PCAN-GPS Pro FD

User Manual

Relevant Products

Product name	Part number
PCAN-GPS Pro FD	IPEH-003105

Imprint

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Document version 1.0.1 (2025-06-03)

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1 Introduction

The PCAN-GPS Pro FD is a configurable sensor module for detecting position, orientation, and acceleration. It has a magnetic field sensor, an acceleration sensor, a gyroscope, and a satellite receiver that enables position data to be updated at up to 25 Hz. The sensor data is transmitted via CAN or CAN FD. The connection to the CAN bus is designed with two interconnected LEMO circular connectors for integration into measuring chains. Thanks to the robust housing, the module can also be used under tough conditions.

The device parameters, capturing of sensor data, and CAN message transmission of the PCAN-GPS Pro FD can be configured via the USB port using the Windows software included in the scope of supply. Afterwards, the module runs as an independent CAN node.

1.1 Properties at a Glance

- STM32H745 microcontroller with Arm® Cortex® M7 and M4 dual-core and 2 MByte flash
- High-speed CAN connection (ISO 11898-2)
  - Complies with CAN specifications 2.0 A/B and FD
  - CAN FD bit rates for the data field (64 bytes max.) from 40 kbit/s up to 10 Mbit/s
  - CAN bit rates from 40 kbit/s up to 1 Mbit/s
  - NXP TJA1043 CAN transceiver
- CAN termination can be activated

- CAN connection and supply via 9-pin LEMO circular connectors with Alpha coding (30°)
  - 2 interconnected connectors with pin assignment according to M-CAN for integration in measuring chains
- High-speed USB 2.0 via USB-C connector
- Receiver for navigation satellites u-blox NEO-M9N
  - Supported navigation and supplementary systems: GPS, Galileo, BeiDou, GLONASS, SBAS, and QZSS
  - Simultaneous reception of 4 navigation systems
  - Maximum update rate 25 Hz
  - Configurable supply of active GPS antennas with 3.3 V or 5 V
  - Optional direct access to the u-blox via USB
- Gyroscope and three-axis accelerometer ISM330DLC from ST
- Electronic three-axis magnetic field sensor IIS2MDC from ST
- Memory: 8 MByte QSPI flash and 4 GByte eMMC
- Extended operating temperature range from −40 to +85 °C (−40 to +185 °F)
- 2 RGB LEDs for status signaling
- Configuration with Windows software via USB
- Voltage supply from 8 to 32 V via LEMO circular connectors
- 5-Volt supply alternatively via USB for configuration
- Supercap for preserving the RTC and the GPS data to shorten the TTFF (Time To First Fix)
- Aluminum casing with Ingress Protection IP50

1.2 Scope of Supply

- PCAN-GPS Pro FD in aluminum casing
- External antenna for satellite reception:
  - active (supplied via antenna connector)
  - 3 m cable
  - magnetic fastening

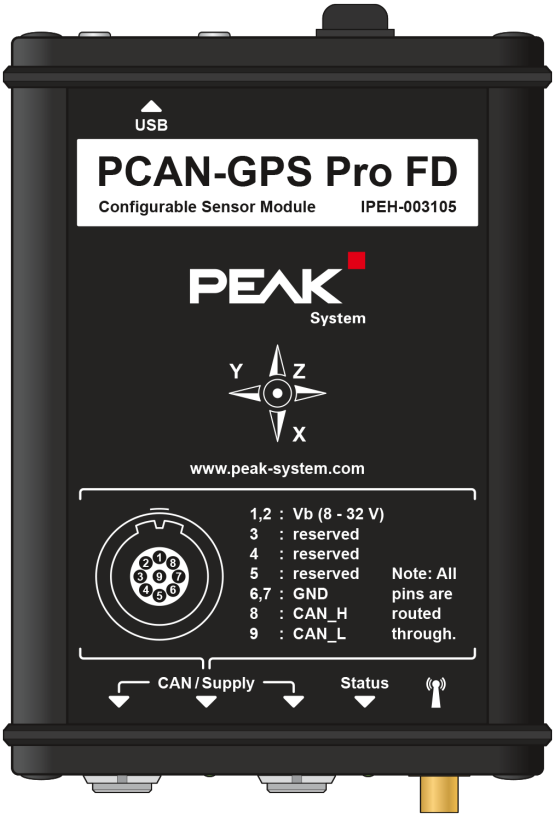
Download

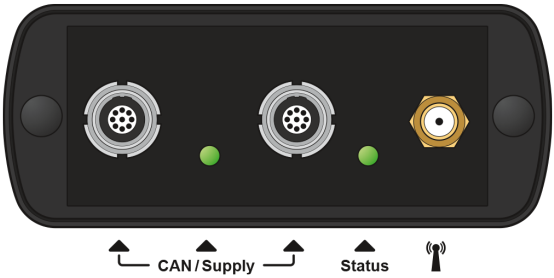
- Configuration software PCAN-GPS Pro FD Configuration for Windows
- Manual in PDF format

