses
  - 1x ARINC 429 output
  - 5x ARINC 429 inputs
  - 1x RS485 port
  - 2X RS232 ports
  - 1x I2C port
  - Over CAN or RS232 firmware update
- **Electrical**
  - Redundant power supply input
  - Reverse polarity protection
  - ESD protection
  - Transient protection
- **Signals**
  - 8x 5V PWM
  - 9x 3.3V GPIO convertible to PWM
  - 4x 3.3V and 5V ECAPs
  - 2x 0V to 3.3V analog inputs
  - 2x 0V to 5V analog inputs
  - 2x 0V to 12V analog inputs
  - 2x 0V to 36V analog inputs

Mechanical Specifications

Weight	117 g
Operating temperature	-40 to 60ºC
	-55 to 60ºC

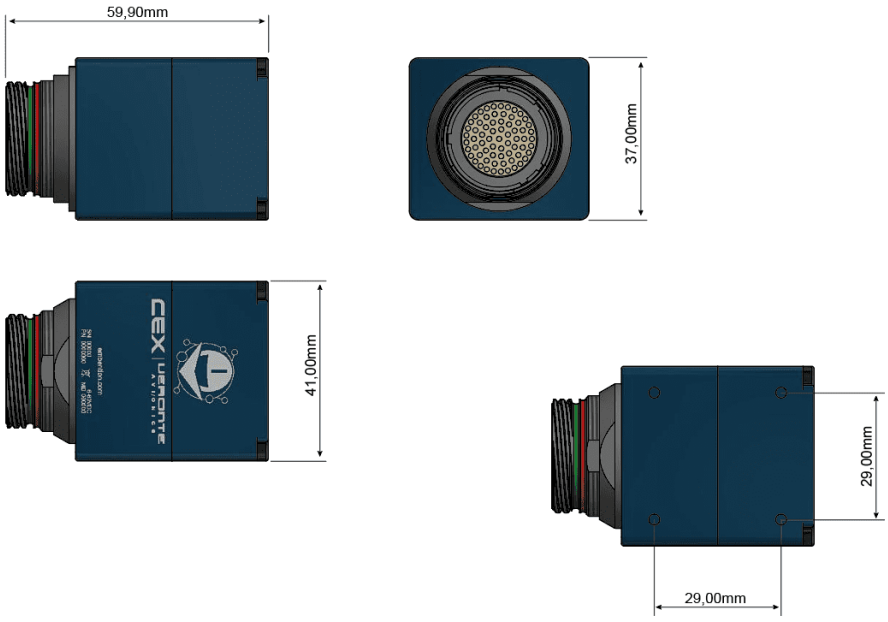
Storage temperature	
Environmental protection	IP68
Enclosure material	Anodized-Aluminium 6061-T6
Fixation	4 x M3 screws

Dimensions

CEX is provided using an anodized-aluminium enclosure with enhanced EMI shielding.

There are no navigation sensors built into the **CEX**, which means there are no restrictions on vibration isolation, location or orientation of the **CEX**.

The following figure shows the dimensions of the enclosure. The mounting holes of the enclosure are **4 mm deep** M3 threads.



CEX dimensions (mm)

Electrical Specifications

Power Supply

DC input	6.5V to 60V
Power Consumption	3.5W

I/O Specifications

Input voltage/current

- Power input: 6.5V to 60V (DC)
- Two different input voltages possible

CAN

- Complies with CAN Bus 2.0A and 2.0B Standards
- Opto-Isolated (4kV)
- Speed up to 1Mbps

RS-232

- Meets the requirements from TIA/EIA-232-F and ITU v.28 standards
- Speed up to 112.5 KHz

RS-485

- Voltage level from -7V to 12V
- Meets the requirements from ANSI TIA/EIA-485-A
- RS-422 compatible
- Speed up to 112.5 KHz

ARINC 429

- Compliance with RTCA/DO-160G, Section 22 Level 3 Pin Injection
- Voltage level from -5V to 5V

