
NEX-FD Hardware Manual

Release 2.0/1.0

Embention Sistemas Inteligentes, S.A.

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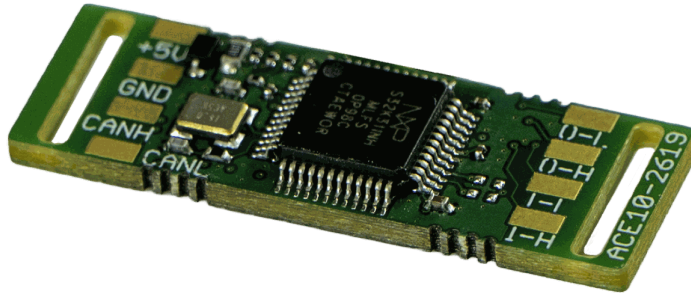
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Scope of Changes

- Version 1.0
 - Added:
 - First version issued

Introduction



NEX-FD

NEX-FD is a compact protocol and interface converter that seamlessly bridges CAN networks with external actuators and peripherals. Powered by an onboard microcontroller, it delivers deterministic, ultra-low latency translation between CAN-FD or CAN 2.0 buses and RS232, RS485, I2C, GPIO, ADC or PWM interfaces.

Thanks to its miniaturized design (33 x 11 x 4 mm, 10 g), NEX-FD is installed **in-wire**: it is soldered directly to the harness, next to the device it controls.

The available interfaces are:

- **1x CAN-FD or CAN 2.0** bus (bidirectional).
- **2x RS232** or **1x RS485** serial port (bidirectional).
- **1x I2C** bus, **2x GPIO**, or **2x PWM** outputs at **5 V**.
- **1x ADC**, with a measurement range of **0 - 5 V**.

Use cases

- Extending the number of supported peripherals, by connecting them to the CAN network.
- Optimizing the harness, allowing devices of any kind to be connected to the same CAN network.
- Connecting devices placed at long distances that use protocols which are not suitable for it, such as PWM or analog signals.

Quick Start

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

System Layout

The following image shows the standard **NEX-FD** system layout for operation:



NEX-FD standard layout

First Steps

NEX-FD is connected between the CAN-FD bus of the system and the device to be controlled. The primary pads are wired to the CAN-FD bus, while the secondary pads are wired to the device through the interface required by the device: RS232, RS485, I2C, GPIO, PWM or ADC. The function of each pad is explained in the [Pinout](#) section.

Warnings

Warning

- Do not power the board with a voltage other than the 5 V provided. The microcontroller, the CAN-FD transceiver and the RS232/RS485 driver operate directly at 5 V.
- Check the polarity of the supply and of the CAN-FD lines before powering the system. Reversing the 5 V and GND pads may damage the board.
- The same output pads are shared by the I2C bus, the GPIO and the PWM outputs. Configure the board according to the connected device before powering it.
- Perform all the soldering and harness operations with the system unpowered.

Requirements

- Any **device providing a CAN-FD or CAN 2.0 bus** and the 5 V supply, such as an autopilot.
- A device with RS232, RS485, I2C, GPIO, PWM or analog interface to be connected to the secondary pads.
- A PC with the configuration software installed.

Technical

Features

The onboard microcontroller performs the protocol translation in a **deterministic** way and with **ultra-low latency**.

- **I/O Interfaces:**

- 1x **CAN-FD or CAN 2.0** bus, bidirectional.
- 2x **RS232** or 1x **RS485** serial port, bidirectional.
- 1x **I2C** bus, 2x **GPIO**, or 2x **PWM** outputs at **5 V**.
- 1x **analog input (ADC)**, with a range of 0 - 5 V

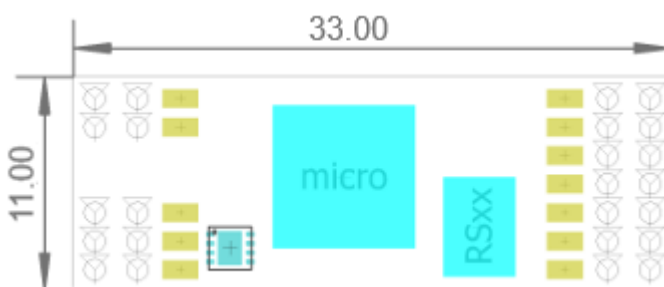
- **Electrical:**

- 1x **power supply**, 5 V.