1.3 Prerequisites for the Operation

- Power supply in the range of 8 to 32 V DC, connection via LEMO circular connector
- For configuring:
  - Windows 11 (x64/ARM64), 10 (x64)
  - vacant USB port on the computer

2 Device Elements





PCAN-GPS Pro FD front:
9-pin circular connectors for CAN and power supply (2.1 on the next page)
SMA antenna connection (2.2 on the next page)
LEDs CAN/Supply and Status (2.4 on page 10)

PCAN-GPS Pro FD rear:
Pressure equalization element
USB-C port for configuring (2.3 on page 10)

2.1 Circular Connector Sockets

for power supply and CAN

9-pin circular connector socket with Alpha coding (30°)

Pin	Identifier	Function
1, 2	V_b	Power supply 8 to 32 V DC, e.g. via car terminal 15; reverse-polarity protection
3, 4, 5	reserved	
6, 7	GND	Ground
8	CAN-High	Differential High-speed CAN signal (ISO 11898-2)
9	CAN-Low	

- 2 interconnected round plug sockets with pin assignment according to M-CAN for integration in measuring chains
- Mechanical coding with 2 grooves 30°
- Possible mating connector type: LEMO FEA.0B

2.2 SMA Antenna Connector

An external antenna must be connected to the SMA socket for the reception of satellite signals. Both passive and active antennas are suitable. For an active

antenna, a supply of 3.3 V or 5 V can be switched by configuration. The scope of supply provides an active antenna that can be powered by either voltage.

2.3 USB Connector

The mechanical USB-C type connection is used to configure the device with the associated Windows program. In this case, the electronics are supplied with power via the USB connection, with exception of the CAN part of the device and the 5-Volt antenna supply. Accordingly, no power supply via one of the circular connectors is required for configuring.

> **Note:** The power supply via the USB port is not intended for regular operation of the device. Use the power supply via one of the circular connectors for this purpose.

Information about the configuration procedure: 4.1 *Configuration* on page 15

2.4 LED Status Indications

LED *CAN/Supply* (left)

Indication	Description
violet	Powered via USB, no function of the CAN transceivers and no 5-Volts supply of the antenna
green	CAN OK
green blinking slowly	CAN traffic
orange blinking slowly	CAN controller in Error Passive mode
red blinking	CAN controller in Bus Off mode
off*	General error

Indication	Description
red blinking quickly*	No or invalid configuration
orange blinking quickly*	Internal device communication error, power off and on required

* While the LED *Status* is indicating a device error (red blinking quickly).

LED *Status* (right)

Indication	Description
white	Bootloader active
yellow	Flash process
green blinking	Antenna okay, no GNSS Fix
green blinking slowly	GNSS Fix
blue blinking slowly	No or passive antenna
violet blinking quickly	Overcurrent of the antenna supply (short circuit)
red blinking quickly	No or invalid configuration

blinking slowly = 0.5 Hz
blinking = 1 Hz
blinking quickly = 2 Hz

3 Special Settings on Hardware

For special applications, settings can be done on the circuit board of the PCAN-GPS Pro FD by using switches:

- Internal CAN bus termination

Procedure for Changing the Hardware Configuration

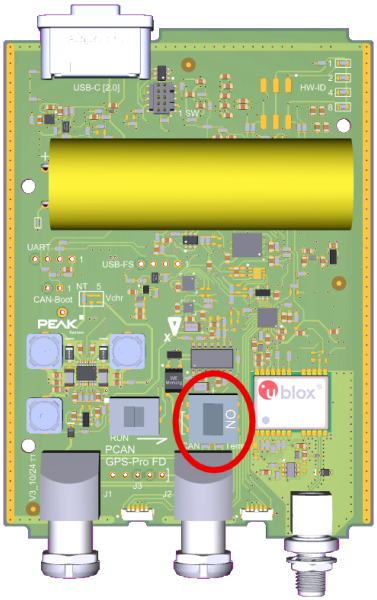
Attention! Electrostatic discharge (ESD) can damage or destroy components on the circuit board. Take precautions to avoid ESD when handling the circuit board.