I2C

- 3.3V Signals up to 400KHz

3.3V Output

- 100 mA fuse protected

5V Output

- 100 mA fuse protected

PWM Output

- Voltage: 5V
- Current I (oh): 22mA / I (ol): -22mA
- Micro Edge Positioning (MEP) step size = 150ps

Digital Inputs (ECAP)

- Maximum voltage: 5V
- Maximum input current: 2.5mA
- Sampling rate: up to 1us

Digital Input/Output (GPIO)

- Voltage: 3.3V
- Current I (oh): 1.6mA and I (ol) = -1.6mA

Analog signals

- Input impedance: 10GOhm
- Resolution:
  - 0-3.3V pins: 0.00080V
  - 0-5V pins: 0.0012V
  - 0-12V pins: 0.0029V
  - 0-36V pins: 0.0087V

Interfaces

CEX only requires one interface connection.

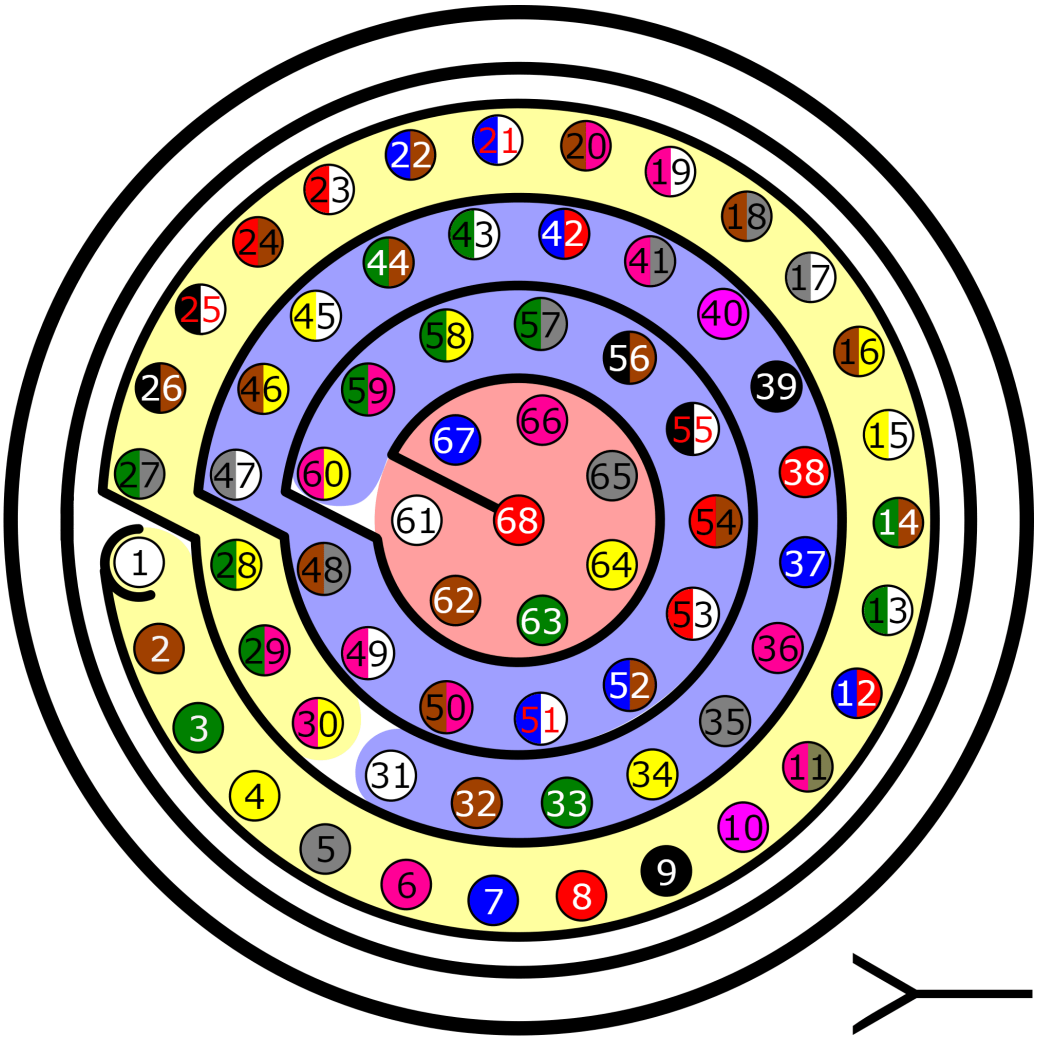
CEX Connector	Mating Connector
Connector HEH.LM.368.XLNP	Mating connector: **Veronte Connector Green 68P** (FGH.LM.368.XLCT) (Embention reference **P005653**) Mating harnesses are available on demand: • Veronte Harness Green 68P (Embention reference **P001623**) • Veronte Avionics: Dev Harness CEX 2.0 (Embention reference **P006140**)