Mechanical Specifications

Parameter	Value
Dimensions	33 x 11 x 4 mm
Weight	10 g
Operating temperature	-40 to 80°C

Dimensions



NEX-FD dimensions

Electrical Specifications

Parameter	Value
Supply voltage	5 V

Interfaces

NEX-FD has two sets of solder pads: the **primary pads**, connected to the CAN bus, and the **secondary pads**, connected to the actuator or peripheral.

Connector Layout

Side	Pads	Connected to
Primary	5	CAN-FD / CAN 2.0 bus and power supply
Secondary	8	Actuator or peripheral: RS232/RS485, I2C/GPIO/PWM and ADC

The description of each pad is detailed in the [Pinout](#) section.

Mating Connectors

NEX-FD is soldered directly to the harness wires, so no mating connector is used.

Hardware Installation

Mechanical

Location

NEX-FD is a miniaturized board intended to be installed **in-wire**: it is not mounted on the structure of the platform inside a box, but integrated in the harness itself, as one more element of the wire run. It should be placed as close as possible to the device it controls, in order to keep the RS232/RS485, I2C, GPIO, PWM or ADC wires as short as possible.

Protection

It is recommended to protect the board, either by covering it with heat-shrink tubing or by installing it in a protected location.

Electrical

Power

NEX-FD is supplied with **5 V** through the primary pads.

Pinout

Primary pads:

Pad	Signal	Description
1	CAN-H	CAN bus, high line
2	CAN-L	CAN bus, low line
3	GND	Ground
4	5 V	5 V power supply
5	GND	Ground

Note

One of the two GND pads can be removed if the harness requires it.

Secondary pads:

The 8 secondary pads are shared by three independent interfaces: the **serial port** (pads 1 to 4), the **I2C bus, GPIO, PWM outputs** (pads 6 and 7) and the **analog input (ADC)** (pad 8). Pad 5 is the common ground for all the interfaces.

Serial port pads:

Pads 1 to 4 are shared by the RS232 and RS485 interfaces, so only the signals of the configured interface are available.

Pad	RS232 configuration	RS485 configuration
1	Tx 1 (transmission, RS232 1)	OUT-H (transmission, high line)
2	Tx 2 (transmission, RS232 2)	OUT-L (transmission, low line)
3	Rx 1 (reception, RS232 1)	IN-H (reception, high line)
4	Rx 2 (reception, RS232 2)	IN-L (reception, low line)

Ground pad:

Pad 5 is the **GND** reference, common to the all the secondary pads.

I2C and PWM pads:

Pads 6 and 7 are shared by the I2C bus, the GPIO and the PWM outputs, so only the signals of the configured interface are available:

Pad	I2C configuration	PWM / GPIO configuration
6	SCL (clock)	PWM 1 / GPIO 1
7	SDA (data)	PWM 2 / GPIO 2

ADC pad:

Pad 8 is used for the analog input (ADC).

Pad	Signal	Description
8	ADC	Analog Digital Converter, up to 5 V

Harness

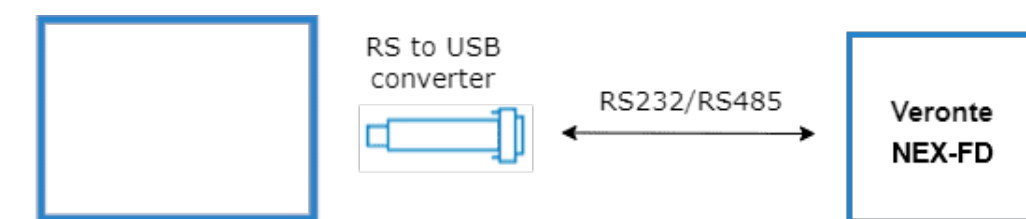
The wires are soldered directly to the pads of the board, as no mating connector is used.