1. Remove all connectors from the PCAN-GPS Pro FD.
2. On the rear of the device, unscrew the fastening screws (hexalobular T9) for the USB port.
3. On the front of the device, carefully remove the inserted protective caps for the casing screws on the right and left. Then unscrew the screws (hexalobular T10).
4. With the front panel, pull the circuit board out of the casing.
5. On the circuit board, set the switch(es) according to the desired setting (see relevant section).
6. To reassemble, proceed in reverse order.

3.1 Internal CAN Bus Termination

If the PCAN-GPS Pro FD is connected to one end of a CAN bus and if there is no termination of the CAN bus yet, an internal termination with 120 Ω between the lines CAN-High and CAN-Low can be activated. At delivery, the termination is inactive.

Tip: We recommend adding the termination at the CAN cabling, for example with the PCAN-Term termination adapter. Thus, CAN nodes can be flexibly connected to the bus.

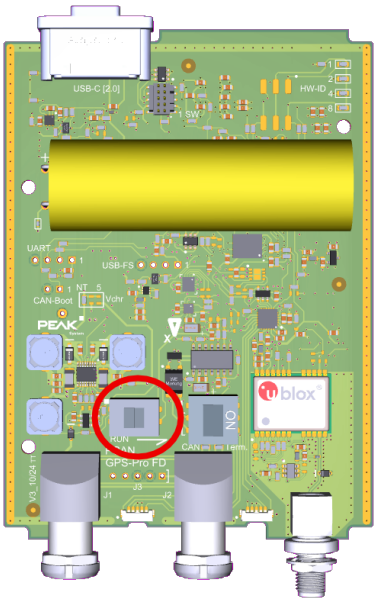


Switch for CAN bus termination

Switch state	Termination
Left	inactive (Default)
Right “ON”	active

3.2 Reserved *Run* Switch

The *Run* switch on the circuit board is reserved for a future functional extension and should remain on the left (inactive) switch position.



Run switch for future functional extension

Switch state	Function
Left	inactive (Default)
Right “ON”	active

4 Operation

4.1 Configuration

The PCAN-GPS Pro FD is configured via a USB connection using the freely available Windows program “PCAN-GPS Pro FD Configuration”. The program can be additionally used as monitor of the current sensor states.

Prerequisites

- Windows 11 (x64/ARM64), 10 (x64)
- Vacant USB port on the computer

Downloading and Installing the Configuration Software

1. Open the software download page of PEAK-System
   www.peak-system.com/quick/DL-Software-E
   and there, download *PCAN-GPS Pro FD Configuration*.
2. On your computer, open the downloaded ZIP file and from there start the setup program:
   `PCAN-GPS_Pro_FD_Config_Setup.exe`
3. Follow the instructions of the setup program.

Creating a Configuration

1. Via the Windows Start menu, start the configuration program:
   PCAN-GPS Pro FD Configuration

2. On the *Configuration* tab, you define general parameters for the PCAN-GPS Pro FD. You can select the CAN bit rate(s) using the button next to the *Bitrate string* field.

   Tip: For special bit rates, you can alternatively us the Bit Rate Calculation Tool which is also freely available on the above-mentioned web page. Use 80 MHz as the clock frequency. Copy the bit rate string generated with the tool into the corresponding field.

3. On the *Messaging* tab, the assignment of signals from the PCAN-GPS Pro FD to specific messages is already defined. You can change the key settings of the CAN messages, for example the name and the CAN ID.
4. Save the finished configuration as file using the corresponding button .

Transferring the Configuration to the Device

1. Connect the PCAN-GPS Pro FD to your computer using a USB cable.

   The PCAN-GPS Pro FD is supplied via USB for the configuration process. The supply via USB includes the sensors, but not the CAN communication and the 5-Volt supply of an antenna. The *Status* LED on the device starts blinking according to the GNSS status, the *CAN/Supply* LED remains violet.

   The configuration program automatically detects the device and establishes a connection to it. In the status bar on the bottom, two green check marks are displayed.

2. In the toolbar of the configuration program, click on the Write button .

   For a moment, a progress bar appears in the status bar on the bottom, indicating that the configuration is being written to the device.