> ⓘ **Note**
>
> Please contact sales@embention.com for more information on the different harnesses.

Hardware Installation

Pinout

The 68 pin main connector has the distribution of input/output channels as follows:



Connector HEW.LM.368.XLNP (mounted in CEX)

> ⚠ **Warning**
>
> Check the pin number before connecting. The color code is repeated 3 times due to the amount of pins. First section corresponds to pins 1-30, the second section to pins 31-60 and the third one to pins 61-68. Pin number increases following the black line of the pictures above: counterclockwise for the connector and clockwise for the plug.

PIN	Signal	Color Code	Descriptio
1	Power supply 1	White	Power supply for the main system, re
2	Power supply 2	Brown	Power supply for the main system, re
3	GND	Green	Ground for su
4	GND	Yellow	Ground for su
5	CAN (A) P	Gray	CAN bus interface. Supports data rates up to recommend
6	CAN (A) N	Pink	
7	CAN GND	Blue	Ground for CAN
8	CAN (B) P	Red	CAN bus interface. Supports data rates up to recommend
9	CAN (B) N	Black	
10	OUT RS-485 (P)	Violet	Non-inverted output fro
11	OUT RS-485 (N)	Gray - Pink	Inverted output from
12	IN RS-485 (N)	Red - Blue	Inverted input to R
13	IN RS-485 (P)	White - Green	Non-inverted input to
14	RS-485 GND	Brown - Green	Ground for RS
15	RS-232 (A) TX	White - Yellow	RS-232 A Ou
16	RS-232 (A) RX	Yellow - Brown	RS-232 A In

PIN	Signal	Color Code	Descriptio
17	GND	White - Gray	Ground for digita
18	RS-232 (B) TX	Gray - Brown	RS-232 B Ou
19	RS-232 (B) RX	White - Pink	RS-232 B In
20	I2C SCL	Pink - Brown	Clock line for I2
21	I2C SDA	White - Blue	Data line for I2
22	3.3V Output	Brown - Blue	3.3V-100 mA pow
23	GND	White - Red	Ground for powe
24	5V Output	Brown - Red	5V - 100 mA pow
25	GND	White - Black	Ground for powe
26	ATX (0) N	Brown - Black	ARINC 429 inverted
27	ATX (0) P	Gray - Green	ARINC 429 non-inverte
28	ARX (0) P	Yellow - Green	ARINC 429 non-inverte
29	ARX (0) N	Pink - Green	ARINC 429 inverted
30	ECAP 0	Yellow - Pink	Encoder quadratu
31	ECAP 1	White	Encoder quadratu
32	ECAP 2	Brown	Encoder quadratu
33	ECAP 3	Green	Encoder quadratu
34	PWM 0	Yellow	