Software Installation

There are two ways to make the connection to configure **NEX-FD**: direct connection or via **Embention Autopilot**.

- **Direct connection**

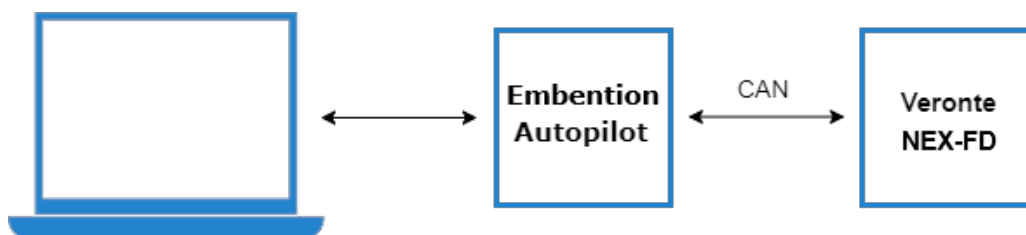
NEX-FD can also be connected directly to the PC through its serial port, using an RS232 to USB adapter (or an RS485 to USB adapter, depending on the interface configured in the board).



NEX-FD connection to PC

- **Via Embention Autopilot**

NEX-FD is connected via CAN to a **Embention Autopilot**, which acts as a tunnel to the PC. The autopilot must be configured accordingly to enable this connection.



NEX-FD connection through Embention Autopilot

Maintenance

Preventive maintenance

Apart from cleaning, no extra maintenance is required to guarantee the correct operation of the NEX-FD.

In order to clean NEX-FD properly follow these 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.

Software update

To update the software, an additional app is required: [Veronte Updater](#).

Integration examples

This section will present examples of integration between NEX-FD and other devices.

- [Veronte products](#)