4.2 Device Startup

The PCAN-GPS Pro FD is started by applying the supply voltage (for connection, see 2.1 *Circular Connector Sockets* on page 9). This can be done, for example, using

terminal 15 “Ignition” in the car being connected to the supply input of the device. It does not matter which of the two LEMO sockets is used.

The *CAN/Supply* LED indicates the current CAN status, the *Status* LED indicates the status of the antenna (see 2.4 *LED Status Indications* on page 10). If CAN communication is error-free and GNSS fix is active at the same time, both LEDs blink green slowly and synchronously. The device is in operation after approx. 1 second from switch-on. A GNSS fix may already exist after 3 seconds, depending on the up-to-dateness of the cached satellite data and the receiving situation.

5 Description of the Sensors

This chapter describes the characteristics of the sensors that are used in the PCAN-GPS Pro FD in short form.

5.1 Receiver for Navigation Satellites (GNSS)

The u-blox NEO-M9N receiver module is designed for the following global navigation satellite systems (GNSS):

- GPS
- GLONASS
- Galileo
- Beidou

Furthermore, the following satellite-based supplementary systems can be received in connection with GPS:

- QZSS
- SBAS (EGNOS, GAGAN, MSAS, and WAAS)

The receiver module supports simultaneous reception of four navigation satellite systems and the supplementary systems. A maximum of 16 satellites are used at 25 Hz sampling frequency.

To receive a satellite signal, an external antenna must be connected to the SMA socket. Both passive and active antennas can be used. An active antenna is included in the scope of supply. On the sensor side, the antenna is monitored for short circuits. If a short circuit is detected, the voltage supply to the external antenna is interrupted to prevent damage to the PCAN-GPS Pro FD.

For a faster position determination after switching on the PCAN-GPS Pro FD, the internal RTC and the internal backup RAM receive a transitional supply by the build-in supercap.

Receiver for navigation satellites (GNSS)	
Type	u-blox NEO-M9N-00B
Receivable navigation systems	GPS, Galileo, BeiDou, GLONASS, QZSS, SBAS
Connection to microcontroller	Serial connection (UART 6) with 230,400 Baud 8N1 (default) Direct connection via USB Input for synchronization pulses (ExtInt) Output of timing pulses: 1 PPS (0.25 Hz to 10 MHz, configurable)
Antenna type	active or passive
Maximum number of satellites received at the same time	16 (at an update rate of 25 Hz)
Time to first position fix after cold start (TTFF)	GPS: 29 s, GLONASS: 27 s, Beidou: 32 s, Galileo: 42 s
Accuracy of the position values	GPS: 2 m Galileo: 3 m BeiDou: 3 m GLONASS: 4 m
Supply output for active antenna	3.3 V or 5 V (configurable), max. 50 mA, short-circuit and open-circuit detection

5.2 3D Accelerometer and 3D Gyroscope

The STMicroelectronics ISM330DLC sensor module is a multi-chip module with a 3D accelerometer, a digital 3D gyroscope, and a temperature sensor. The sensor module measures the acceleration along the X, Y, and Z axes as well as the rotation rate around them.

In a steady state on a horizontal surface, the acceleration sensor measures 0 g on the X and Y axes. On the Z-axis it measures 1 g (9.81 m/s^2) due to the gravitational acceleration.

Gyroscope axes in relation to the device casing
Z: yaw, X: roll, Y: pitch

Axes of the acceleration sensor in relation to the device casing

3D acceleration sensor	
Type	ST ISM330DLC
Connection to microcontroller	SPI
Measuring ranges	±2, ±4, ±8, ±16 G
Data format	16 bit, two's complement
Filter possibilities	Configurable digital filter chain
Operating modes	Power-down, Low-power, Normal, and High-performance mode
Correction options	Offset compensation

3D gyroscope	
Type	ST ISM330DLC
Connection to microcontroller	SPI
Axes	roll (X), pitch (Y), yaw (Z)
Measuring ranges	±125, ±250, ±500, ±1000, ±2000 dps (degrees per second)
Data format	16 bit, two's complement
Output data rate (ODR)	12.5 Hz, 26 Hz, 52 Hz, 104 Hz, 208 Hz, 416 Hz, 833 Hz, 1666 Hz, 3332 Hz, 6664 Hz
Filter possibilities	Configurable digital filter chain
Power saving mode	Power-down
Operating modes	Low-power, Normal, and High-performance mode

5.3 3D Magnetic Field Sensor

The STMicroelectronics IIS2MDC magnetic field sensor is used to determine the position in a magnetic field, e.g. the earth's magnetic field. Its dynamic range is ±50 Gauss.