PIN	Signal	Color Code	Descriptio
35	PWM 1	Gray	PWM/DIGITAL output / DIGITA **Warning** Each pin withstands a maxi
36	PWM 2	Pink	
37	PWM 3	Blue	
38	PWM 4	Red	
39	PWM 5	Black	
40	PWM 6	Violet	
41	PWM 7	Gray - Pink	
42	GND	Red - Blue	Ground for digital/an
43	ANALOG (0) 3.3V	White - Green	Analog input 0
44	ANALOG (1) 3.3V	Brown - Green	Analog input 0
45	ANALOG (2) 5V	White - Yellow	Analog input
46	ANALOG (3) 5V	Yellow - Brown	Analog input
47	ANALOG (4) 12V	White - Gray	Analog input 0
48	ANALOG (5) 12V	Gray - Brown	Analog input 0
49		White - Pink	Analog input 0

PIN	Signal	Color Code	Descriptio
	ANALOG (6) 36V		
50	ANALOG (7) 36V	Pink - Brown	Analog input 0
51	GND	White - Blue	Ground for digital/an
52	ARX (1) P	Brown - Blue	ARINC 429 non-inverte
53	ARX (1) N	White - Red	ARINC 429 inverted
54	ARX (2) P	Brown - Red	ARINC 429 non-inverte
55	ARX (2) N	White - Black	ARINC 429 inverted
56	ARX (3) P	Brown - Black	ARINC 429 non-inverte
57	ARX (3) N	Gray - Green	ARINC 429 inverted
58	ARX (4) P	Yellow - Green	ARINC 429 non-inverte
59	ARX (4) N	Pink - Green	ARINC 429 inverted
60	GPIO 8	Yellow - Pink	DIGITAL output / DIGITAL in
61	GPIO 9	White	
62	GPIO 10	Brown	
63	GPIO 11	Green	
64	GPIO 12	Yellow	
65	GPIO 13	Gray	

Warning

Each pin withstands a maximu

PIN	Signal	Color Code	Descriptio
66	GPIO 14	Pink	
67	GPIO 15	Blue	
68	GPIO 16	Red	

Harness

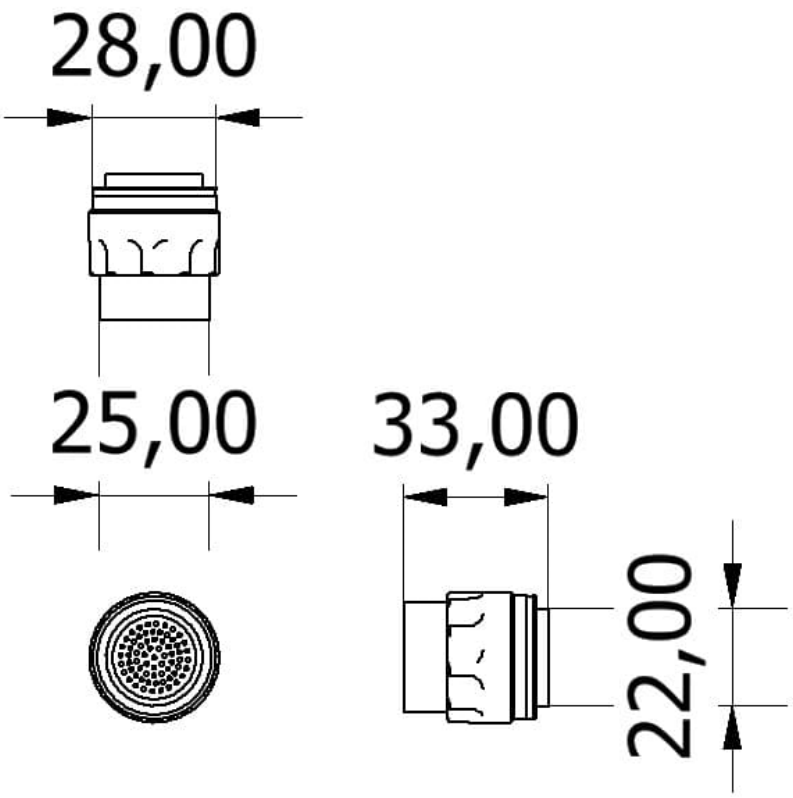
A wire harness is a structured assembly of cables and connectors used to organize and manage wiring in electrical and electronic systems. It is designed to ensure a tidy and secure installation of cables, preventing tangles, electromagnetic interference, and facilitating maintenance.