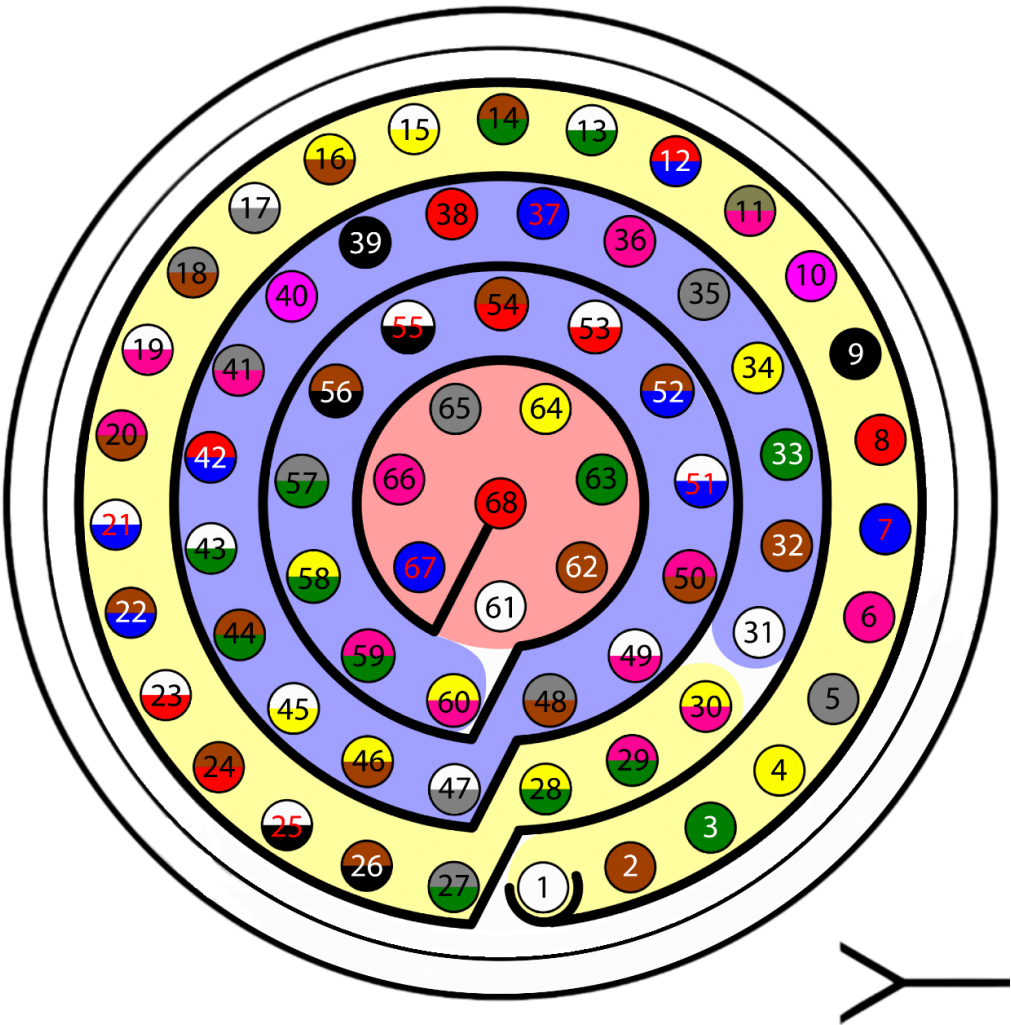
Veronte products

This section explains how to integrate NEX-FD with Veronte products.

1. Autopilot 1x

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

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



Connector for Autopilot 1x

Autopilot 1x connector			NEX-FD connector	
PIN	Signal	Color code	PIN	Signal
25 / 28	CANA_P / CANB_P	White-Black / Yellow-Green	1	CAN_H
26 / 29	CANA_N / CANB_N	Brown-Black / Pink-Green	2	CAN_L
30	GND	Yellow-Pink	3	GND

 Note

Either **CAN A** or **CAN B** must be selected to connect the Autopilot 1x to the CAN bus of the NEX-FD.

 Warning

Reminder: In **Autopilot 1x**, all GND pins are common. Note that pin 54 is not a common GND pin.

Troubleshooting

The NEX-FD is not detected on the CAN-FD bus

- Check that the 5 V supply reaches the input pads of the board.
- Check that CAN-H and CAN-L are not swapped and that the bus is correctly terminated.
- Check the solder joints of the input pads.

There is no communication with the actuator or peripheral

- Check that the configured output interface (RS232, RS485, I2C or PWM) matches the one used by the actuator or peripheral.
- In RS232, check that Tx and Rx are not swapped. In RS485, check the polarity of the OUT-H/OUT-L and IN-H/IN-L pairs.
- Check that the GND of NEX-FD and the GND of the actuator or peripheral are connected.

Acronyms and Definitions

ADC	Analog Digital Converter
CAN	Controller Area Network
CAN-FD	Controller Area Network with Flexible Data-rate
CAN-H / CAN-L	CAN bus high line / CAN bus low line
DC-DC	Direct Current to Direct Current converter
GND	Ground
GPIO	General Purpose Input/ Output
I2C	Inter-Integrated Circuit
IN-H / IN-L	Serial reception high line / Serial reception low line
LDO	Low-Dropout regulator
OUT-H / OUT-L	Serial transmission high line / Serial transmission low line
PC	Personal Computer
PCB	Printed Circuit Board
PWM	Pulse Width Modulation

RS232	Recommended Standard 232
RS485	Recommended Standard 485
Rx	Reception
SCL	Serial Clock
SDA	Serial Data
Tx	Transmission
USB	Universal Serial Bus

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