Axes of the magnetic field sensor in relation to the device casing

3D magnetic field sensor	
Type	ST IIS2MDC
Connection to microcontroller	I^2C direct connection
Sensitivity	±49.152 Gauss (±4915 µT)
Data format	16 bits, two's complement
Filter possibilities	Configurable digital filter chain
Output data rate (ODR)	10 to 150 measurements per second
Operating modes	Idle, Continous, and Single mode

6 Technical Specifications

Power supply	
Supply input voltage	8 to 32 V DC
Current consumption (without antenna supply and supercap charge)	8 V: 130 mA 12 V: 90 mA 32 V: 38 mA
Supply buffer for GNSS almanac	Supercap, about 8 days
Supply output for active antenna	- no supply - 3.3 V, max. 30 mA - 5.0 V, max. 45 mA short-circuit and open-circuit detection

Connectors	
I/O + Supply	Circular push-pull self-latching connection system, 2 interconnected ports, mating connector e.g. LEMO FGA.0B.309.CLAD52Z
Antenna	SMA (Sub Miniature version A)

CAN (FD)		
Protocols	CAN FD ISO 11898-1:2015, CAN FD non-ISO, CAN 2.0 A/B	
Physical transmission	ISO 11898-2 (High-speed CAN)	
CAN bit rates	Nominal:	40 kbit/s to 1 Mbit/s
CAN FD bit rates	Nominal: Data:	40 kbit/s to 1 Mbit/s 40 kbit/s to 10 Mbit/s*
Transceiver	NXP TJA1043	
Internal termination	Activation via switch on the PCB; not activated at delivery	

* According to the CAN transceiver data sheet, only CAN FD bit rates up to 5 Mbit/s are guaranteed with the specified timing.

Receiver for navigation satellites (GNSS)

Type	u-blox NEO-M9N-00B
Receivable navigation systems	GPS, Galileo, BeiDou, GLONASS, QZSS, SBAS
Connection to microcontroller	Serial connection (UART 6) with 230,400 Baud 8N1 (default) Direct connection via USB Input for synchronization pulses (ExtInt) Output of timing pulses: 1 PPS (0.25 Hz to 10 MHz, configurable)
Antenna type	active or passive
Maximum number of satellites received at the same time	16 (at an update rate of 25 Hz)
Time to first position fix after cold start (TTFF)	GPS: 29 s, GLONASS: 27 s, Beidou: 32 s, Galileo: 42 s
Accuracy of the position values	GPS: 2 m Galileo: 3 m BeiDou: 3 m GLONASS: 4 m
Supply output for active antenna	3.3 V or 5 V (configurable), max. 50 mA, short-circuit and open-circuit detection

Antenna for satellite reception (in scope of supply)

Type	taoglas Ulysses AA.162
Center frequency range	1574 to 1610 MHz
Receivable systems	GPS, Galileo, BeiDou, GLONASS
Operating temperature range	-40 to +85 °C (-40 to +185 °F)
Size	40 x 38 x 10 mm
Cable length	approx. 3 m
Weight	59 g
Special feature	Integrated magnet for mounting

3D gyroscope	
Type	ST ISM330DLC
Connection to microcontroller	SPI
Axes	roll (X), pitch (Y), yaw (Z)
Measuring ranges	±125, ±250, ±500, ±1000, ±2000 dps (degrees per second)
Data format	16 bit, two's complement
Output data rate (ODR)	12.5 Hz, 26 Hz, 52 Hz, 104 Hz, 208 Hz, 416 Hz, 833 Hz, 1666 Hz, 3332 Hz, 6664 Hz
Filter possibilities	Configurable digital filter chain
Power saving mode	Power-down
Operating modes	Low-power, Normal, and High-performance mode

3D acceleration sensor	
Type	ST ISM330DLC
Connection to microcontroller	SPI
Measuring ranges	±2, ±4, ±8, ±16 G
Data format	16 bit, two's complement
Filter possibilities	Configurable digital filter chain
Operating modes	Power-down, Low-power, Normal, and High-performance mode
Correction options	Offset compensation

3D magnetic field sensor	
Type	ST IIS2MDC
Connection to microcontroller	I^2C direct connection
Sensitivity	±49.152 Gauss (±4915 µT)
Data format	16 bits, two's complement
Filter possibilities	Configurable digital filter chain
Output data rate (ODR)	10 to 150 measurements per second
Operating modes	Idle, Continous, and Single mode