CEX 2.0 has two compatible harnesses:

Veronte Harness Green 68P	Dev Harness CEX 2.0
	
Harness available on demand with the Embention reference **P001623**	Harness available on demand with the Embention reference **P006140**

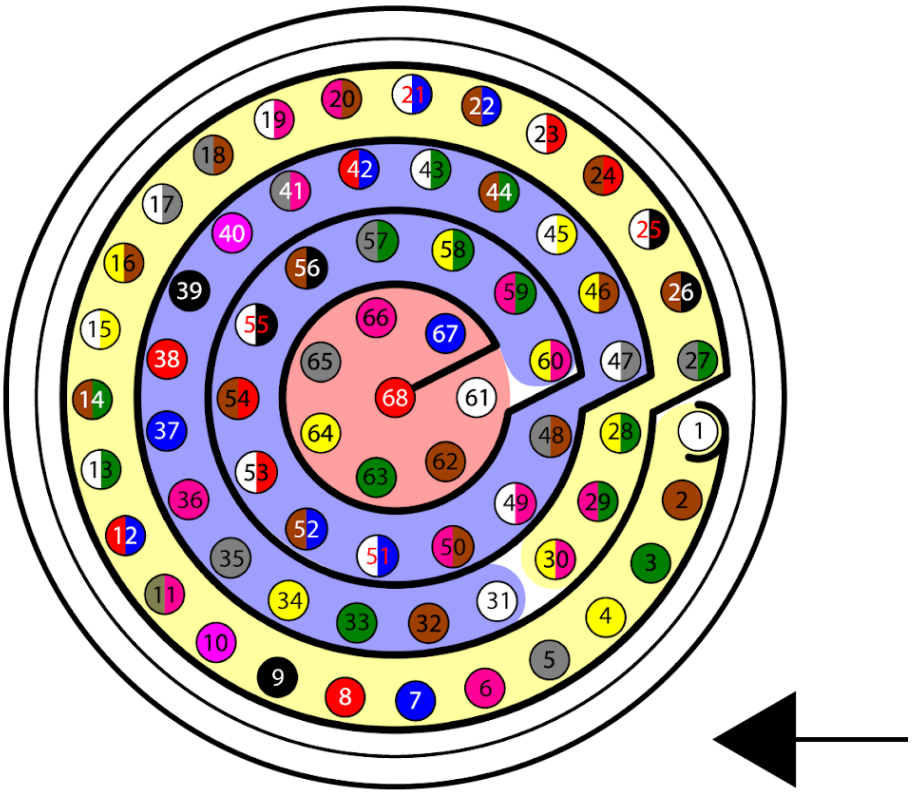
Dimensions

- **Harness Green 68P wire gauge:** 22 AWG
- **Cables length:** 52 cm
- **Harness plug dimensions:**



Connector FGW.LM.368.XLCT dimensions (cm)

Pinout



Harness plug - FGH.LM.368.XLCT (frontal view)

Veronte Harness Green 68P

The pinout of this harness is the same as the Veronte CEX pinout above. The **color code** of the harness wires is given below.

> ⚠ **Warning**
>
> Check the pin number before connecting. The color code is repeated 3 times due to the amount of pins. First section (yellow) corresponds to pins 1-30, the second section (blue) to pins 31-60 and the third one (red) to pins 61-68. Pin number increases following the black line of the pictures above: counterclockwise for the connector and clockwise for the plug.

PIN	Color code	PIN	Color code
1	White	35	Gray
2	Brown	36	Pink
3	Green	37	Blue
4	Yellow	38	Red
5	Gray	39	Black
6	Pink	40	Violet
7	Blue	41	Gray - Pink
8	Red	42	Red - Blue
9	Black	43	White - Green

PIN	Color code	PIN	Color code
10	Violet	44	Brown - Green
11	Gray - Pink	45	White - Yellow
12	Red - Blue	46	Yellow - Brown
13	White - Green	47	White - Gray
14	Brown - Green	48	Gray - Brown
15	White - Yellow	49	White - Pink
16	Yellow - Brown	50	Pink - Brown
17	White - Gray	51	White - Blue
18	Gray - Brown	52	Brown - Blue

Dev Harness CEX 2.0

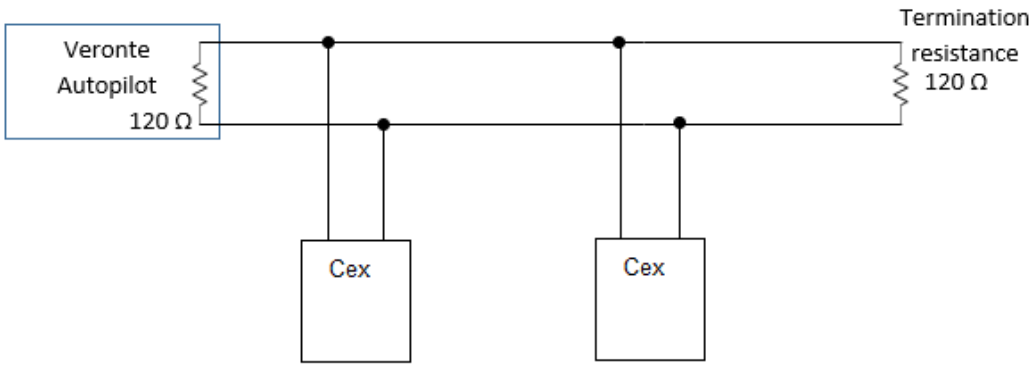
This harness has some connectors already implemented for easy operation. Below is detailed information on which pins these connectors are connected to:

Connector	PIN	Signal
Main VCC	1	Power supply 1
	2	

Connector	PIN	Signal
		Power supply 2
	3	GND
	4	GND
RS232 connector	15	RS-232 (A) TX
	16	RS-232 (A) RX
	17	GND
Maintenance button	20	I2C SCL
	21	I2C SDA

CAN Assembly

As described in Warnings section, **CEX** itself does not allow the connection of multiple **CEX** or other CAN Bus devices to the same line. It is therefore possible to use a **Veronte Autopilot** for this purpose. Considering **Veronte Autopilot** includes one entrance resistance of 120 Ω, a second resistance needs to be placed at the end of the line (again 120 Ω). This resistance may be placed on the cable or on another PCB.



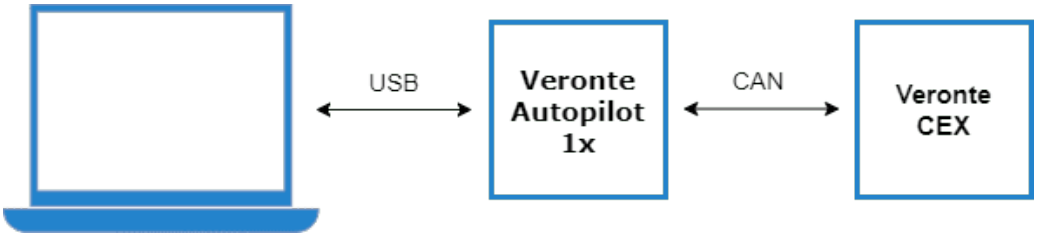
CAN assembly diagram example

Software Installation

There are two ways to make the connection to configure **CEX**: via **Veronte Autopilot 1x** or direct connection.