Microcontroller	
Type	STMicroelectronics STM32H745ZIT6
Clock frequency quartz	8 MHz with PLL
Clock frequency internally	480 MHz Cortex M7, 240 MHz Cortex M4
Memory	2 MByte MCU Flash (Program) 1 kByte EEPROM 8 MByte QSPI Flash 4 GByte eMMC

Measures	
Size	115 x 85 x 35 mm (W x D x H)
Weight	250 g (without connectors and antenna)

Environment	
Operating temperature	-40 to +85 °C (-40 to +185 °F)
Temperature for storage and transport	-40 to +85 °C (-40 to +185 °F)
Relative humidity	15 to 90 %, not condensing
Ingress protection (IEC 60529)	IP50, with special LEMO mating connectors IP54

Conformity	
RoHS	EU Directive 2011/65/EU (RoHS 2) + 2015/863/EU DIN EN IEC 63000:2019-05
EMC	EU Directive 2014/53/EU DIN EN 61326-1:2022-11

Appendix A CE Certificate

EU Declaration of Conformity

This declaration applies to the following product:

Product name:	**PCAN-GPS Pro FD**
Item number(s):	**IPEH-003105**
Manufacturer:	PEAK-System Technik GmbH Leydheckerstraße 10 64293 Darmstadt Germany

We declare under our sole responsibility that the mentioned product is in conformity with the following directives and the affiliated harmonized standards:

EU Directive 2011/65/EU (RoHS 2) + 2015/863/EU (amended list of restricted substances)

DIN EN IEC 63000:2019-05
Technical documentation for the assessment of electrical and electronic products with respect to the restriction of hazardous substances (IEC 63000:2016);
German version of EN IEC 63000:2018

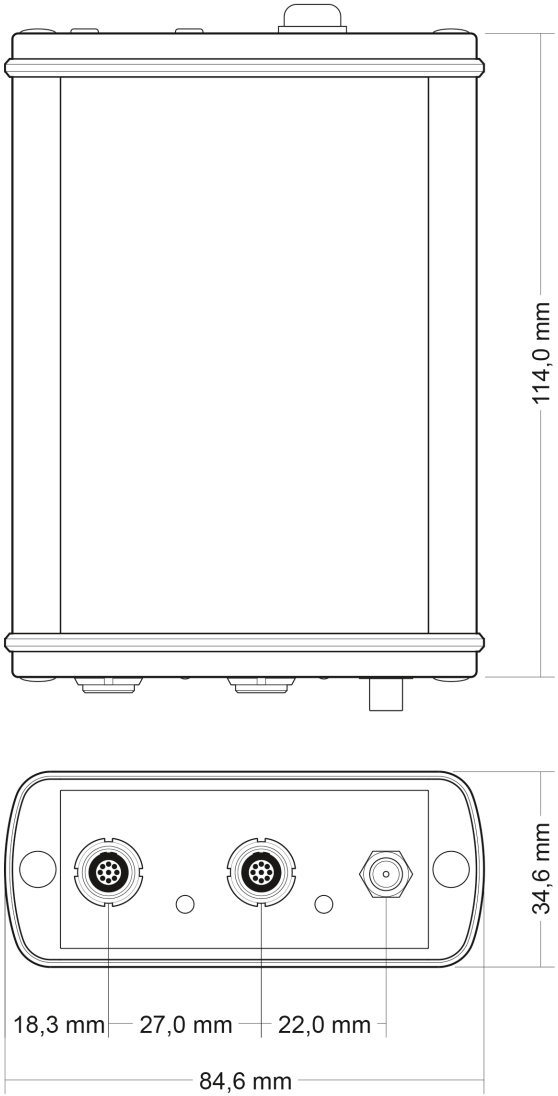
EU Directive 2014/53/EU (Radio Equipment)

DIN EN 61326-1:2022-11
Electrical equipment for measurement, control and laboratory use - EMC requirements - Part 1: General requirements (IEC 61326-1:2020);
German version of EN IEC 61326-1:2021

Darmstadt, 23 May 2025

Andreas Staat, Engineering Manager HW

Appendix B Dimension Drawing



Appendix C Disposal

The PCAN-GPS Pro FD must not be disposed of with household waste. Dispose of this electronic device in accordance with local regulations.

The PCAN-GPS Pro FD does not contain a battery for separate disposal.