- **Via Veronte Autopilot 1x**

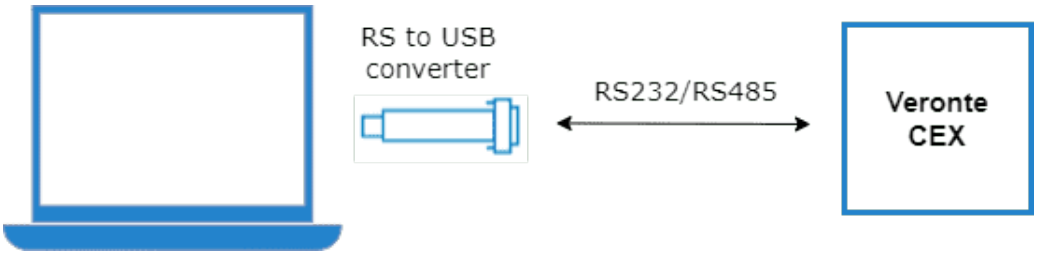
  It is usual to have a **CEX** in a system that does not allow to directly connect **CEX** to a PC. In that situation, we can configure a **Veronte Autopilot 1x** that is connected via CAN with **CEX**. To be able to establish a connection between **1x PDI Builder** and **CEX**, please see the Integration examples section of the **CEX PDI Builder** user manual.



CEX connection through Veronte Autopilot 1x

- **Direct connection**

  By default **CEX** can establish VCP communications over its SCI-A and SCI-B ports. Using any of these connection will be possible to connect it to a PC.



Direct CEX connection

The **CEX** software configuration is explained in the CEX Software Manual.

Maintenance

Preventive maintenance

Apart from cleaning, no extra maintenance is required to guarantee the correct operation of the **CEX**.

In order to clean **CEX** properly follow the next recommendations.

- Turn off the device before cleaning.
- Use a clean, soft, damp cloth to clean the unit.
- Do not immerse the unit in water to clean it if the connector is connected.

Software update

To update the software, an additional app is required: Veronte Updater.

> ⓘ **Note**
>
> The file with the new software version will be shared with the customer in the **Joint Collaboration Framework** when it is requested.
>
> For more information about the **Joint Collaboration Framework**, read its user manual.

Integration examples

Examples of how to set up a configuration for **CEX** can be seen in Integration examples section of the **CEX PDI Builder** user manual.

- Veronte products

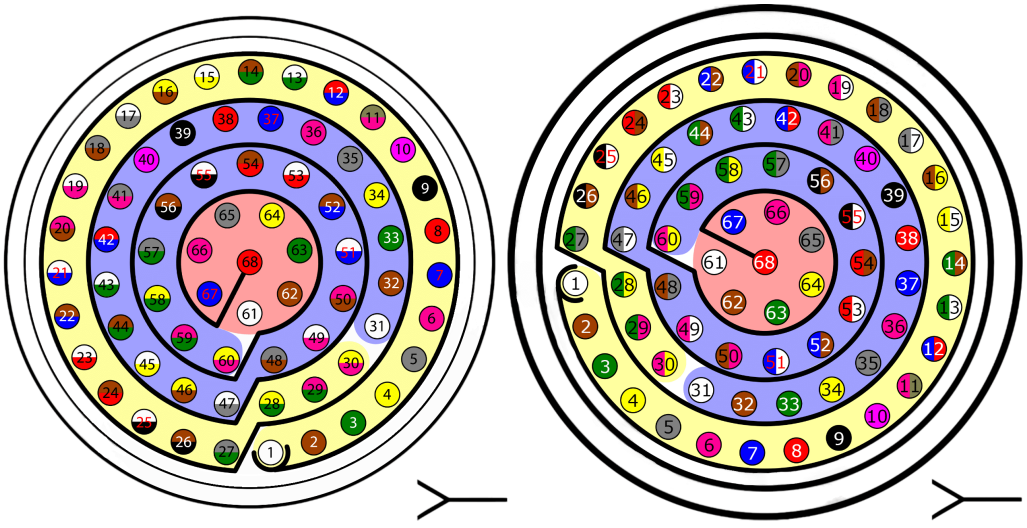
Veronte products

This section explains how to integrate **CEX** with Veronte products.

Autopilot 1x connection

When communication is established between the PC and the **CEX** using the **Veronte Autopilot 1x** as a tunnel, the connection between the **CEX** and **Autopilot 1x** is via CAN.

The pin connection between the two devices should be like this:



Connector for Autopilot 1x - HEW.LM.368.XLNP
(frontal view)

Connector for CEX - HEW.LM.368.XLNP
(frontal view)

Autopilot 1x connector			CEX connector		
PIN	**Signal**	**Color code**	**PIN**	**Signal**	**Color code**
25	CANA_P	White-Black	5	CAN (A) P	Gray
26	CANA_N	Brown-Black	6	CAN (A) N	Pink
28	CANB_P	Yellow-Green	8	CAN (B) P	Red
29	CANB_N	Pink-Green	9	CAN (B) N	Black
30	GND	Yellow-Pink	7	CAN GND	Blue

> ⓘ **Note**
>
> If only CAN A or CAN B has been configured in the software for communications, only the corresponding pins must be connected. For more information on CAN connection, please visit CAN Assembly - Hardware Installation.

> ⚠ **Warning**
>
> **Remember!!** In **Autopilot 1x**, all GND pins are common. Note that pin 54 is not a common GND pin.

> **Important**
>
> Integration is also possible by connecting CAN A of the **Autopilot 1x** to CAN B of the **CEX** and vice versa, i.e. it does not necessarily have to be CAN A-CAN A or CAN B-CAN B. However, any connections made must be **consistent** with the **configuration** made at software level in 1x PDI Builder and CEX PDI Builder.

Troubleshooting

In case of any issue with software, read the Troubleshooting section of the **CEX PDI Builder** user manual.

Forcing maintenance mode

If a mistake was made when building the configuration and communication with the device has been lost, it is possible to force the device to boot into maintenance mode in order to modify its configuration.

There are two ways to force the maintenance mode: using power supply or using the I2C pins.

Power supply

When communication with the unit is lost, it is possible to active **maintenance mode by** power input.

In order to active **maintenance mode**, power cycle **CEX** repetively with periods of 700 ms (with a margin range between 380 and 965 ms). After **30 cycles**, **CEX** will enter in maintenance mode.

I2C pins

To enter in maintenance mode with **I2C**:

1. Unplug **CEX**
2. Connect both I2C pins each other
3. Then, power up **CEX**
4. Finally, disconnect both pins

Both pins are I2C SCL (number 20) and I2C SDA (number 21) according to the pinout.

> **Note**
>
> **Veronte Avionics: Dev Harness CEX 2.0** (Embention reference `P006140`) has already included a button with this 2 pins to easily enter maintenance mode. The procedure is the same as for the pins, but instead of connecting and disconnecting the pins, press and release the button.

Acronyms and Definitions

Abbreviation	Description
ARINC	Aeronautical Radio, Inc.
BEC	Battery Eliminating Circuit
CAN	Controller Area Network
CAP	Capture Module
CEX	CAN Expander
COM	Communications
DC	Direct Current
ECAP	Enhanced CAP
EQEP	Enhanced Quadrature Encoder Pulse sensor
ESC	Electronic Speed Control
ESD	ElectroStatic Discharge
GND	Ground
GPIO	General Purpose Input/ Output

Abbreviation	Description
I/O	Input/Output
I2C	Inter-Integrated Circuit
JTAG	Joint Test Action Group
Mbps	Megabits Per Second
MEP	Micro Edge Positioning
MPU	Micro-Processor Unit
OEM	Original Equipment Manufacturer
PCB	Printed Circuit Board
PDI	Parameter Data Items
PPM	Pulse Position Modulation
PWM	Pulse Width Modulated signal
RPM	Revolutions Per Minute
RS-232	Recommended Standard 232
RS-485	

Abbreviation	Description
	Recommended Standard 485
SCI	Serial Communications Interface
SCL	Serial Clock line
SDA	Serial Data line
SN	Serial Number
SW	Software
UART	Universal Asynchronous Receiver Transmitter
VCP	Virtual Communication Port

Contact Data

For support-related inquiries, customers have access to a dedicated portal through the Joint Collaboration Framework. This platform facilitates communication and ensures traceability of all support requests, helping us to address your needs efficiently.

For other questions or general inquiries, you can reach us via email at sales@embention.com or by phone at (+34) 965 115 421